



**GE APPLIANCES**

# Service Manual

## NF97X\*\*\*V\*\*R

97% Upflow/Horizontal Two Stage  
Variable Speed Ultra Low NOx  
( $<14$  Ng/J) Gas Furnace



### Contact GE Appliances at:

Homeowner: [GEAppliances.com](http://GEAppliances.com)  
HVAC Pro: [GEAppliancesAirandWater.com](http://GEAppliancesAirandWater.com)  
or  
866.814.3633

Split System USAC and USHP matches:  
[AHRIDirectory.org](http://AHRIDirectory.org)

**READ CAREFULLY.  
KEEP THESE INSTRUCTIONS.**

# General Information

NF97X\*\*\*V\*\*R series units are 97% efficiency gas furnaces used for upflow or horizontal applications only, manufactured with heat exchangers formed of aluminized steel tubes. NF97X\*\*\*V\*\*R units are available in heating inputs of 40,000 to 80,000 Btuh and cooling applications up to 5 tons.

Units are factory equipped for use with natural gas. NF97X\*\*\*V\*\*R model units are equipped with a two-stage variable speed integrated control. NF97X\*\*\*V\*\*R units meet the California Nitrogen Oxides (NOx) Standards (14 Ng/J) and California Seasonal Efficiency requirements. All units use a redundant gas valve to assure safety shut-off as required by C.S.A.

All specifications in this manual are subject to change. Procedures outlined in this manual are presented as a recommendation 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.

## ⚠ WARNING

- This furnace is equipped with an ignition control factory enabled for use with A2L refrigerant systems. Disabling the refrigerant detection functionality on A2L system is prohibited by safety codes. Refer to furnace installation instructions for refrigerant system setup.
- 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.



- **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.

## ⚠ 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.

# Technical Specifications

## Physical and Electrical Data

Model	Input (Btuh)	Output (Btuh)	AFUE (ICS)	Nominal Cooling Capacity	Gas Inlet (in.)	Volts/ Hz/ Phase	Max. Time Delay Breaker or Fuse	Nominal Full Load Amps	Trans (VA)	Approx Shipping Weight (lbs)
NF97X040V3BR	40,000	39,000	97%	3 Ton	1/2	120-60-1	15	7.7	40	125
NF97X060V3BR	60,000	58,000	97%	3 Ton	1/2	120-60-1	15	7.7	40	130
NF97X080V4CR	80,000	78,000	97%	4 Ton	1/2	120-60-1	15	10.1	40	154
NF97X080V5CR	80,000	78,000	97%	5 Ton	1/2	120-60-1	15	12.8	40	156

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

## Accessory List

Catalog Number	Description
<b>Return Air Base</b>	
68W62	17.5" B Width
68W63	21.0" C Width
<b>Flush Mount Termination (90% Furnaces only) US Only</b>	
51W11	2" & 3.0" Vent – US Version
<b>Concentric Vent Kit (90% Furnaces only) US Only</b>	
71M80	1-1/2" Vent Version (United States)
69M29	2" Vent Version (United States)
60L46	3" Vent Version (United States)
<b>Refrigerant Detection Sensor Kit</b>	
27V53	All models

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL

NF97X040V3BR BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	873				1153			
+18%	831				1099			
+12%	816				1041			
+6%	771				999			
Factory Default	704				944			
-6%	651				887			
-12%	578				826			
-18%	542				757			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	549	732	862	970	907	1072	1233	1373
Factory Default	521	637	760	873	830	975	1117	1268
-	441	560	684	784	736	574	1014	1142

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X040V3BR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	17	30	47	64	78	97	113	130	152	60	80	109	130	158	181	205	231	251	271	288
	Med-low	31	39	60	91	118	136	156	182	199	112	132	158	186	214	237	263	288	315	344	359
	Med-High	65	77	96	126	144	174	191	217	238	176	196	225	257	288	318	344	372	402	432	455
	High	87	104	128	157	178	201	227	250	276	256	277	309	338	373	404	431	465	493	521	531
<b>Factory Default</b>																					
Cooling Speed	Low	23	27	42	57	70	86	108	120	139	45	59	85	108	132	156	179	197	213	241	257
	Med-low	25	35	57	78	101	117	145	155	179	86	95	125	147	175	197	223	252	275	296	320
	Med-High	41	58	82	102	130	145	171	186	206	125	150	175	204	233	260	281	314	340	363	395
	High	65	84	108	133	157	175	198	222	246	201	219	245	277	310	338	364	392	420	451	483
<b>- Setting</b>																					
Cooling Speed	Low	15	23	35	37	65	82	96	117	127	31	42	64	89	111	133	150	169	190	207	230
	Med-low	19	28	46	65	81	99	113	134	152	62	74	99	120	147	170	194	214	238	258	278
	Med-High	25	32	58	86	105	125	144	166	183	86	107	137	159	185	212	236	263	286	308	335
	High	45	59	82	102	131	151	172	197	212	130	160	190	218	246	271	295	321	351	377	404

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X040V3BR BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	863				1129			
+18%	807				1087			
+12%	761				1021			
+6%	713				775			
Factory Default	716				723			
-6%	683				686			
-12%	589				599			
-18%	562				558			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	554	705	841	958	868	1057	1217	1344
Factory Default	509	606	724	875	799	969	1109	1253
-	436	559	675	754	703	860	1002	1137

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X040V3BR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	21	32	44	63	81	97	121	136	150	65	85	103	127	154	173	199	220	242	264	287
	Med-low	30	44	67	90	116	136	158	176	200	122	142	162	188	211	235	264	289	318	341	366
	Med-High	41	68	94	120	144	166	191	214	234	181	203	232	261	287	316	346	377	408	432	452
	High	85	105	129	159	173	203	228	248	276	262	281	313	347	374	393	429	463	496	514	534
<b>Factory Default</b>																					
Cooling Speed	Low	17	24	42	57	72	87	110	124	138	42	57	83	106	128	150	174	200	217	236	260
	Med-low	25	35	56	74	96	122	138	159	187	84	101	127	149	171	198	220	247	270	292	320
	Med-High	45	59	74	100	124	152	165	190	207	123	150	187	213	238	257	289	316	338	361	395
	High	68	85	111	133	154	179	201	227	249	200	222	255	286	314	337	366	396	413	454	476
<b>- Setting</b>																					
Cooling Speed	Low	18	24	35	48	64	79	95	117	127	35	42	67	83	106	126	151	166	191	201	236
	Med-low	21	29	45	65	79	95	114	137	159	61	72	99	122	142	166	187	211	230	259	278
	Med-High	23	32	62	83	105	127	144	167	186	84	105	141	160	188	209	242	259	285	311	328
	High	45	58	83	100	124	150	168	188	211	132	166	198	217	243	273	303	331	360	374	400

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X040V3BR BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
	+24%	886				905		
+18%	825				859			
+12%	802				819			
+6%	769				770			
Factory Default	688				736			
-6%	634				678			
-12%	635				605			
-18%	547				553			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	542	698	835	947	886	1034	1201	1320
Factory Default	462	634	735	855	808	949	1096	1248
-	413	534	678	779	734	868	987	1130

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X040V3BR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	20	29	49	62	84	94	108	129	144	61	75	98	126	150	177	197	219	241	268	284
	Med-low	35	42	65	87	110	134	152	174	195	102	126	153	174	204	229	255	284	305	333	357
	Med-High	45	67	94	115	135	165	184	204	231	177	196	218	256	281	307	338	364	396	414	442
	High	87	95	121	146	166	201	220	244	269	235	260	288	324	357	381	406	439	474	502	529
<b>Factory Default</b>																					
Cooling Speed	Low	18	24	39	53	70	85	104	123	145	44	52	81	104	123	146	169	192	210	234	255
	Med-low	34	50	75	92	116	140	163	182	204	129	143	167	190	220	243	277	298	322	360	388
	Med-High	60	77	94	122	145	170	193	216	235	188	205	234	264	288	318	351	377	405	437	466
	High	65	84	108	133	157	175	198	222	246	201	219	245	277	310	338	364	392	420	451	483
<b>- Setting</b>																					
Cooling Speed	Low	14	21	35	48	63	84	92	109	128	25	35	64	88	109	136	150	176	194	216	234
	Med-low	20	30	42	59	77	100	126	139	150	46	64	84	113	136	166	187	206	229	252	271
	Med-High	22	32	49	85	99	124	142	164	187	88	101	131	152	183	204	225	256	278	304	331
	High	45	62	70	106	122	150	167	196	218	138	155	177	204	232	264	284	317	342	366	389

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X060V3BR BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1106				1234			
+18%	1047				1158			
+12%	989				1110			
+6%	940				1054			
Factory Default	886				999			
-6%	837				947			
-12%	780				882			
-18%	722				826			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	611	739	843	949	879	1046	1212	1380
Factory Default	554	681	783	883	816	952	1107	1254
-	486	630	712	802	739	876	1006	1132

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X060V3BR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	32	44	59	77	94	109	126	142	157	71	86	110	132	158	179	204	225	238	258	277
	Med-low	45	62	79	97	123	138	156	177	193	126	142	166	189	211	236	263	293	317	335	358
	Med-High	67	81	103	124	150	174	192	206	231	182	202	232	259	288	316	343	372	405	430	459
	High	88	107	135	154	183	201	229	254	273	269	293	328	364	386	420	444	481	511	530	521
<b>Factory Default</b>																					
Cooling Speed	Low	26	37	56	67	82	94	113	129	148	70	87	97	119	144	166	177	203	213	229	251
	Med-low	33	45	71	88	112	131	142	158	173	100	112	134	154	179	208	233	253	279	293	306
	Med-High	43	67	87	113	135	148	171	188	207	134	157	188	216	239	268	299	321	349	374	397
	High	78	96	117	137	156	184	209	222	250	203	229	256	284	317	346	370	404	433	466	491
<b>- Setting</b>																					
Cooling Speed	Low	143	154	168	190	205	221	96	117	127	31	42	64	89	111	133	150	169	190	207	230
	Med-low	33	45	59	77	95	111	130	143	163	68	83	108	128	149	171	197	217	236	255	270
	Med-High	40	50	73	92	115	132	145	164	178	98	115	143	165	192	214	242	266	289	310	329
	High	49	66	94	113	133	156	171	196	207	145	164	194	222	247	275	305	332	352	380	411

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X060V3BR BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1114				1237			
+18%	1063				1168			
+12%	1010				1106			
+6%	951				1064			
Factory Default	892				1003			
-6%	837				942			
-12%	761				869			
-18%	693				809			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	599	749	867	981	892	1057	1229	1404
Factory Default	549	656	754	866	775	958	1115	1279
-	475	609	680	773	708	854	1011	1147

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X060V3BR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	33	42	60	75	92	107	124	144	164	88	97	116	142	158	186	203	226	245	265	284
	Med-low	46	62	84	104	124	141	160	180	197	126	149	176	199	221	253	274	295	324	345	368
	Med-High	71	88	107	131	151	177	196	211	227	204	226	251	279	306	333	358	382	413	448	471
	High	101	119	142	169	189	214	242	262	271	311	333	366	396	421	458	481	511	527	528	498
<b>Factory Default</b>																					
Cooling Speed	Low	27	34	54	67	79	91	108	132	142	56	74	97	118	138	155	173	198	212	232	246
	Med-low	34	42	66	88	104	122	133	154	172	101	118	142	164	187	209	234	254	271	295	316
	Med-High	60	70	86	108	126	147	169	185	201	155	178	201	230	251	282	307	330	352	377	400
	High	79	95	117	136	161	184	200	218	238	234	259	291	313	340	366	399	427	449	480	485
<b>- Setting</b>																					
Cooling Speed	Low	19	28	42	55	69	84	98	115	130	34	55	76	94	117	132	152	167	185	203	223
	Med-low	27	41	60	74	89	106	124	144	162	73	87	108	134	159	176	196	209	238	251	273
	Med-High	32	45	70	92	107	127	146	163	178	102	128	153	173	202	223	250	275	293	313	335
	High	59	70	87	112	134	150	170	189	203	161	188	212	242	266	283	313	347	367	395	409

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X060V3BR BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1098				1229			
+18%	1039				1168			
+12%	992				1104			
+6%	930				1051			
Factory Default	885				996			
-6%	822				937			
-12%	773				878			
-18%	717				817			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	578	746	847	957	889	1042	1197	1364
Factory Default	556	665	764	864	799	949	1093	1249
-	485	593	706	783	721	845	988	1122

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X060V3BR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	32	44	59	70	94	109	128	143	167	70	82	105	127	149	170	195	215	237	256	274
	Med-low	43	59	80	103	115	140	160	174	195	111	134	160	181	206	230	252	278	301	325	353
	Med-High	61	73	100	125	145	168	185	208	222	170	193	222	246	273	301	328	355	384	407	439
	High	89	114	138	160	181	203	227	248	263	262	291	315	349	373	401	430	461	490	517	535
<b>Factory Default</b>																					
Cooling Speed	Low	22	32	47	62	78	93	111	123	142	58	70	88	106	132	148	168	189	209	230	247
	Med-low	30	40	57	80	99	117	135	155	169	99	108	123	147	172	191	220	239	256	282	305
	Med-High	44	58	77	99	120	141	158	177	202	135	151	177	202	224	251	278	299	319	348	375
	High	62	88	101	123	145	168	192	210	230	207	224	251	282	302	327	361	384	409	435	461
<b>- Setting</b>																					
Cooling Speed	Low	20	28	44	59	69	86	98	114	132	33	45	68	89	109	129	145	165	183	202	218
	Med-low	31	44	60	76	94	112	127	144	157	69	81	100	121	141	164	185	207	227	247	265
	Med-High	48	57	73	95	107	127	146	167	186	99	113	136	162	184	207	233	251	279	300	322
	High	52	65	97	118	132	151	175	189	209	132	164	189	213	243	266	289	318	339	367	385

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X080V4CR BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1499				1640			
+18%	1427				1546			
+12%	1361				1472			
+6%	1294				1399			
Factory Default	1219				1315			
-6%	1176				1242			
-12%	1090				1173			
-18%	1007				1077			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	797	954	1071	1241	1102	1304	1508	1713
Factory Default	713	873	969	1147	1006	1186	1392	1588
-	623	767	880	1025	911	1068	1252	1422

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X080V4CR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	45	57	78	103	121	145	167	184	205	97	116	144	167	200	228	255	276	302	325	352
	Med-low	70	83	107	132	155	184	208	228	253	160	174	202	233	265	296	328	357	382	414	443
	Med-High	88	105	135	160	191	215	241	268	297	226	251	286	323	358	387	423	461	494	527	554
	High	133	154	179	209	240	271	299	327	357	321	357	397	434	474	505	547	587	630	668	711
<b>Factory Default</b>																					
Cooling Speed	Low	28	43	65	92	114	134	153	174	192	77	97	129	152	178	203	224	255	279	298	325
	Med-low	46	69	94	117	138	161	187	210	230	123	148	179	205	236	267	289	318	348	367	399
	Med-High	70	88	116	140	165	192	211	242	260	182	204	242	266	297	336	363	396	430	450	481
	High	106	129	156	184	213	243	264	288	313	275	305	344	377	408	443	478	519	550	585	612
<b>- Setting</b>																					
Cooling Speed	Low	25	41	58	78	95	113	126	144	165	62	75	97	128	151	172	197	213	235	263	281
	Med-low	44	57	74	98	122	141	162	185	204	83	109	137	162	194	215	242	271	291	318	335
	Med-High	58	71	95	121	143	168	195	214	233	141	162	190	222	255	288	313	341	360	401	423
	High	72	94	122	149	173	201	225	249	274	200	223	258	290	324	358	387	426	453	477	506

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X080V4CR BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1433				1542			
+18%	1353				1480			
+12%	1275				1398			
+6%	1229				1334			
Factory Default	1154				1253			
-6%	1093				1181			
-12%	1024				1107			
-18%	958				1054			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	792	959	1118	1264	1104	1302	1530	1730
Factory Default	844	876	1008	1162	1001	1202	1397	1612
-	643	771	908	1055	915	1090	1253	1443

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X080V4CR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	50	64	92	116	135	155	184	202	216	123	156	180	207	237	266	289	316	344	371	392
	Med-low	88	106	128	153	178	201	231	254	272	206	225	258	290	318	351	379	416	445	474	498
	Med-High	119	139	171	196	221	251	276	305	326	304	330	369	407	446	482	511	540	588	615	653
	High	183	201	231	260	287	320	349	379	409	423	464	503	544	587	631	661	703	736	781	783
<b>Factory Default</b>																					
Cooling Speed	Low	62	74	105	126	151	170	197	216	238	91	118	143	167	196	220	247	271	295	318	341
	Med-low	68	79	102	127	150	175	201	220	244	146	178	213	241	268	292	323	360	384	409	433
	Med-High	88	108	137	160	188	217	242	261	288	234	259	295	329	364	394	424	458	490	518	558
	High	129	157	184	214	239	265	295	317	349	333	368	407	448	493	529	561	598	631	668	704
<b>- Setting</b>																					
Cooling Speed	Low	42	58	72	90	111	128	146	168	180	75	95	116	141	166	190	215	237	260	280	304
	Med-low	52	70	88	113	140	162	182	203	221	121	139	164	194	219	245	275	303	326	353	379
	Med-High	73	95	116	143	172	190	215	237	259	169	191	228	259	288	320	345	377	408	434	467
	High	101	119	146	172	199	222	249	276	300	239	267	309	350	379	421	441	474	509	545	575

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X080V4CR BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1407				1528			
+18%	1342				1461			
+12%	1283				1388			
+6%	1217				1304			
Factory Default	1152				1237			
-6%	1080				1150			
-12%	1015				1114			
-18%	953				1038			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	831	969	1103	1269	1096	1323	1541	1731
Factory Default	753	905	1008	1150	1005	1208	1385	1605
-	806	807	932	1045	920	1102	1269	1451

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X080V4CR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	45	62	89	112	135	156	176	200	220	103	135	164	190	212	247	270	298	325	350	376
	Med-low	77	90	116	144	171	194	217	240	264	191	207	239	275	311	337	368	394	429	461	484
	Med-High	116	129	154	181	208	235	263	289	314	285	303	343	377	416	454	489	523	556	585	621
	High	153	177	204	238	264	297	329	356	387	399	430	468	508	554	589	639	677	709	752	779
<b>Factory Default</b>																					
Cooling Speed	Low	41	54	78	103	121	143	163	185	207	102	113	132	156	184	211	240	259	286	313	334
	Med-low	56	78	106	132	151	177	201	221	244	134	164	191	224	253	282	312	340	368	397	425
	Med-High	91	106	135	163	185	211	235	260	284	219	242	272	305	341	379	407	435	462	498	529
	High	131	150	176	206	234	262	288	316	341	305	338	377	419	454	493	531	565	603	629	664
<b>- Setting</b>																					
Cooling Speed	Low	49	63	86	106	130	156	175	194	217	68	84	111	135	160	186	210	230	254	280	298
	Med-low	35	56	82	104	131	151	170	191	212	112	133	161	189	215	240	267	296	318	347	370
	Med-High	66	77	109	132	153	178	201	226	250	164	187	221	249	284	309	333	368	396	428	456
	High	101	112	138	165	192	215	243	268	293	223	256	298	327	365	402	434	469	500	526	565

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

NF97X080V5CR BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
<sup>1</sup> Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1477				2011			
+18%	1403				1883			
+12%	1323				1782			
+6%	1249				1697			
Factory Default	1178				1578			
-6%	1103				1477			
-12%	1033				1388			
-18%	965				1291			
COOLING								
<sup>1</sup> Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	<sup>2</sup> High	Low	Medium-Low	Medium-High	<sup>2</sup> High
+	943	1090	1277	1465	1346	1594	1804	2081
Factory Default	839	993	1156	1317	1225	1434	1644	1896
-	732	876	1035	1186	1083	1278	1490	1706

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

## NF97X080V5CR BLOWER MOTOR WATTS (cooling)

<sup>1</sup> Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	89	123	146	171	192	218	240	268	205	248	276	310	346	376	401	437	460	498	371	392
	Med-low	126	159	188	212	242	265	288	313	321	356	391	431	478	513	549	580	608	636	474	498
	Med-High	173	210	242	275	308	338	364	392	443	495	535	582	624	670	712	759	796	831	615	653
	High	252	282	316	347	389	423	451	477	652	710	759	805	849	912	950	1006	1054	1045	781	783
<b>Factory Default</b>																					
Cooling Speed	Low	82	103	122	146	166	194	213	247	163	199	229	265	285	318	346	376	399	419	318	341
	Med-low	103	133	157	179	207	232	255	274	234	272	305	342	388	417	452	482	511	539	409	433
	Med-High	143	173	205	232	251	283	310	334	336	378	416	453	508	534	576	622	644	687	518	558
	High	190	225	258	293	327	353	379	409	499	550	591	638	680	717	767	815	859	909	668	704
<b>- Setting</b>																					
Cooling Speed	Low	70	85	103	122	147	165	187	207	125	158	189	217	236	265	300	321	343	374	280	304
	Med-low	86	111	128	149	173	197	221	249	181	214	251	288	319	343	373	404	433	459	353	379
	Med-High	109	139	172	197	217	244	269	290	261	303	336	372	414	441	478	510	544	574	434	467
	High	145	179	214	248	268	299	323	348	368	408	455	499	533	578	610	663	695	727	545	575

# Blower Data

## BLOWER PERFORMANCE DATA - UPFLOW/HORIZONTAL (cont.)

### NF97X080V5CR BLOWER PERFORMANCE (less filter)

**SINGLE SIDE RETURN AIR** - Air volumes in **bold** require Optional Return Air Base and field fabricated transition to accommodate 20 X 25 X 1 in. cleanable air filter in order to maintain proper air velocity across the filter.

**0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range**

HEATING								
1 Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
	+24%	1446				<b>1952</b>		
+18%	1374				<b>1853</b>			
+12%	1304				1745			
+6%	1218				1668			
Factory Default	1161				1558			
-6%	1096				1466			
-12%	1015				1380			
-18%	953				1278			
COOLING								
1 Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	2 High	Low	Medium-Low	Medium-High	2 High
+	945	1279	1430	1609	1599	1823	<b>2051</b>	<b>2239</b>
Factory Default	1003	1160	1308	1454	1438	1649	1863	<b>2097</b>
-	894	1044	1166	1309	1301	1490	1683	1897

<sup>1</sup> Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

<sup>2</sup> Factory default setting.

**NOTES** - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

### NF97X080V5CR BLOWER MOTOR WATTS (cooling)

1 Cooling Speed DIP Switch Settings	Motor Watts @ Various External Static Pressures - in. wg.																				
	First Stage										Second Stage										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
<b>+ Setting</b>																					
Cooling Speed	Low	86	122	150	172	197	220	245	267	180	226	265	301	330	370	399	434	471	514	325	352
	Med-low	124	151	188	216	239	266	295	312	296	334	380	422	462	507	547	577	619	652	414	443
	Med-High	171	201	238	270	309	339	366	389	442	474	532	567	623	665	718	743	805	852	527	554
	High	233	278	311	341	387	430	460	496	645	702	751	813	874	919	974	1000	1051	1044	668	711
<b>Factory Default</b>																					
Cooling Speed	Low	77	101	123	137	159	188	206	233	158	197	231	268	289	321	349	378	404	429	298	325
	Med-low	95	123	157	182	203	231	258	277	242	283	320	349	389	435	467	494	527	557	367	399
	Med-High	135	173	198	235	264	288	311	340	327	366	417	461	500	548	584	626	662	702	450	481
	High	192	227	256	294	330	357	391	409	495	540	587	628	677	723	764	828	868	922	585	612
<b>- Setting</b>																					
Cooling Speed	Low	64	82	104	122	135	156	181	197	123	157	187	221	246	270	294	323	352	368	263	281
	Med-low	84	105	129	152	169	195	221	240	179	219	250	289	324	355	382	405	435	458	318	335
	Med-High	111	132	168	199	216	241	264	290	260	305	337	368	406	446	487	521	556	584	401	423
	High	141	176	209	243	268	298	320	349	365	414	449	494	533	577	629	671	697	751	477	506

# Parts Arrangement

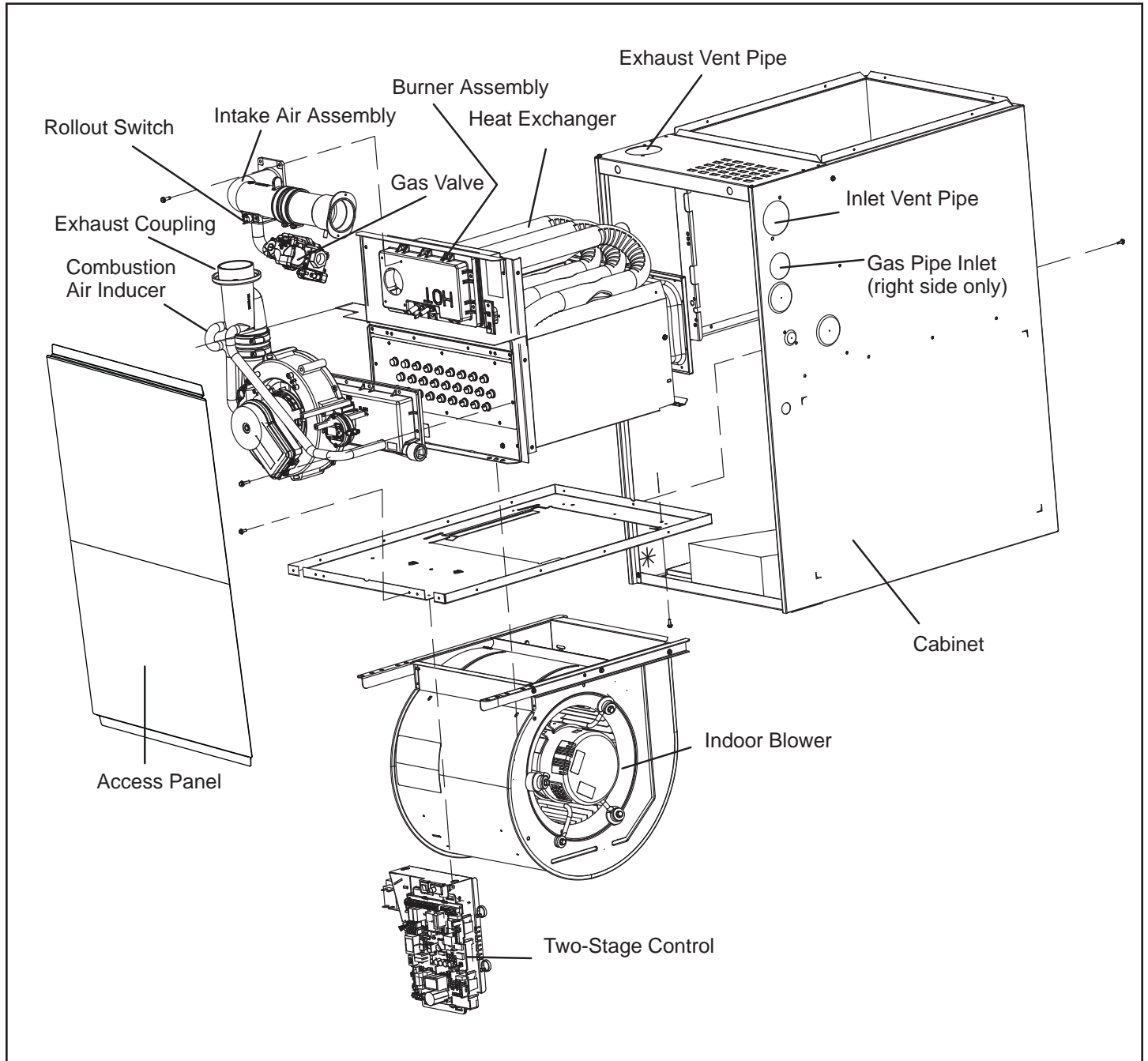


Figure 1.

# Service Information

## UNIT COMPONENTS

NF97X\*\*\*V\*\*R 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 section.

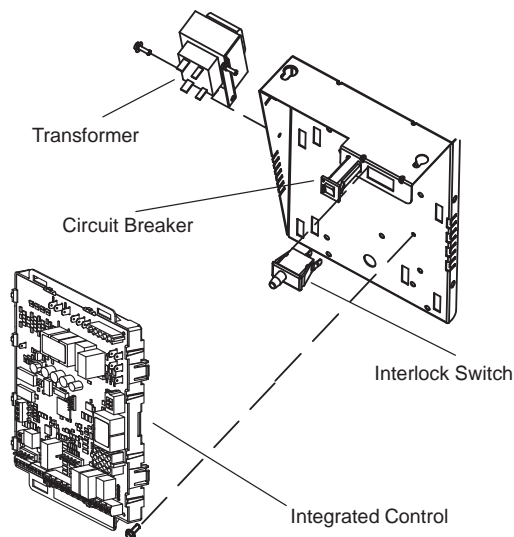
NF97X\*\*\*V\*\*R units are factory equipped with a bottom return air panel in place. The panel is designed to be field removed as required for bottom air return. Markings are provided for side return air and may be cut out in the field.

**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 24V secondary.



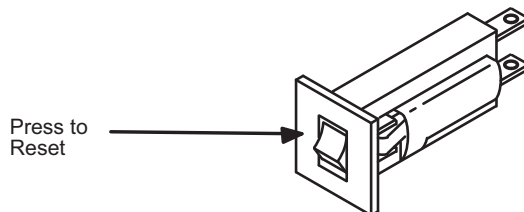
**Figure 2. Control Box**

#### 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 at 3A at 32V. If the current exceeds this limit the breaker will trip and all unit operation will shut down. 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. 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 two-stage, variable speed integrated control. The control can operate with a non-communicating conventional single or two-stage thermostat. The system consists of a ignition / blower control (**Figure 4**) with control pin designations in **Table 1**, **Table 2**, **Table 3**, **Table 4** and 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 5 under LIMIT CODE, an "E" followed by "2" followed by "5" followed by "0", the limit switch circuit is open. The control also has two unpowered (dry) 1/4" contacts for a humidifier and a 120 volt accessory terminal. Both rated at (1) one amp each.

# Service Information

## UNIT COMPONENTS (Cont.)

Table 1.

1/4" Quick Connect Terminals	
HUM	120 VAC Output to Humidifier
XFMR	120 VAC Output to Transformer
L1	120 VAC Input to Control
CIRC	120 VAC Output to Circulating Blower
ACC	120 VAC To Electrical Air Cleaner
NEUTRALS (5)	120 VAC Neutral

Table 2.

12 PIN MAIN HARNESS	
1	Main Valve High
2	High Pressure Switch
3	Rollout Input
4	Ground
5	24vac Hot
6	High Limit Switch
7	Main Valve Low
8	Main Valve Common
9	24VAC Return
10	Ground
11	Rollout Switch Output
12	Low Pressure Switch

Table 3.

Thermostat Input Terminals	
W1	Low Stage Heat
W2	High Stage Heat
G	Fan
Y1	Low Stage Cool
Y2	High Stage Cool
C	Thermostat Common / Ground
R	24VAC Power to the Thermostat
DH	Dehumidification (Comm Only)
H	24V Humidifier Output
L	LSOM (Comm Only)
O	Heat Pump Reversing Valve
DS	Dehumidification (Non-Comm Only)

### Electronic Ignition

At the beginning of the heat cycle the integrated control monitors the first stage and second stage combustion air inducer prove switch. The control will not begin the heating cycle if the first stage prove switch is closed (by-passed). Likewise the integrated control will not begin the second stage heating cycle if the second stage prove switch is closed, and will remain in first stage heat. However, if the second stage prove switch closes during the first stage heat pre-purge, the control will allow second stage heat.

**NOTE:** During abnormal conditions such as low supply voltage or low outdoor temperatures and the low fire pressure switch does not close, the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.

After the 15-second pre-purge period, the ignitor warms up for 20 seconds after which the gas valve opens for a 4-second trial for ignition. The ignitor energizes during the trial until flame is sensed. If ignition is not proved during the 4-second period, 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 Flame Failure mode. After a 60-minute reset period, the control will begin the ignition sequence again.

### Two Stage Operation / Thermostat Selection DIP Switch

The control can be utilized in two modes: SINGLE-STAGE thermostat or TWO-STAGE thermostat. The thermostat selection is made using a DIP switch and must be positioned for the particular application. DIP switch 1, labeled T"STAT HEAT STAGE is factory-set in the OFF position for use with a two-stage thermostat. Move the DIP switch to ON for use with a single stage thermostat.

While in the single-stage thermostat mode, the burners will always fire on first-stage heat. The combustion air inducer will operate on low speed and indoor blower will operate on low heat speed. The unit will switch to second stage heat after a "recognition period". DIP switch 2, labeled SECOND STAGE DELAY, is factory set in the OFF position for a 7 minute recognition period. The switch can be moved to the ON position for a 12 minute recognition period, after which time the unit will switch to secondstage heat.

While in the two-stage thermostat mode (two DIP switch setting) the burners will fire on first-stage heat. The combustion air inducer will operate on low speed and indoor blower will operate on low heat speed. The unit will switch to second-stage heat on call from the indoor thermostat. If there is a simultaneous call for first and second stage heat, the unit will fire an first stage heat and switch to second stage heat after 30 seconds of operation. See Sequence of Operation flow charts in the back of this manual for more detail.

# Service Information

## UNIT COMPONENTS (Cont.)

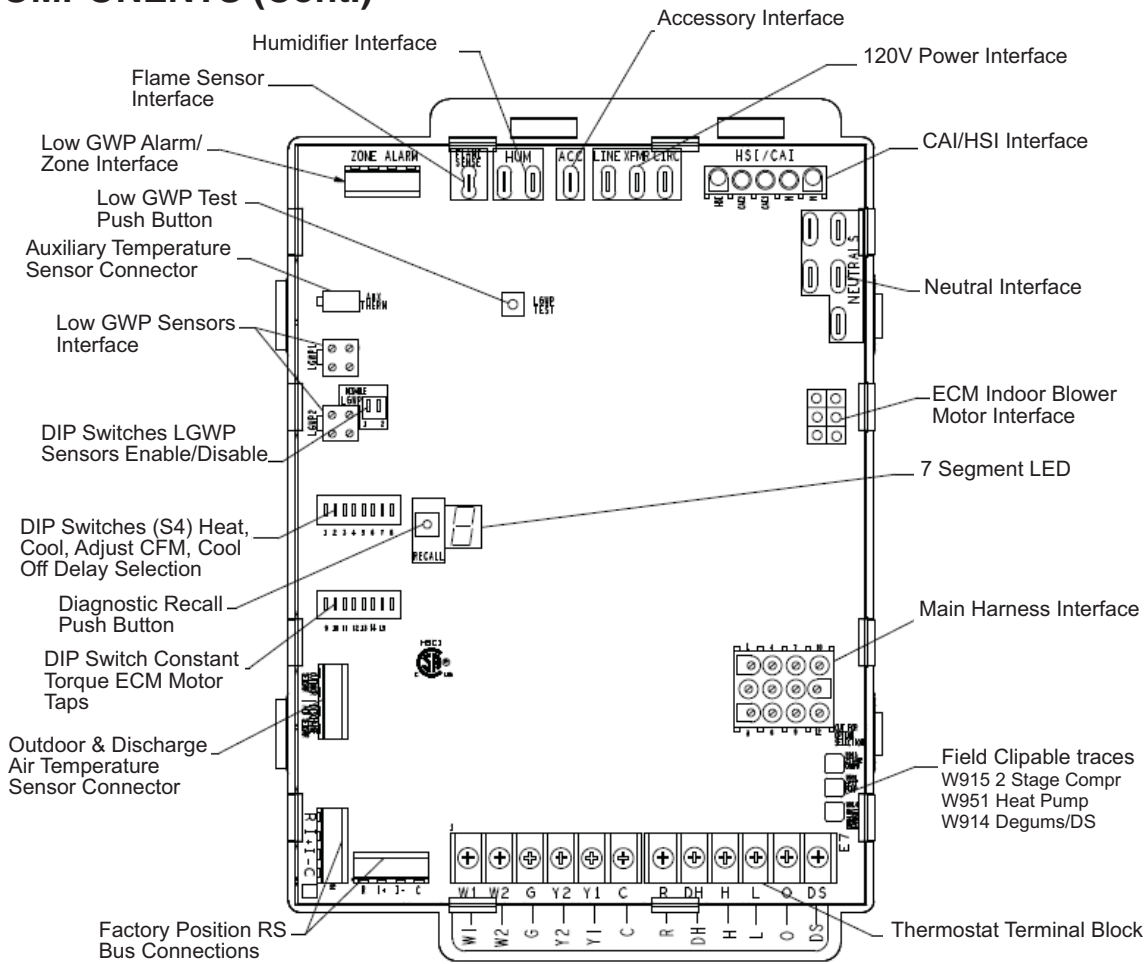


Figure 4. Two Stage, Variable Speed

### Diagnostic LED (Figure 4)

The seven-segment diagnostic LED displays operating status, target airflow, error codes and other information (see **Tables 4, 5 and 6**) lists diagnostic LED codes.

### Diagnostic Push Button (Figure 4)

The diagnostic push button is located adjacent to the seven-segment diagnostic LED (see **Figure 4** or **Figure 5**). This button is used to enable the Error Code Recall "E" mode and the Flame Signal "F" 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.

### Flame Signal Mode

Select "F" from the menu to access the flame signal mode. The integrated control will display the flame current on 7 segment LED in in micro amps (uA).

Flame signal mode is exited after the following:

- Power is reset
- Pressing and holding push button until 3 horizontal lines "≡" are displayed
- 10 minutes of entering the flame sense mode.

# Service Information

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## UNIT COMPONENTS (Cont.)

### Program Unit Capacity/Size Mode

After the "P" is selected (by releasing the push button) the integrated control will start flashing the "P" on display for 90 seconds. If push button is pressed again and held during that time, the control will start to display characters corresponding to different variable speed furnace models for 3 seconds each. While the wanted character-model is displayed push button has to be released. Selected option will flash display for 10 seconds and during that time push button has to be pressed and held for 5 seconds. Once control accepts new setting it will store data in non-volatile memory and reset itself. If 10 seconds expires or push button is held less than 5 seconds, control will exit field test mode and go into idle without changing programming the unit size.

### Soft Disable

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 reset All.

# Service Information

Table 4.

DIAGNOSTIC CODES / STATUS OF FURNACE	CODE
Idle Mode (Decimal blinks at 1 Hertz -- 0.5 Seconds ON, 0.5 Seconds OFF)	.
Indoor Blower Operation: Continuous Fan Mode (Constant Torque Only) Indoor Blower Operation: Followed by CFM Setting for Indoor Blower (1 Second ON, 0.5 Second OFF) / CFM Setting for Mode Displayed (Variable Speed Only)	A
Cooling Stage (1 Second ON, 0.5 Second OFF) 1 or 2 Displayed / Pause / Repeat Codes. Variable Speed Only	C
Gas Heat (1 Second ON, 0.5 Second OFF) Pause / CFM Displayed / Pause / Repeat Codes Blinking - Ignition	H
Heat Pump Stage (1 Second ON, 0.5 Second OFF) 1 or 2 Displayed / Pause / CFM Setting Displayed / Pause / Repeat Codes	h
Defrost Mode	dF
ERROR/FAULT CONDITION	CODE
No Error in the Memory	E000
ELECTRICAL FAULTS (WAIT FOR RECOVERY)	
AC Line Voltage Low	E110
Line Voltage Polarity Reversed	E111
Earth Ground Not Detected	E112
AC Line Voltage High	E113
Line Voltage Frequency Out Of Range	E114
Low 24V - Control Will Restart if the Error Recovers	E115
HARDWARE FAULT (5 MINUTES LOCKOUT)	
Control Hardware (Include A/D Electronics and Flame Test) Failure	E125
HARD LOCKOUT FAULT	
Rollout Open or Previously Opened	E200
GAS VALVE/PRESSURE SWITCH/LIMIT FAULTS (wait for recovery)	
Gas Valve Relay (1st or 2nd Stage) Problem	E204
Gas Valve 2nd Stage B Relay Problem	E206
Low Pressure SW Failed to Close (Stuck Open)	E223
Low Pressure SW Failed to Open (Stuck Closed)	E224
High Pressure SW Failed to Close (Stuck Open)	E225
High Pressure SW Failed to Open (Stuck Closed)	E226
Low Pressure Switch Opened in RUN or TFI	E227
Flame Sense Out of Sequence-Still Present	E241
Primary Limit Switch Opened	E250
RSBUS COMMUNICATION CODES	
Device Communication Problem - No Other Devices on Bus	E105
Unresponsive Device	E120
Active Subnet Controller Missing for More than 3 Minutes	E124
OUTDOOR UNITS CODES	
Relay Y1 Stuck	E344
Relay O Failure	E345
Outdoor Air Temperature Sensor Failure	E180
Relay Y1 Failure - Relay Energized but No Input Sensed	E347
Relay Y2 Failure - Relay Energized but No Input Sensed	E348
Interlock Switch (DS Terminal) Sensed Open (Communicating Mode Only)	E370

# Service Information

Table 4. (Cont.)

ERROR/FAULT CONDITION (Cont.)	CODE
<b>SOFT LOCKOUT FAULTS (60 MINUTES)</b>	
Unable to Communicate with Circular Motor	E201
Gas Valve Relay (1st or 2nd Stage) Contact Shorted	E205
Hot Surface Ignitor (HSI) Sensed Open	E207
Soft Lockout-Flame Failure on Ignition, Ignition Retry>Max, Last Failed Retry Due to Flame Failure	E270
Soft Lockout-Pressure Switch Open, Ignition Retry>Max, Last Failed Retry Due to LPSW Open	E271
Soft Lockout-Pressure Switch Open, in Run Mode Heating Recycles>Max, Last Failed Retry Due to LPSW Open	E272
Soft Lockout-Flame Failure in Run Mode, Heating Recycles>Max, Last Failed Retry Due to Loss of Flame	E273
Soft Lockout-Limit Open > 3 Minutes	E274
Soft Lockout-Flame Out of Sequence and is Gone	E275
Ignitor Circuit Fault-Failed Ignitor or Triggering Circuitry.	E290
Indoor Blower Unable to Start	E292
<b>PERFORMANCE WARNING</b>	
Poor Ground Detected	E117
Ignition on High Fire	E229
Low Flame Current in Heating Mode	E240
Non-Volatile Data Corruption	E131
Low Flame Current in Heating Mode	E240
Discharge Temperature Too High	E252
Indoor Blower Motor Temperature Too High	E295
Discharge Air Sensor Failure - No Error if Just Disconnected, Only Show if Shorted or Out of Range	E310
Restricted Airflow Heating, Heat Firing Rate Reduced to Match Cfm	E311
Restricted Airflow Cooling or Continuous Fan Mode - Information Only	E312
Indoor Outdoor Unit Capacity Mismatch	E313
<b>LOW GWP REFRIGERANT FAULTS</b>	
Refrigerant Leak Detected, Thermostat Lockout	E150
Refrigerant Leak Detector Sensor #1 Fault	E151
Refrigerant Leak Detector Sensor #2 Fault	E152
Refrigerant Leak Detector Sensor #1 Comm. Lost	E154
Refrigerant Leak Detector Sensor #2 Comm. Lost	E155
Refrigerant Leak Detector Sensor #1 Type Incorrect	E160
Refrigerant Leak Detector Sensor #2 Type Incorrect	E161
Refrigerant Leak Detector Control Failure	E163
Low GWP Test	E164
Low GWP Relay Stuck	E390

# Service Information

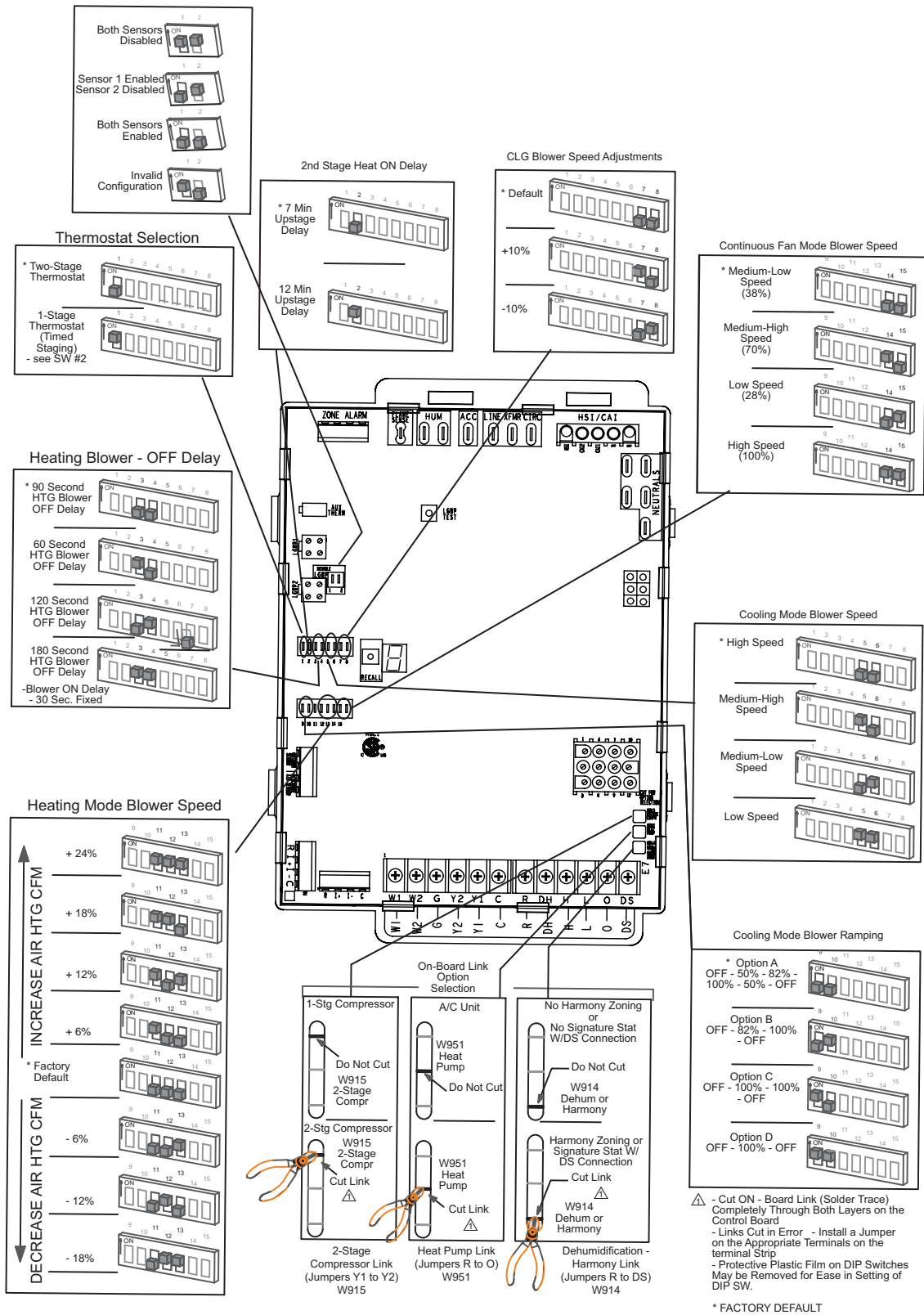



Figure 5. Integrated Control Configuration Guide

# Service Information

Display	Action (when button released)
No change (idle)*	Remain in idle mode
Solid "E"	Enter diagnostic recall mode
Solid "D"	Discharge air installed
Solid "F"	Enter flame signal mode
Solid "P" (variable speed only)	Program unit capacity / size (Unit Code)**
Two horizontal bars 	Soft disable
* No change implies the display will continue to show whatever is currently being displayed for normal operation (blinking decimal, active error code, heat state, etc.).	

**Table 5. Integrated Control Diagnostic Modes**

# Service Information

**Table 6. Integrated Diagnostic Codes/Status of Equipment**

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
.	Idle mode (Decimal blinks at 1 Hertz -- 0.5 second ON, 0.5 second OFF).	
A	Cubic feet per minute (cfm) setting for indoor blower (1 second ON, 0.5 second OFF) / cfm setting for current mode displayed.	
C	Cooling stage (1 second ON, 0.5 second 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 second OFF) / % of input rate displayed / Pause / cfm setting / Pause / Repeat codes.	
H	Gas Heat Stage (1 second ON, 0.5 second 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).	
E110	Low line voltage.	Line Voltage Low (Voltage lower than nameplate rating). Check power line voltage and correct. Alarm clears 5 seconds after fault recovered.
E111	Low line voltage.	Reverse line power voltage wiring. System resumes normal operation 5 seconds after fault recovered.
E112	Ground not detected	System shuts down. Provide proper earth ground. System resumes normal operation 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 Low (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.
E116	High 24V.	24-Volt Power high (Range is 18 to 30 volts). Check and correct voltage. Check for proper line voltage (120V 240V etc) to equipment. Clears when control senses proper voltage.
E117	Poor ground detected (Warning only)	Provide proper grounding for unit. Check for proper earth ground to the system. Warning only will clear 30 seconds after fault recovered.

# Service Information

**Table 6. Integrated Diagnostic Codes/Status of Equipment (Cont.)**

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
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. Critical alert. 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 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 'Set Factory Default mode Control will still operate on default parameter settings.
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.
E206	Gas valve second-stage relay failure	Furnace will operate on 1st stage for remainder of the heating demand. Will clear after fault recovered. If unable to operate 2nd stage 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.

# Service Information

**Table 6. Integrated Diagnostic Codes/Status of Equipment (Cont.)**

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
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.
E229	Ignition on high fire	IFC switched to high fire ignition because low fire pressure switch did not close in allowed time. No action is needed.
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	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.

# Service Information

**Table 6. Integrated Diagnostic Codes/Status of Equipment (Cont.)**

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
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.
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.
E344	Relay "Y1" stuck on integrated control.	Replace integrated control.
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.
E370	Interlock switch sensed open for 2 minutes.	Control sees the loss of 24VAC for 2 minutes. Terminate all services and wait for interlock switch to close. The alarm will clear when 24VAC is continuously sensed on DS terminal for a minimum of 10 seconds or on a power reset.
E272	Soft lockout - Exceeded maximum number of recycles. Last recycle due to the pressure switch opening.	Check operation of low pressure switch 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 (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.

# Service Information

**Table 6. Integrated Diagnostic Codes/Status of Equipment (Cont.)**

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
E400	LSOM - Compressor internal overload tripped	Thermostat demand Y1 is present; but, compressor is not running. Check power to outdoor unit. Clears the error after current is sensed in both RUN and START sensors for at least 2 seconds, or after service is removed; or power reset.
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.

# Service Information

## DIP SWITCH SETTINGS

### Heating Operation DIP Switch Settings

**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.

- Select "OFF" for two-stage heating operation controlled by a two-stage heating thermostat (factory setting);
- Select "ON" for two-stage heating operation controlled by a single-stage heating thermostat. This setting provides a timed delay before second-stage heat is initiated.

**Switch 2 -- Second Stage Delay (Used with Single-Stage Thermostat Only)** -- This switch is used to determine the second stage on delay when a single-stage thermostat is being used. The switch is factory-set in the OFF position, which provides a 7-minute delay before second-stage heat is initiated. If the switch is toggled to the ON position, it will provide a 12-minute delay before second-stage heat is initiated. This switch is only activated when the thermostat selector jumper is positioned for single-stage thermostat use.

**Switches 3 and 4 -- Blower-Off Delay** -- The blower-on delay of 30 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 3 and 4 on the integrated control. The unit is shipped from the factory with a blower-off delay of 120 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 7** provides the blower off timings that will result from different switch settings.

Blower Off Delay (Seconds)	Switch 3	Switch 4
60	On	Off
120 (Factory)	Off	Off
180	Off	On
210	On	On

**Table 7. Blower Off Delay Switch Settings**

### Indoor Blower Operation DIP Switch Settings

#### Switches 5 and 6 -- Cooling Mode Blower 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 8** provides the cooling mode blower speeds that will result from different switch settings. Switches 5 and 6 set the blower cfm for second stage cool. The integrated control automatically ramps down to 70% of the second-stage cfm for first-stage cfm. Refer to blower data tables for corresponding cfm values.

Speed	Switch 5	Switch 6
Low	On	On
Medium Low	Off	On
Medium High	On	Off
High (Factory)	Off	Off

**Table 8. Cooling Mode Blower Speeds**

#### Switches 7 and 8 -- Cooling Blower Speed Adjustment

-- 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 9** provides blower speed adjustments that will result from different switch settings. Refer to blower data tables for corresponding cfm values.

Adjustment	Switch 7	Switch 8
+10% (approx.)	On	Off
Factory Default	Off	Off
-10% (approx.)	Off	On

**Table 9. Cooling Blower Speed Adjustment**

#### Switches 9 and 10 -- Cooling Mode Blower Speed Ramping

-- Blower speed ramping may be used to enhance dehumidification performance. The switches are factory set at option A which has the greatest effect on dehumidification performance. **Table 10** 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.

**NOTE:** In heat pump mode blower operation defaults to Option C.

Ramping Option	Switch 9	Switch 10
A (Factory)	Off	Off
B	Off	On
C	On	Off
D	On	On

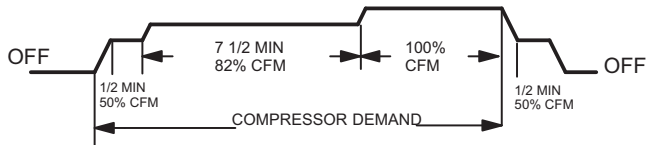
**Table 10. Cooling Mode Blower Speed Ramping**

# Service Information

## DIP SWITCH SETTINGS (Cont.)

### 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.



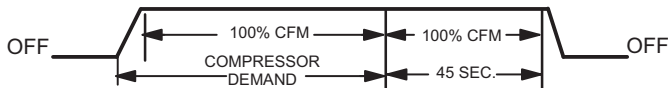
### Ramping Option B

- 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.



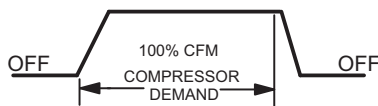
### Ramping Option C

- 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 11, 12 and 13 -- Heating Mode Blower Speed

-- The switches are factory set to the OFF position which provides factory default heat speed. Refer to **Table 11** for switches 11, 12 and 13 that provided the corresponding increases or decrease to both high and low heat demand.

Heat Speed	Switch 11	Switch 12	Switch 13
Increase 24%	On	On	On
Increase 18%	On	On	Off
Increase 12%	On	Off	On
Increase 6%	On	Off	Off
Factory Default	Off	Off	Off
Decrease 6%	Off	Off	On
Decrease 12%	Off	On	Off
Decrease 18%	Off	On	On

**Table 11. Heating Mode Blower Speeds**

**Switches 14 and 15 -- Continuous Blower Speed -- Table 12** provides continuous blower speed adjustments that will result from different switch settings.

Continuous Blower Speed	Switch 14	Switch 15
28% of High Cool Speed	Off	On
38% of High Cool Speed (Factory)	Off	Off
70% of High Cool Speed	On	Off
100% of High Cool Speed	On	On

**Table 12. Continuous Blower Speed**

## ON-BOARD LINKS

**▲ WARNING** Carefully review all configuration information provided. Failure to properly set DIP switches, jumpers and on-board links can result in improper operation!

### On-Board Link W951 Heat Pump (R to O)

On-board link W914, is a clippable connection between terminals R and DS 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 PMW signal from the control will be blocked and also lead to control damage. Refer to **Table 13** for operation sequence in applications including NF97X\*\*\*V\*\*R, a thermostat which features humidity control and a single-speed outdoor unit. Table 14 gives the operation sequence in applications with a two-speed outdoor unit.

# Service Information

## ON-BOARD LINKS (Cont.)

### On-Board Link W951 Heat Pump (R to O)

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 2 Stage Compr (Y1 to Y2)

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 Y1 to Y2 link is not cut the outdoor unit will operate in second-stage cooling only.

Operating Sequence		System Demand				System Response				
System Condition	Step	Thermostat Demand				Relative Humidity		Compressor	Blower CFM (cool)	Comments
		Y1	O	G	W1	Status	D			
<b>NO CALL FOR DEHUMIDIFICATION</b>										
Normal Operation	1	On	On	On		Acceptable	24 VAC	High	100%	Compressor and indoor blower follow thermostat demand
<b>BASIC MODE (only active on a Y1 thermostat demand)</b>										
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%*	
<b>PRECISION MODE (operates independent of a Y1 demand)</b>										
Normal Operation	1	On	On	On		Acceptable	24 VAC	High	100%	Dehumidification mode begins when humidity is greater than set point
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 try to maintain room humidity setpoint by allowing the room space to maintain a cooler room thermostat setpoint**
Jumpers at indoor unit with a single stage outdoor unit With Condensing unit - Cut W914 (R to DS) on control With Heat Pump - Cut W914 (R to DS) & W951 (R to O) on control										
Comfort Sync® thermostat to use for this application - Y2081 4 heat / 2 cool										
*Dehumidification blower speed is 70% of COOL speed for all units.										
**In Precision mode, thermostat will maintain room temperature up to 2 °F (1.2°C) cooler than room setting.										

**Table 13. Operating Sequence  
Non-Communicating Thermostat with Humidity Control Feature and Single-Speed Outdoor Unit**

# Service Information

## ON-BOARD LINKS (Cont.)

Operating Sequence		System Demand						System Response				
System Condition	Step	Thermostat Demand						Relative Humidity		Compressor	Blower CFM (cool)	Comments
		Y1	Y2	O	G	W1	W2	Status	D			
<b>NO CALL FOR DEHUMIDIFICATION</b>												
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%	
<b>ROOM THERMOSTAT CALLS FOR FIRST STAGE COOLING</b>												
<b>BASIC MODE (only active on a Y1 thermostat demand)</b>												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	70%*	Thermostat energizes Y1 and de-energizes D on a call for de-humidification
Dehumidification call	2	On	On	On	On			Demand	0 VAC	High	70%**	
<b>PRECISION MODE (operates independent of a Y1 demand)</b>												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	70%*	Dehumidification mode begins when humidity is greater than set point
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 try to maintain room humidity setpoint by allowing the room space to maintain a cooler room thermostat setpoint**
<b>ROOM THERMOSTAT CALLS FOR FIRST AND SECOND STAGE COOLING</b>												
<b>BASIC MODE (only active on a Y1 thermostat demand)</b>												
Normal Operation	1	On	On	On	On			Acceptable	24 VAC	High	100%	Thermostat energizes Y2 and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	70%**	
<b>PRECISION MODE (operates independent of a Y1 thermostat demand)</b>												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	70%*	Dehumidification mode begins when humidity is greater than set point
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 try to maintain room humidity setpoint by allowing the room space to maintain a cooler room thermostat setpoint***
	Jumpers at indoor unit with a two stage outdoor unit Cut factory jumper from Y1 to Y2 or cut W915 (Y1 to Y2) With Condensing unit - Cut W914 (R to DS) on control With Heat Pump - Cut W914 (R to DS) & W951 (R to O) on control											
*Normal operation first stage cooling blower speed is 70% COOL speed.												
**Dehumidification blower speed is, reduced to 70% of COOL.												
***In Precision mode, thermostat will maintain room temperature up to 2 °F (1.2°C) cooler than room setting.												

**Table 14. Operating Sequence  
Non-Communicating Thermostat with Humidity Control Feature and Two-Speed Outdoor Unit**

# Service Information

## INDOOR BLOWER MOTOR

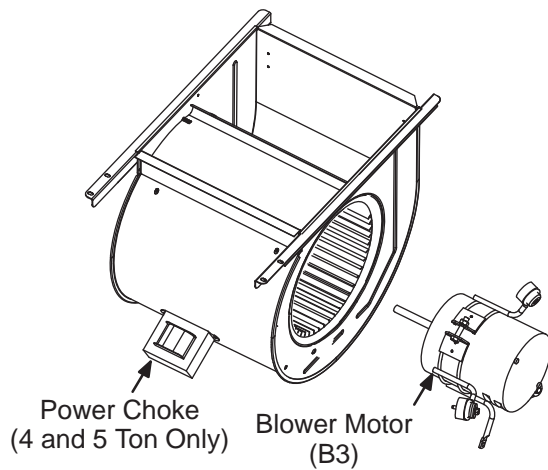


Figure 6.

**⚠ 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 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. Units use a three-phase, electronically controlled D.C. brushless motor (controller converts single phase a.c. to three phase D.C.), with a permanent-magnet-type rotor (Figure 7). Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors.

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 furnace models are not interchangeable with motors used on the NF97X\*\*\*V\*\*R 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).

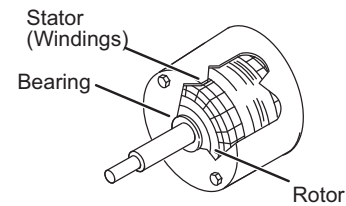


Figure 7. Blower Motor Components

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 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.

# Service Information

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## INDOOR BLOWER MOTOR (Cont.)

### 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.

### **▲ WARNING**

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 NF97X\*\*\*V\*\*R 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 8** and **Figure 9**.

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 a motor tester with the 16 to 4 pin adaptor. The use of a tester isolates the motor from the integrated control. Follow the instructions provided with the kit. If the motor runs do not replace.

# Service Information

## INDOOR BLOWER MOTOR (Cont.)

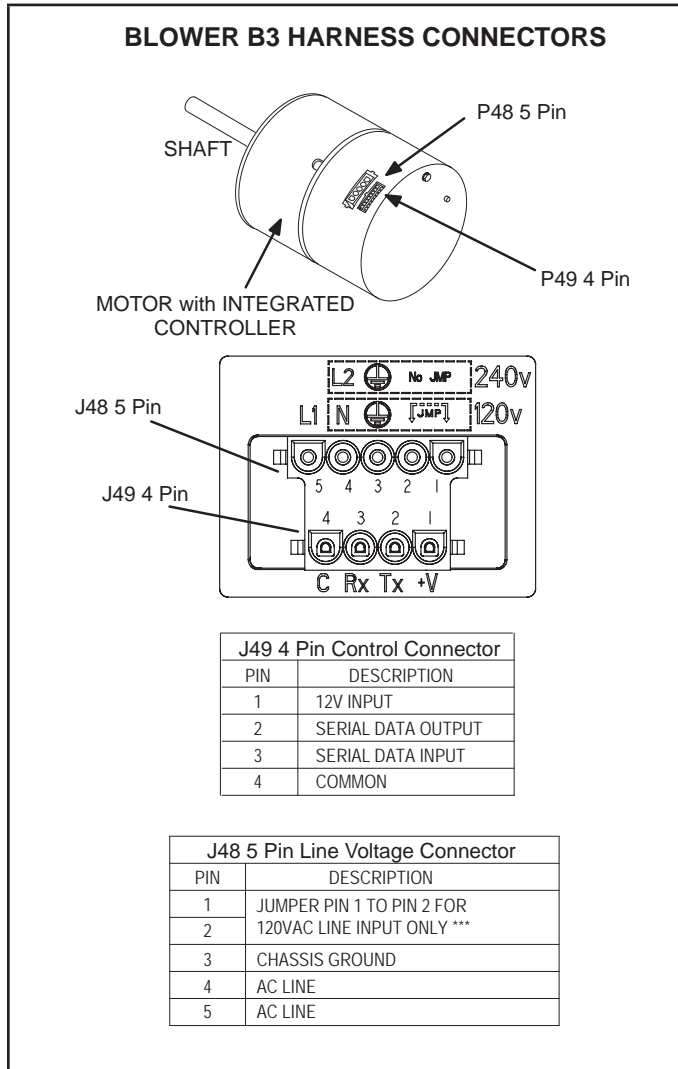


Figure 8.

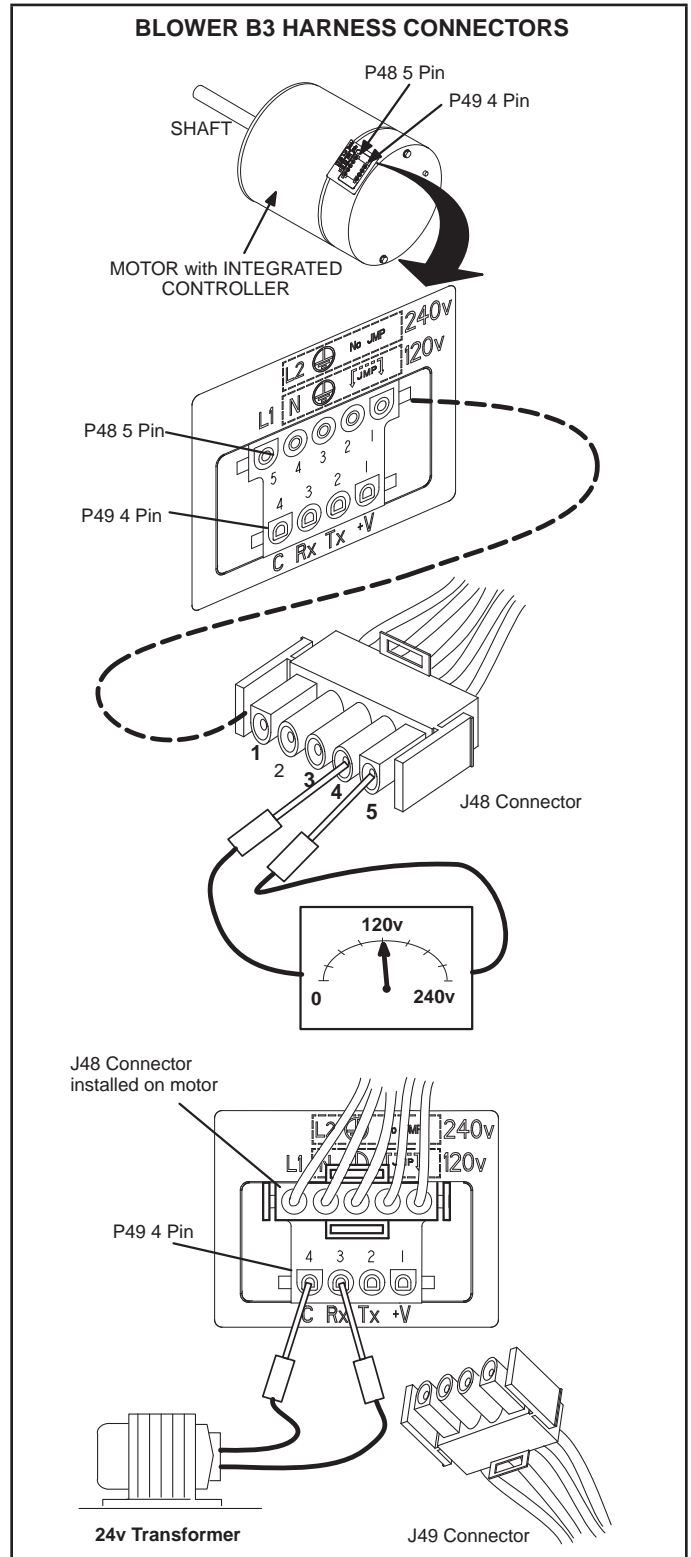


Figure 9.

# Service Information

## INDOOR BLOWER MOTOR (Cont.)

### 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 15. Ohm Meter Range

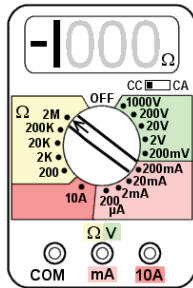


Figure 10.

### 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 11. 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 12. 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 a regulated 120 volts to the ignitor for a consistent ignition and long ignitor life. Ohm value should be 39 to 70. The ignitor is located on the bottom of the air gas plenum (Figure 13). See Figure 14 for ignitor check out.

**NOTE** - The furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

### Flame Sensor

A flame sensor is located on the bottom of the air gas plenum. See Figure 13. The sensor can be removed for service without removing the burner. 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 16 for flame signal.

Table 16. Flame Signal in Microamps

Normal	Low	Drop Out
2.6 or greater	2.5 or less	1.1

# Service Information

## HEATING COMPONENTS

### Gas Valve

The valve (**Figure 44**) is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

24VAC terminals and gas control knob are located on the valve. A wire harness connects the terminals from the gas valve to the electronic ignition control. 24V applied to the terminals energizes the valve.

Inlet and outlet pressure taps are located on the valve. A regulator adjustment screw is located on the valve.

### Flame Rollout Switch (S47)

Flame rollout switch is a high temperature limit located on the front of the intake air assembly. ner box, one on each side.- See **Figure 13**. The limit is a N.C. SPST autoreset limit. When S47 senses rollout, the circuit breaks and the ignition control immediately stops ignition and closes the gas valve. Rollout can be caused by a blocked heat exchanger, flue or lack of combustion air.

### Burner and Orifice

Burners are factory set and require no adjustment. Always operate the unit with air gas plenum in place. The burner has one orifice located between the gas valve and the air intake assembly (**Figure 13**). To check or replace the orifice remove

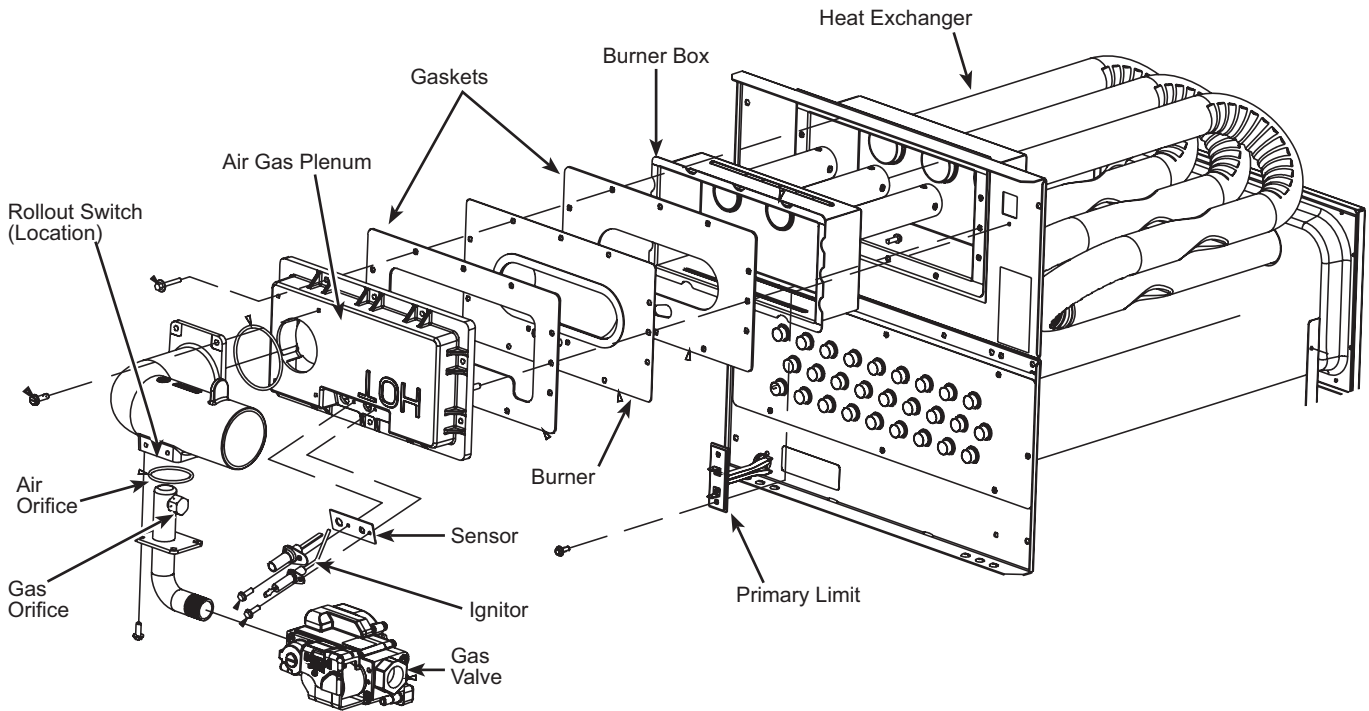
the black iron inlet pipe from the gas valve then remove the four screws securing the gas valve to the intake air pipe. The orifice is located in the orifice housing. The burner uses an orifice (see **Table 17**) that is precisely matched to the burner input. The burner can be removed for service. If burner has been removed, it is critical to replace all gaskets.

Unit Input	Orifice Size (0 - 4500 ft)
040	0.0472
060	0.0595
080	0.0689

**Table 17. Orifice Size**

### Primary Limit Control (S10)

The primary limit (S10) is located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. If the limit is open, the furnace control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch must reset within three minutes or the control will go into Watch guard for one hour. The switch is factory set and cannot be adjusted. The switch may have a different set point for each unit model number.



**Figure 13. Heating Components**

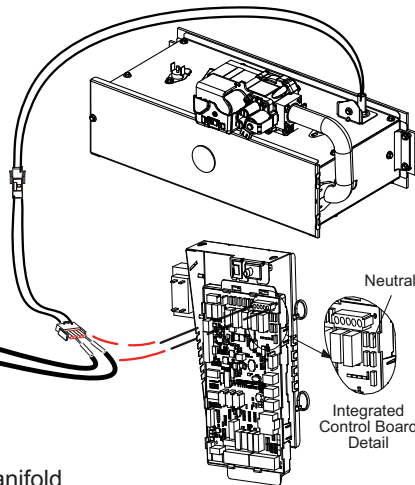
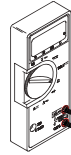
# Service Information

## HEATING COMPONENTS (Cont.)

### Test 1

Remove HSI/CAI 5-pin plug from control. Check ohms reading across terminals 1 and 5 Ohm value should be between 39 - 70.

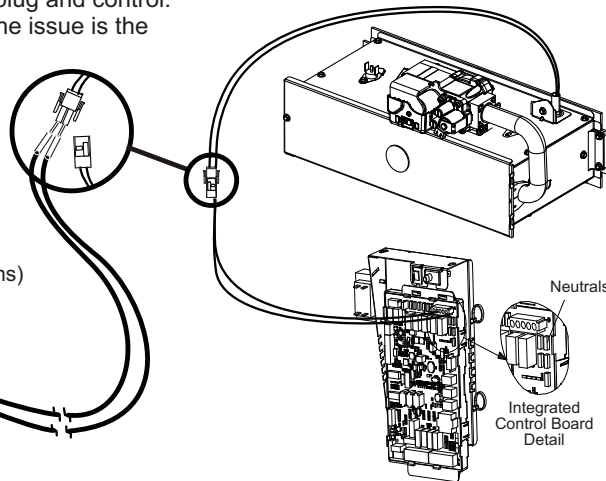
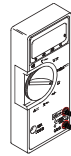
Meter  
(set to ohms)



### Test 2

Separate the 2-pin jack plug near the manifold and check resistance of the ignitor. If the reading is correct, then there is a problem with the wiring between the jack plug and control. If the reading is not correct the issue is the ignitor.

Meter  
(set to ohms)



### Test 3

Insert meter probes into the terminals 1 and 5. (Use small diameter probes in order to not damage plug). Check voltage during 20 second warm up period. Voltage should read 120 volts  $\pm 10\%$ . If voltage is above these values, check for correct supply voltage to furnace.

Meter  
(set to AC volts)

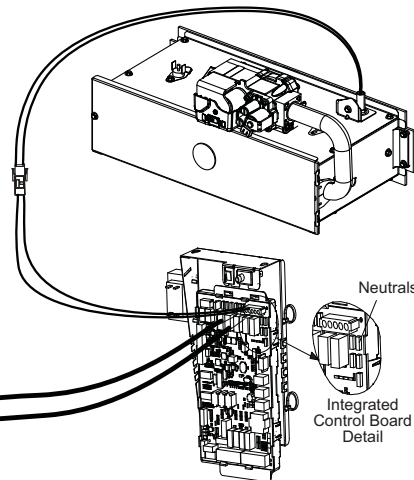


Figure 14. Ignitor Check Out

# Service Information

## HEATING COMPONENTS (Cont.)

### Combustion Air Inducer (B6)

All units use a two-stage combustion air inducer (**Figure 15**) to move air through the burners and heat exchanger during heating operation. The blower uses a 120VAC motor. The motor operates during all heating operation and is controlled by integrated control A92. The inducer also operates for 15 seconds before burner ignition (pre-purge) and for 5 seconds after the gas valve closes (post-purge). The inducer operates on low speed during first-stage heat, then switches to high speed for second stage heat.

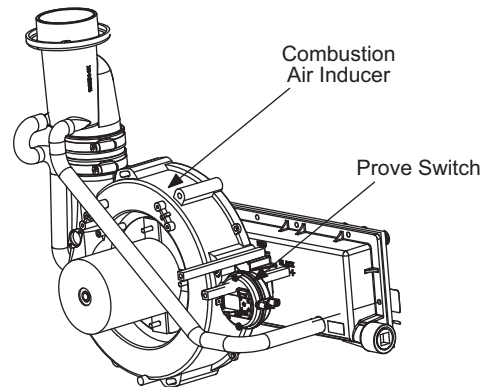
### Combustion Air Inducer Prove Switch (S18)

NF97X\*\*\*V\*\*R series units are equipped with a single combustion air proving switch (first and second stage) located near the gas valve. See **Figure 16**. The switch is a single-pole single-throw proving switch electrically connected to the integrated control. The purpose of the switch is to prevent burner operation if the combustion air inducer is not operating or if the flue becomes obstructed.

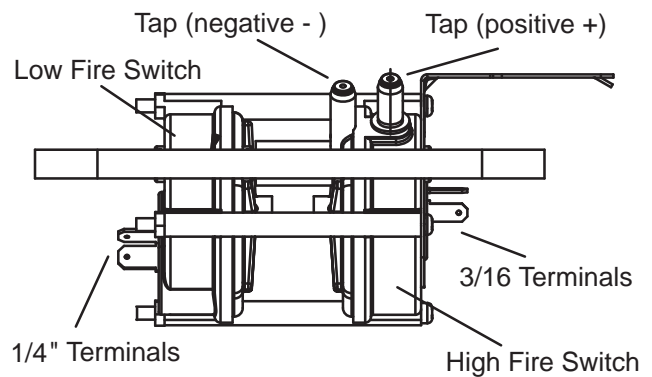
The switches are a single-pole single-throw proving switch electrically connected to the integrated control. The purpose of the switch is to prevent burner operation if the combustion air inducer is not operating or if the flue becomes obstructed.

On heat demand (first or second stage) the switch senses that the combustion air inducer is operating. It closes a circuit to the integrated control when pressure inside the combustion air inducer decreases to a certain set point.

Set points vary depending on unit size. See **Table 18**. The pressure sensed by the switch is negative relative to atmospheric pressure. If the flue becomes obstructed during operation, the switch senses a loss of negative pressure (pressure becomes more equal with atmospheric pressure) and opens the circuit to the furnace control and gas valve. A bleed port on the switch allows relatively dry air in the vestibule to purge switch tubing, to prevent condensate build up.



**Figure 15. Combustion Air Inducer and Prove Switch**



**Figure 16. Combustion Air Pressure Switch**

**NOTE** - The switch is factory set and is not field adjustable. It is a safety shut-down control in the furnace and must not be by-passed for any reason. If switch is closed or bypassed, the control will not initiate ignition at start up.

Unit	Set Point Low Heat	Set Point High Heat
-040	0.15"	0.50"
-060		
-080		

**Table 18. 0 - 4500 ft.**

# Service Information

## VENTING PRACTICES

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** NF97X\*\*\*V\*\*R 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.

**NOTE:** The intake coupling on the furnace is ABS material. Use transitional solvent to make connections to PVC pipe.

**NOTE:** Exhaust coupling must be installed with provided appliance adapter. See **Figure 19**.

Schedule 40 PVC (Pipe)	D1785
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 (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
<b>PRIMER &amp; SOLVENT CEMENT</b>	<b>ASTM SPECIFICATION</b>
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
<b>CANADA PIPE &amp; FITTING &amp; SOLVENT CEMENT</b>	<b>MARKING</b>
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	
<b>POLYPROPYLENE VENTING SYSTEM</b>	ULC-S636
PolyPro® by Duravent	
InnoFlue® by Centrotherm	
ECCO Polypropylene Vent™	ULC-S636

**Table 19. Piping and Fittings Specifications**

# Service Information

## VENTING PRACTICES (Cont.)

Input Size	Vent Pipe Dia. (in.)	STANDARD		Flush-Mount Kit	CONCENTRIC		
		Outdoor Exhaust Accelerator requirements for field provided terminations			1-1/2" Concentric Kit	2" Concentric Kit	3" Concentric Kit
		<sup>2</sup> Exhaust Accelerator (Dia. X Length)	<sup>2</sup> Exhaust Accelerator (Dia. X Length)	151W11	371M80	469M29	460L46
		1-1/2" X 12"	2" X 12"				
040	2	YES	NO	YES	YES	NO	NO
	3	YES	NO	YES	YES	NO	NO
060	2	YES	NO	YES	YES	NO	NO
	3	YES	NO	YES	YES	NO	NO
080	2	NO	NO	YES	NO	YES	YES
	3	NO	YES	YES	NO	YES	YES

**NOTE - ALL KITS MUST BE PROPERLY INSTALLED ACCORDING TO KIT INSTRUCTIONS**

- 1 Flush mount kit 51W11 includes a 1-1/2" outdoor exhaust accelerator, which is required when used with 040, 060, and 080 input models.
- 2 Field provided or field fabricated terminations require use of a field provided exhaust accelerator as defined in the table.
- 3 Concentric kit 71M80 includes a 1-1/2" outdoor accelerator which must be installed on the exhaust outlet when used with 040 and 060 input models.
- 4 No Accelerator is required for kits 69M29 or 60L46.
- 5 When the vent/intake diameters are different from the concentric vent kit size, field provided transitions must be used.

**Table 20. Outdoor Termination Kits**

## JOINT CEMENTING PROCEDURE

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

### **▲ 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.

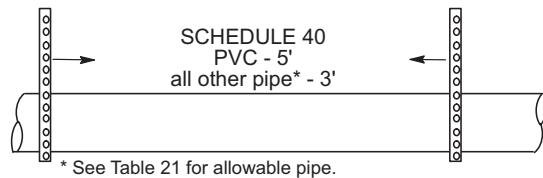
1. Measure and cut vent pipe to desired length.
2. Deburr and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.
- NOTE:** Check the inside of vent pipe thoroughly for any obstruction that 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 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.

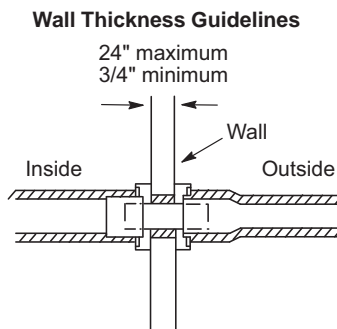
# Service Information

## VENTING PRACTICES (Cont.)



**NOTE:** Isolate piping at the point where it exits the outside wall or roof in order to prevent transmission of vibration to the structure.

**NOTE:** All horizontal runs of exhaust pipe must slope back toward unit a minimum of 1/4" (6mm) drop for each 12" (305mm).



**Figure 17. Piping Suspension Guidelines**

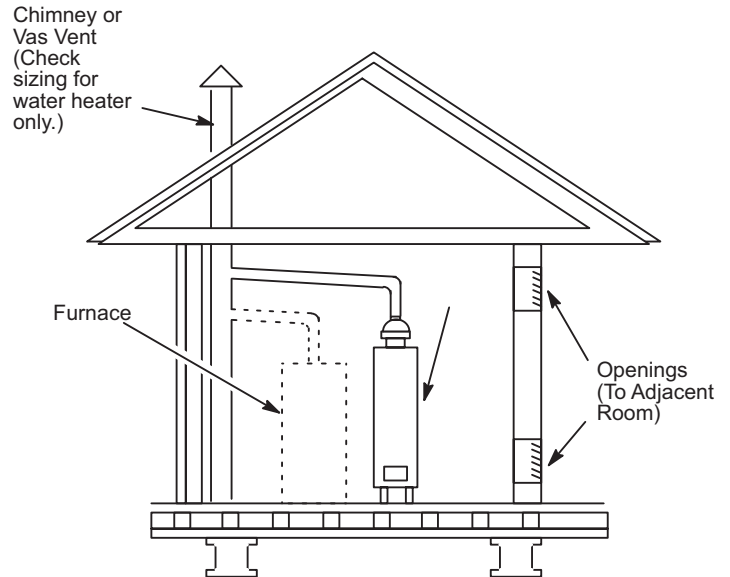
- In areas where piping penetrates joists or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.
- When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions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

### Removal of the Furnace from Common Vent

#### **⚠ WARNING** CARBON MONOXIDE POISONING

**HAZARD -** Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death. The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

In the event that an existing furnace is removed from a venting system commonly run with separate gas appliances, the venting system is likely to be too large to properly vent the remaining attached appliances.



If the furnace replaces a furnace that was commonly vented with another gas appliance, the size of the existing vent pipe for that gas appliance must be checked. Without the heat of the original furnace flue products, the existing vent pipe is probably oversized for the single water heater or other appliance. The vent should be checked for proper draw with the remaining appliance.

**Figure 18. Replacing Furnace that was Part of a Common Vent System**

Conduct the following test while each appliance is operating and the other appliances (which are not operating) remain connected to the common venting system. If the venting system has been installed improperly, you must correct the system as indicated in the general venting requirements section.

1. Seal any unused openings in the common venting system.
2. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
3. Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Follow the lighting instructions. Turn on the appliance that is being inspected. Adjust the thermostat so that the appliance operates continuously.
5. After the main burner has operated for 5 minutes, test for leaks of flue gases at the draft hood relief opening. Use the flame of a match or candle.

# Service Information

## VENTING PRACTICES (Cont.)

### Removal of the Furnace from Common Vent (Cont.)

6. After determining that each appliance connected to the common venting system is venting properly, (step 3) return all doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliances to their previous mode of operation.
7. If a venting problem is found during any of the preceding tests, the common venting system must be modified to correct the problem.

Resize the common venting system to the minimum vent pipe size determined by using the appropriate tables in Appendix G. (These are in the current standards of the National Fuel Gas Code ANSI Z223.1.

### Exhaust Piping

The vent adaptor must be attached to the exhaust coupling on the furnace top panel. Use the provided bands.

#### 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.

See steps below.

1. Remove the caution sticker from vent adaptor.
2. Fully insert vent adaptor with both bands loosely attached on the furnace exhaust coupling.
3. Insert PVC exhaust pipe through vent adaptor. Ensure vent pipe is fully seated into exhaust coupling.
4. Tighten both top and bottom bands to 40 in lbs. See **Figure 19**.
5. Tighten top band.

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

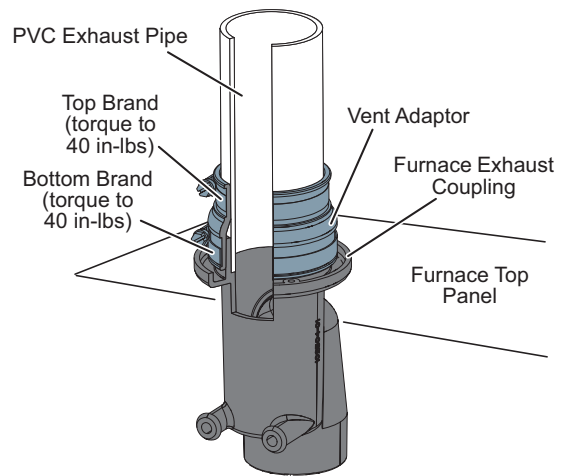


Figure 19. Vent Adaptor to Exhaust Coupling

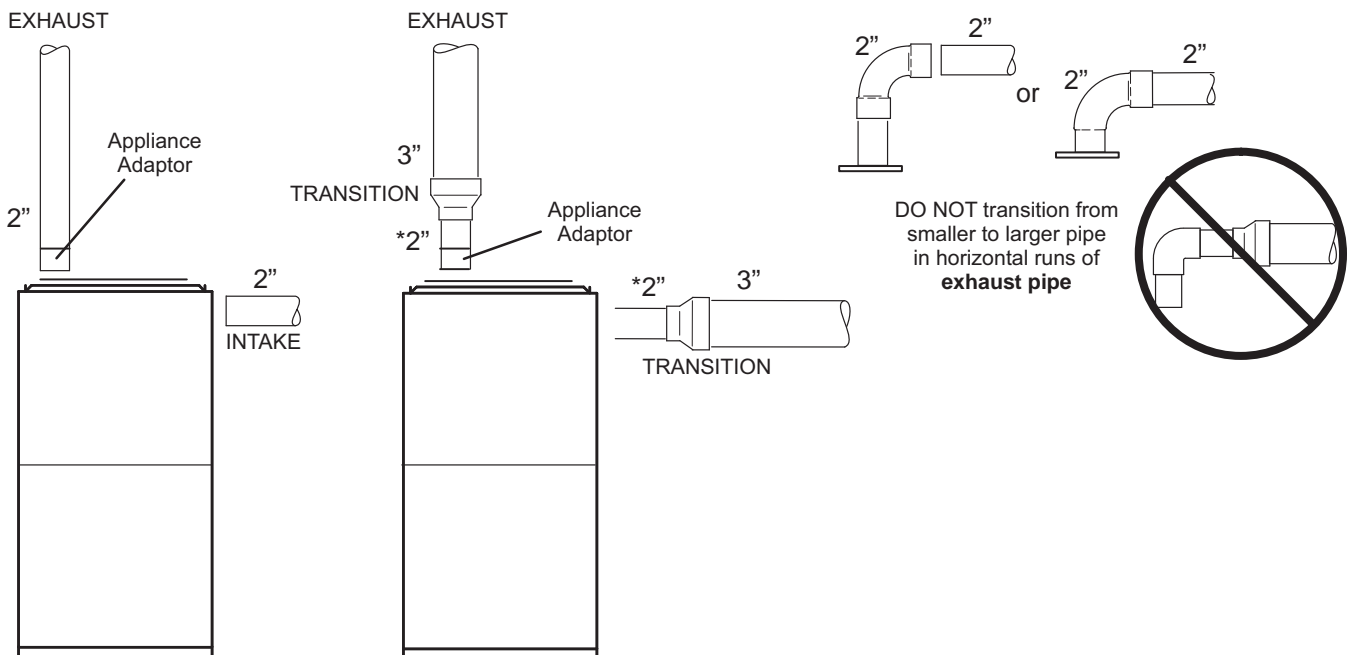
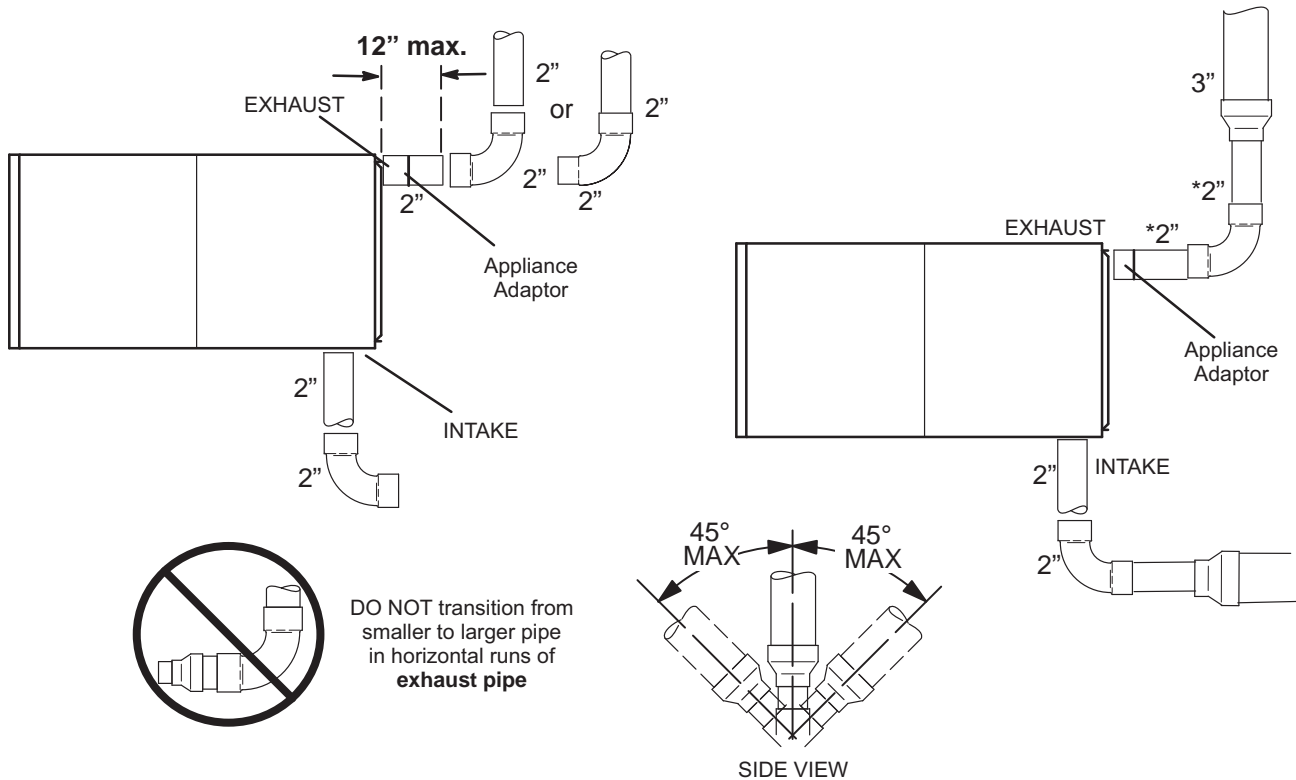


Figure 20. Typical Exhaust and Intake Pipe Connections in Upflow Direct Vent Applications

# Service Information

## VENTING PRACTICES (Cont.)



\* When transitioning up in pipe size, use the shortest length of 2" PVC pipe possible.

**Figure 21. Typical Exhaust and Intake Pipe Connections in Horizontal Direct Vent Applications (Right Hand Discharge Shown)**

## VENT PIPING GUIDELINES

**NOTE:** GE Appliances 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 PolyPro 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 23**.

The NF97X\*\*\*V\*\*R 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** and **Table 22A** through **Table 22F**. Count all elbows inside and outside the home. **Table 21** lists the minimum vent pipe lengths permitted. **Table 22A** through **Table 22F** list the maximum pipe lengths permitted.

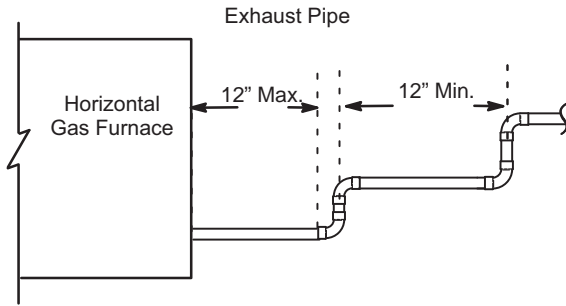
Regardless of the diameter of pipe used, the standard roof and wall terminations described in section Exhaust Piping Terminations should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to **Table 24**.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used.

**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 21**.

# Service Information

## VENT PIPING GUIDELINES (Cont.)



**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 22. Horizontal Installation Offset Requirements**

### ▲ IMPORTANT

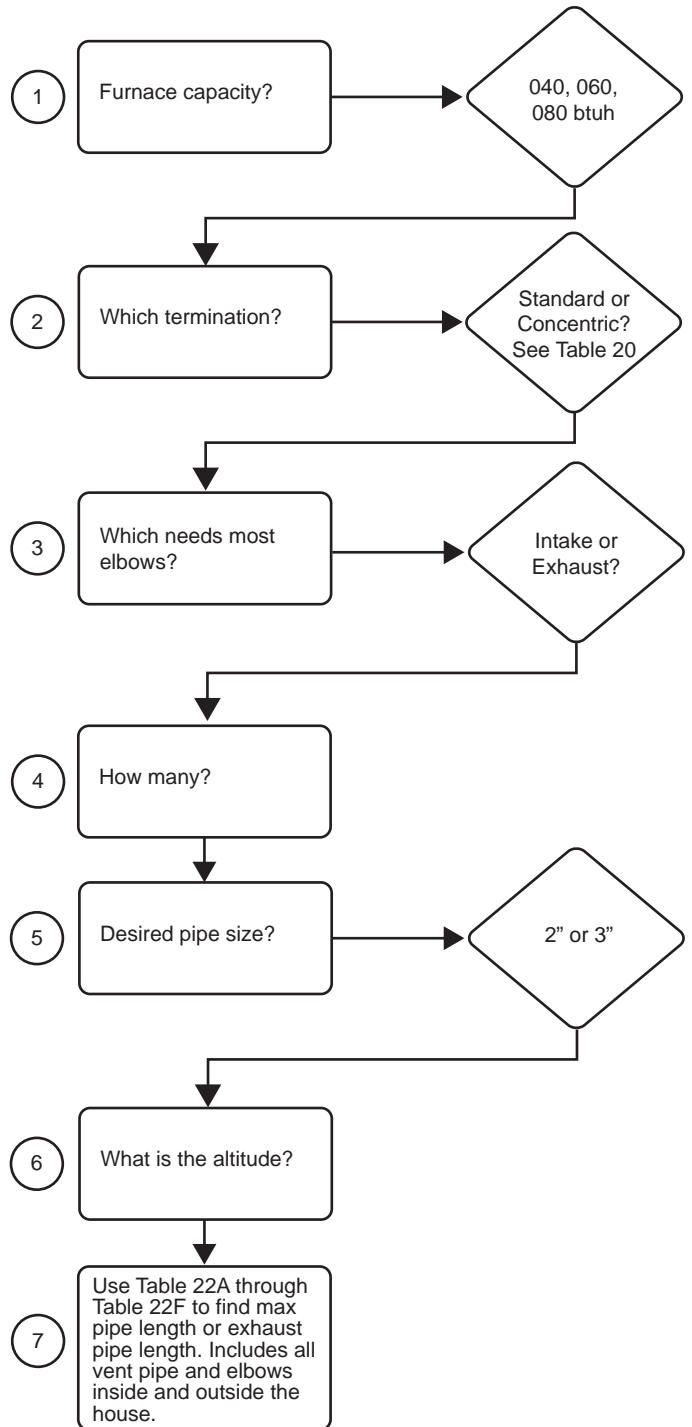
Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

Model	Min. Vent Length*
040, 060, 080	15 ft. or 5 ft. plus 2 elbows or 10 ft. plus 1 elbow

\* Any approved termination may be added to the minimum length listed.

**Table 21. Minimum Vent Pipe Lengths**

Use the following steps to correctly size vent pipe diameter.



**Figure 23.**

# Service Information

## VENT PIPING GUIDELINES (Cont.)

### Maximum Allowable Intake or Exhaust Vent Length in Feet

Standard Termination at Elevation 0 - 4500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	81	66	44	138	137	118
2	76	61	39	133	132	113
3	71	56	34	128	127	108
4	66	51	29	123	122	103
5	61	46	24	118	117	98
6	56	41	19	113	112	93
7	51	36	14	108	107	88
8	46	31	n/a	103	102	83
9	41	26		98	97	78
10	36	21		93	92	73
Standard Termination at Elevation 4501 - 6000 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	81	41	34	138	105	100
2	76	36	29	133	100	95
3	71	31	24	128	95	90
4	66	26	19	123	90	85
5	61	21	14	118	85	80
6	56	16	9	113	80	75
7	51	11	n/a	108	75	70
8	46	n/a		103	70	65
9	41			98	65	60
10	36			93	60	55

**NOTE** - 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.

**NOTE** - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 22A.

# Service Information

## VENT PIPING GUIDELINES (Cont.)

### Maximum Allowable Intake or Exhaust Vent Length in Feet

Standard Termination at Elevation 6001 - 7500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	81	29	24	138	105	100
2	76	24	19	133	100	95
3	71	19	14	128	95	90
4	66	14	9	123	90	85
5	61	9	n/a	118	85	80
6	56	n/a		113	80	75
7	51			108	75	70
8	46			103	70	65
9	41			98	65	60
10	36			93	60	55

**NOTE** - 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.

**NOTE** - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

**Table 22B.**

# Service Information

## VENT PIPING GUIDELINES (Cont.)

### Maximum Allowable Intake or Exhaust Vent Length in Feet

Concentric Termination at Elevation 0 - 4500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	73	58	42	121	121	114
2	68	53	37	116	116	109
3	63	48	32	111	111	104
4	58	43	27	106	106	99
5	53	38	22	101	101	94
6	48	33	17	96	96	89
7	43	28	12	91	91	84
8	38	23	n/a	86	86	79
9	33	18		81	81	74
10	28	13		76	76	69
Concentric Termination at Elevation 4501 - 6000 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	73	33	32	121	89	89
2	68	28	27	116	84	84
3	63	23	22	111	79	79
4	58	18	17	106	74	74
5	53	13	12	101	69	69
6	48	n/a	n/a	96	64	64
7	43			91	59	59
8	38			86	54	54
9	33			81	49	49
10	28			76	44	44
<p><b>NOTE</b> - 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.</p> <p><b>NOTE</b> - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.</p>						

Table 22C.

# Service Information

## VENT PIPING GUIDELINES (Cont.)

### Maximum Allowable Intake or Exhaust Vent Length in Feet

Concentric Termination at Elevation 6001 - 7500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	73	27	22	121	89	89
2	68	22	17	116	84	84
3	63	17	12	111	79	79
4	58	12	7	106	74	74
5	53	7	n/a	101	69	69
6	48	n/a		96	64	64
7	43			91	59	59
8	38			86	54	54
9	33			81	49	49
10	28			76	44	44

**NOTE** - 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.

**NOTE** - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

**Table 22D.**

# Service Information

## VENT PIPING GUIDELINES (Cont.)

Maximum Allowable Exhaust Vent Lengths With Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space For Intake Air in Feet

Standard Termination at Elevation 0 - 4500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	71	56	34	118	117	98
2	66	51	29	113	112	93
3	61	46	24	108	107	88
4	56	41	19	103	102	83
5	51	36	14	98	97	78
6	46	31	9	93	92	73
7	41	26	4	88	87	68
8	36	21	n/a	83	82	63
9	31	16		78	77	58
10	26	11		73	72	53
Standard Termination at Elevation 4501 - 6000 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	71	31	24	118	85	80
2	66	26	19	113	80	75
3	61	21	14	108	75	70
4	56	16	9	103	70	65
5	51	11	n/a	98	65	60
6	46	n/a		93	60	55
7	41			88	55	50
8	36			83	50	45
9	31			78	45	40
10	26			73	40	35

**NOTE** - 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.

**NOTE** - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 22E.

# Service Information

## VENT PIPING GUIDELINES (Cont.)

Maximum Allowable Exhaust Vent Lengths With Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space For Intake Air in Feet

Standard Termination at Elevation 6001 - 7500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	71	19	14	118	85	80
2	66	14	9	113	80	75
3	61	9	n/a	108	75	70
4	56	n/a		103	70	65
5	51			98	65	60
6	46			93	60	55
7	41			88	55	50
8	36			83	50	45
9	31			78	45	40
10	26			73	40	35

**NOTE** - 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.

**NOTE** - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 22F.

# Service Information

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## VENT PIPING GUIDELINES (Cont.)

### Intake Piping

The NF97X\*\*\*V\*\*R furnace is installed in direct vent applications.

Follow the next two steps when installing the unit in **Direct Vent** applications, where combustion air is taken from outdoors and flue gases are discharged outdoors. **The provided air intake screen must not be used in direct vent applications (outdoors).**

1. Use transition solvent cement or a sheet metal screw to secure the intake pipe to the inlet air connector.
2. Route piping to outside of structure. Continue with installation following instructions given in general guidelines for piping terminations and intake and exhaust piping terminations for direct vent sections. Refer to Table 22A through Table 22F for pipe sizes.
3. Use a sheet metal screw to secure the intake pipe to the connector, if desired.

### 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 NF97XV 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 25**. 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 23** 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 permissible. Basements or other enclosed areas that are not exposed to the outdoor ambient temperature and are above 32°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).

# Service Information

## VENT PIPING GUIDELINES (Cont.)

Maximum Allowable Exhaust Vent Pipe Length (in ft.) without Insulation in Unconditioned Space for Winter Design Temperatures							
Winter Design Temperatures <sup>1</sup> °F (°C)	Vent Pipe Diameter	Unit Input Size					
		040		060		080	
		PVC	<sup>2</sup> PP	PVC	<sup>2</sup> PP	PVC	<sup>2</sup> PP
32 to 21 (0 to -6)	2 in.	21	18	33	30	46	42
	3 in.	12	12	21	21	30	30
20 to 1 (-7 to -17)	2 in.	11	9	19	17	28	25
	3 in.	N/A	N/A	9	9	16	16
0 to -20 (-18 to -29)	2 in.	6	4	12	10	19	16
	3 in.	N/A	N/A	N/A	N/A	8	8

<sup>1</sup> Refer to 99% Minimum Design Temperature table provided in the current edition of the ASHRAE Fundamentals Handbook.

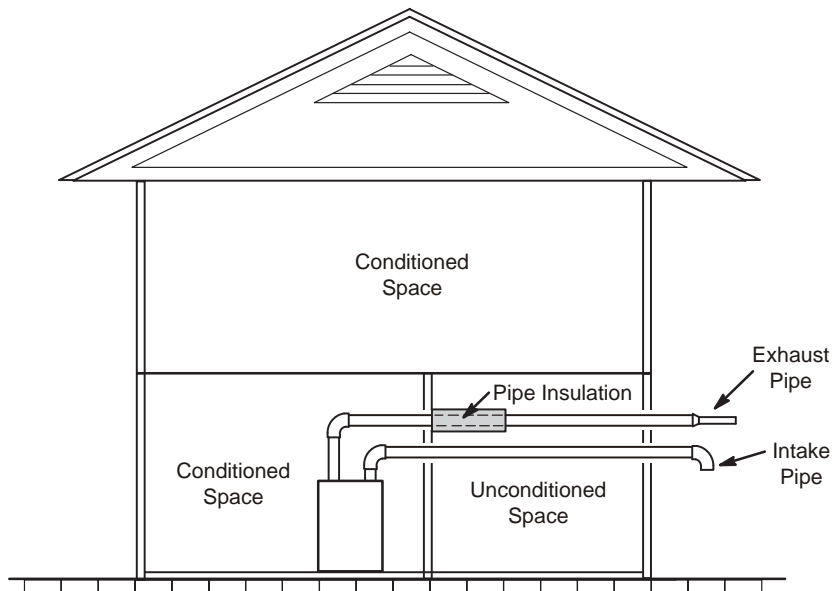
<sup>2</sup> Poly-Propylene vent pipe (PP) by Duravent and Centrotherm

**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 20A through Table 21B, whichever is less.

**NOTE** - If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See Figure 24.

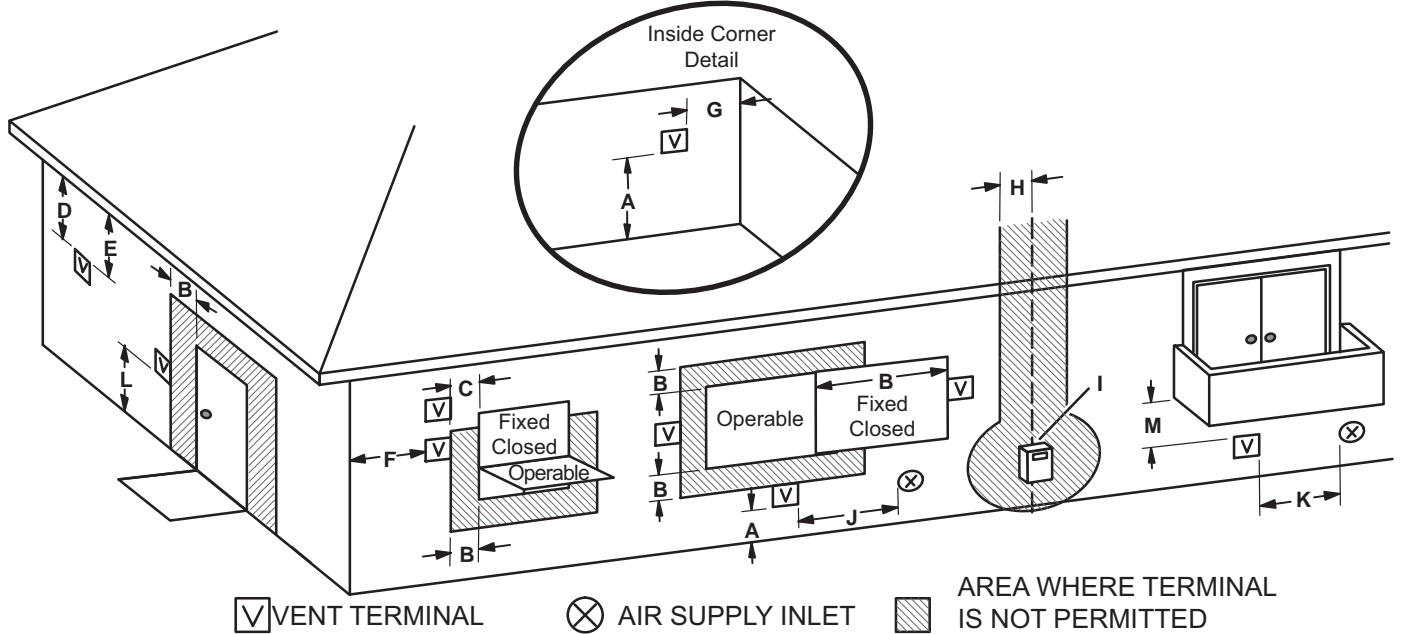
**Table 23.**



**Figure 24. Insulating Exhaust Pipe in an Unconditioned Space**

# Service Information

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



		US Installations <sup>1</sup>	Canadian Installations <sup>2</sup>
A	Clearance above grade, veranda, porch, deck or balcony	12" (305mm) or 12" (305mm) above average snow accumulation	
B	Clearance to window or door that may be opened	6" (152mm) for appliances <10,000 Btuh (3kw), 9" (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15kw), 12" (305m) for appliances > 50,000 Btuh (15kw)	6" (152mm) for appliances <10,000 Btuh (3kw), 12" (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36" (.9m) for appliances > 100,000 Btuh (30kw)
C	Clearance to permanently closed window	* 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	
E	Clearance to unventilated soffit	* Equal to or greater than soffit depth	
F	Clearance 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	
I	Clearance to service regulator vent outlet	* 3 feet (.9m)	
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6" (152mm) for appliances <10,000 Btuh (3kw), 9" (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15kw), 12" (305m) for appliances > 50,000 Btuh (15kw)	6" (152mm) for appliances <10,000 Btuh (3kw), 12" (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36" (.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)	
M	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	

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

<sup>2</sup> 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 25. Vent Termination Clearances Direct Vent Installations**

# Service Information

## VENT PIPING GUIDELINES (Cont.)

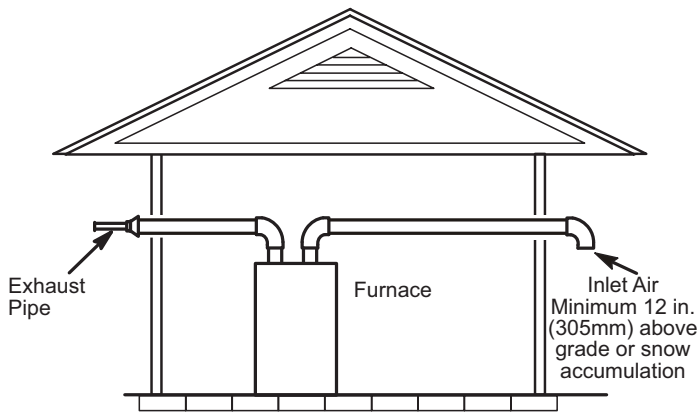
### Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

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

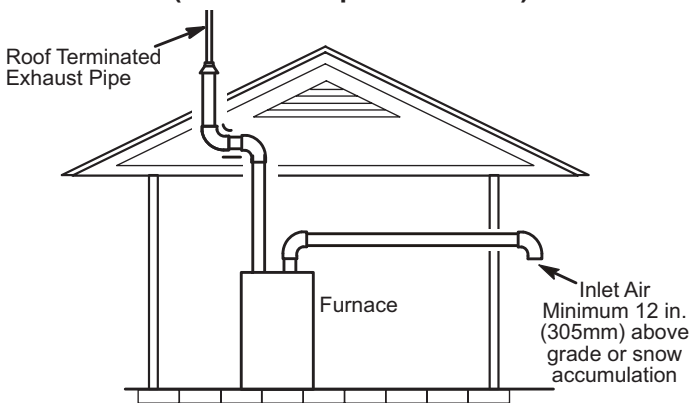
**NOTE:** Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 in. square) should be used to protect the wall surface. If the optional tee is 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 34**.

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 26** through **Figure 34** 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 26**). You may exit the exhaust out the roof and the intake out the side of the structure (**Figure 27**).



**Figure 26. Exiting Exhaust and Intake Vent (no common pressure zone)**

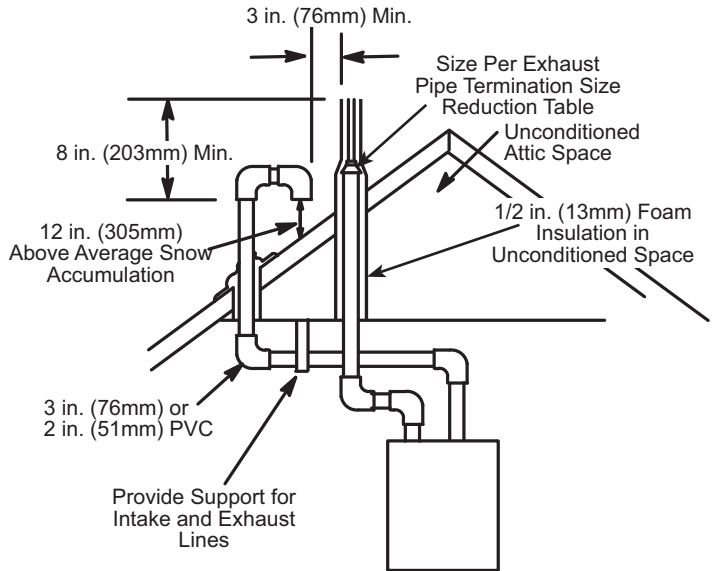


**Figure 27. Exiting Exhaust and Intake Vent (no common pressure zone)**

2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3 in. (76mm) on roof terminations and 6 in. (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 28**).



**Figure 28. 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 24**.

Model	Termination Pipe Size
040 and 060	1-1/2" (38 mm)
080	2" (51 mm)

\* Units with the flush mount termination must use the 1-1/2" accelerator supplied with the kit

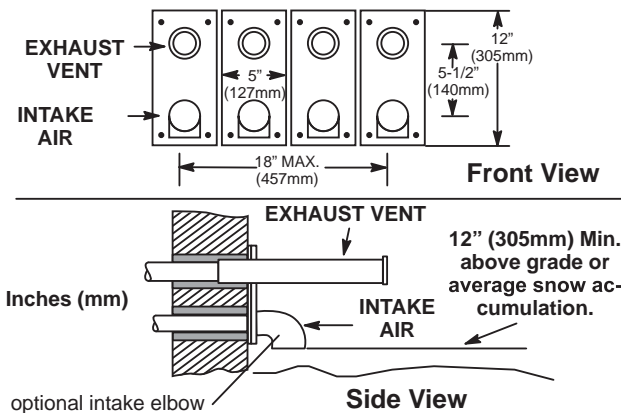
**Table 24. Exhaust Pipe Termination Size Reduction**

5. On field-supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305mm) for 2 in. PVC and 20 inches (508mm) for 3 in. (76mm) PVC beyond the outside wall. Intake piping should be as short as possible. See **Figure 36**.
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 34**.

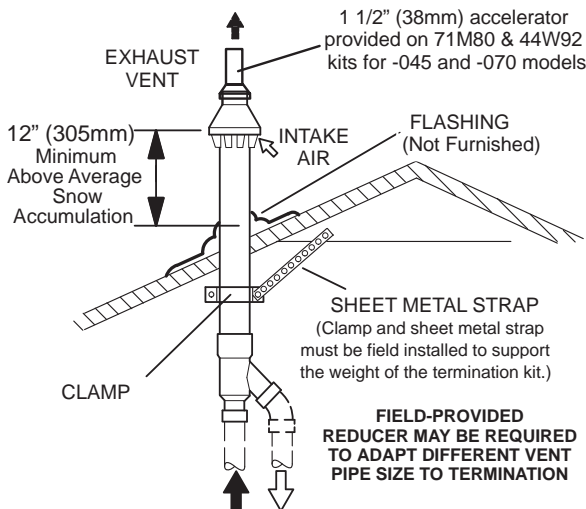
# Service Information

## VENT PIPING GUIDELINES (Cont.)

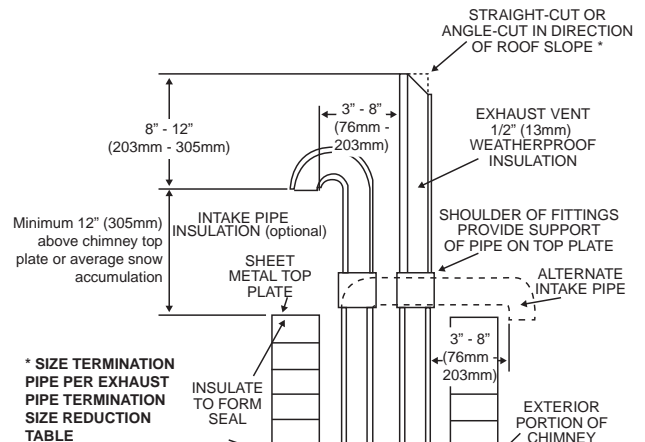
- If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6 in. from the top of the elbow and then every 24 in. (610mm) as shown in **Figure 34**, to prevent any movement in any direction. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per **Table 24**. 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.
- A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in **Figure 29**.



**Figure 29. Optional Vent Termination for Multiple Unit Installation of Direct Vent Wall Termination**

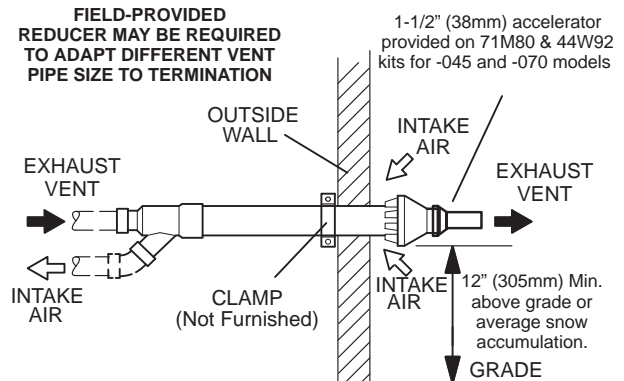


**Figure 30. Direct Vent Concentric Rooftop Termination**

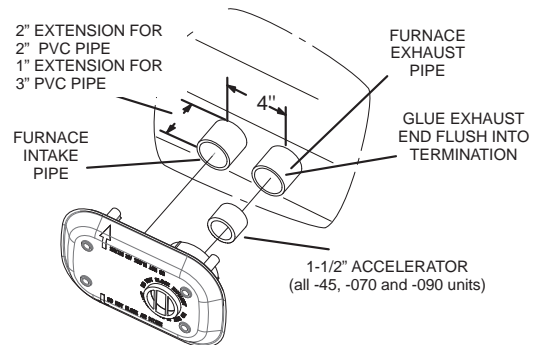


**NOTE:** Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminates as illustrated. In any exterior portion of chimney,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

**Figure 31. Direct Vent Application Using Existing Chimney**



**Figure 32. Direct Vent Concentric Wall Termination**



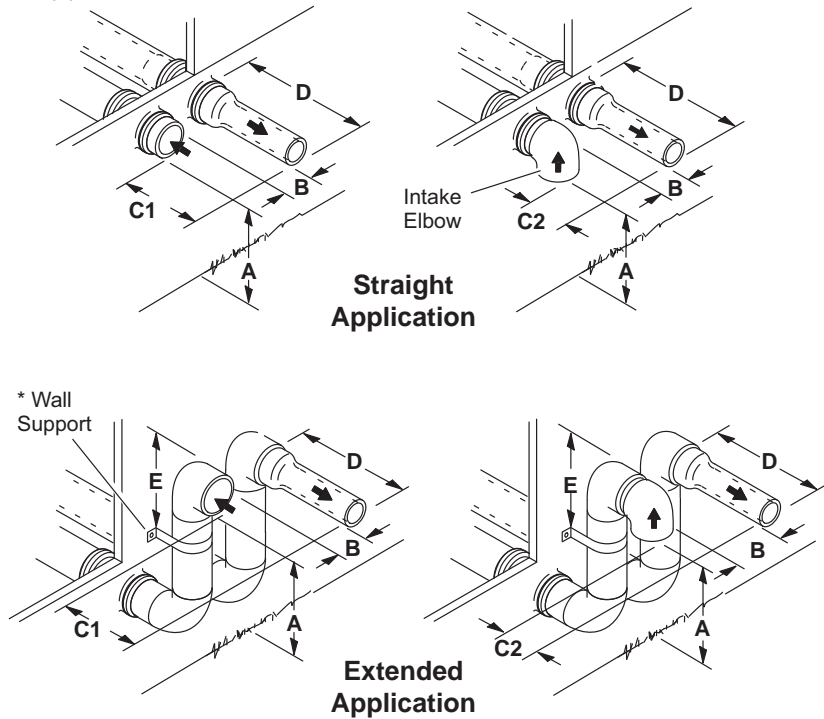
**Figure 33. Flush-Mount Side Wall Termination**

# Service Information

## VENT PIPING GUIDELINES (Cont.)

**NOTE:** Field-provided reducer may be required to adapt larger vent pipe size to termination.

### Field Fabricated Wall Termination

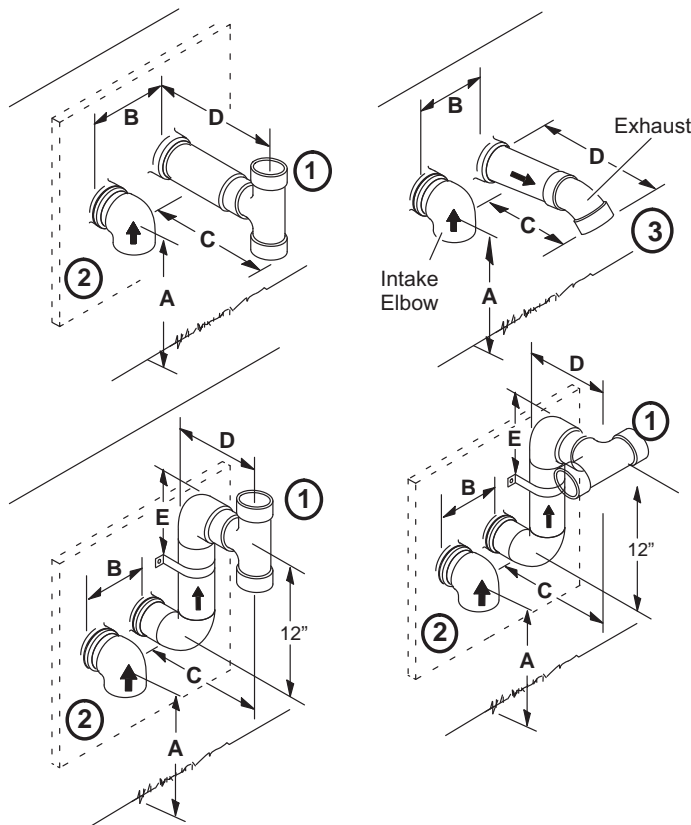


	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
A- Minimum clearance above grade or average snow accumulation	12" (305 mm)	12" (305 mm)
B- Maximum horizontal separation between intake and exhaust	6" (152 mm)	6" (152 mm)
C1 -Minimum from end of exhaust to inlet of intake	8" (203 mm)	8" (203 mm)
C2 -Minimum from 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)

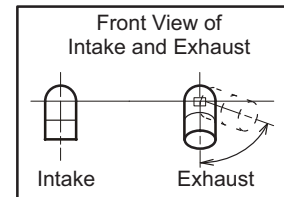
\* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm).

**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" (305mm) Min.	12" (305mm) Min.
B- Horizontal separation between intake and exhaust	6" (152mm) Min. 24" (610mm) Max.	6" (152mm) Min. 24" (610mm) Max.
C -Minimum from end of exhaust to inlet of intake	9" (227mm) Min.	9" (227mm) Min.
D- Exhaust pipe length	12" (305 mm) Min. 16" (405mm) Max.	12" (305 mm) Min. 20" (508mm) Max.
E- Wall support distance from top of each pipe (intake/exhaust)	6" (152mm) Max.	6" (152mm) 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.

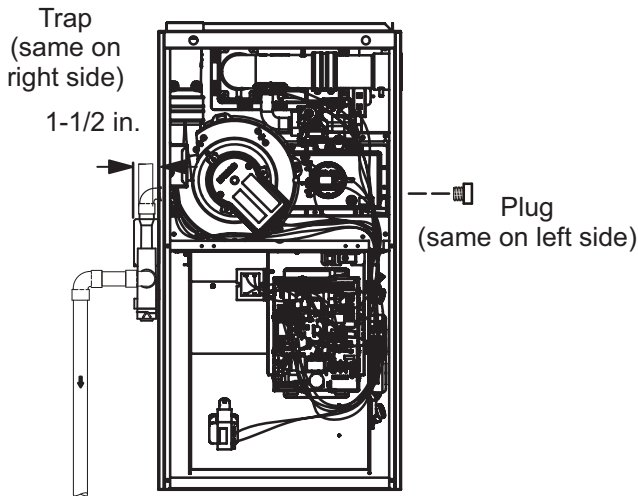
Figure 34.

# Service Information

## 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 35** for condensate trap locations. Figure 43 shows trap assembly using 1/2" PVC or 3/4" PVC.

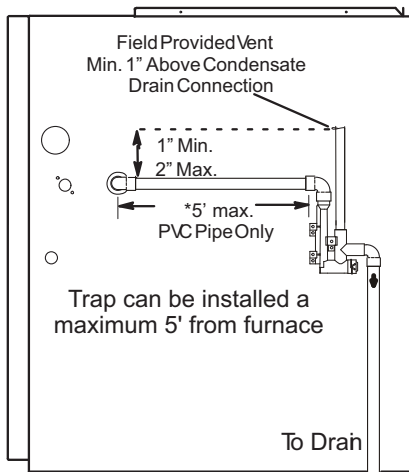
**NOTE:** If necessary the condensate trap may be installed up to 5' away from the furnace. Use PVC pipe to connect trap to furnace condensate outlet. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.



**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 35. Condensate Trap and Plug Locations (unit shown in upflow position)**

(Unit shown in upflow position with remote trap)



\*Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.

**Figure 36. 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 35**) 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 43**.
4. Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in **Figure 43**. 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 38** and **Figure 39** 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 40** through **Figure 42**.

**Upflow furnace (Figure 38)** - 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.

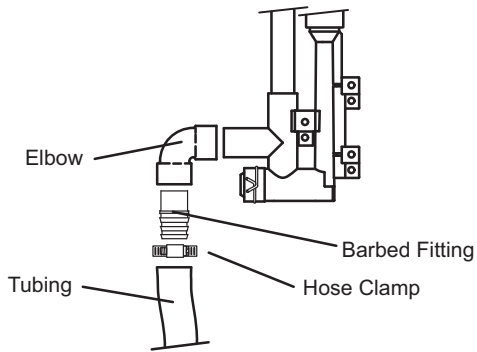
**Horizontal furnace (Figure 39)** - In horizontal furnace applications the field provided vent must be a minimum 4" to a maximum 5" length above the condensate drain outlet connection. Any length above 5" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

**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 37**.

# Service Information

## CONDENSATE PIPING (Cont.)

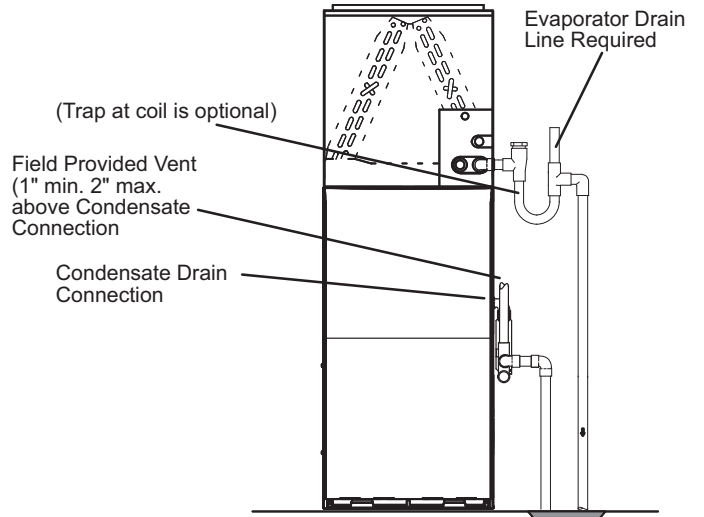


**Figure 37. Field-Provided Drain Components**

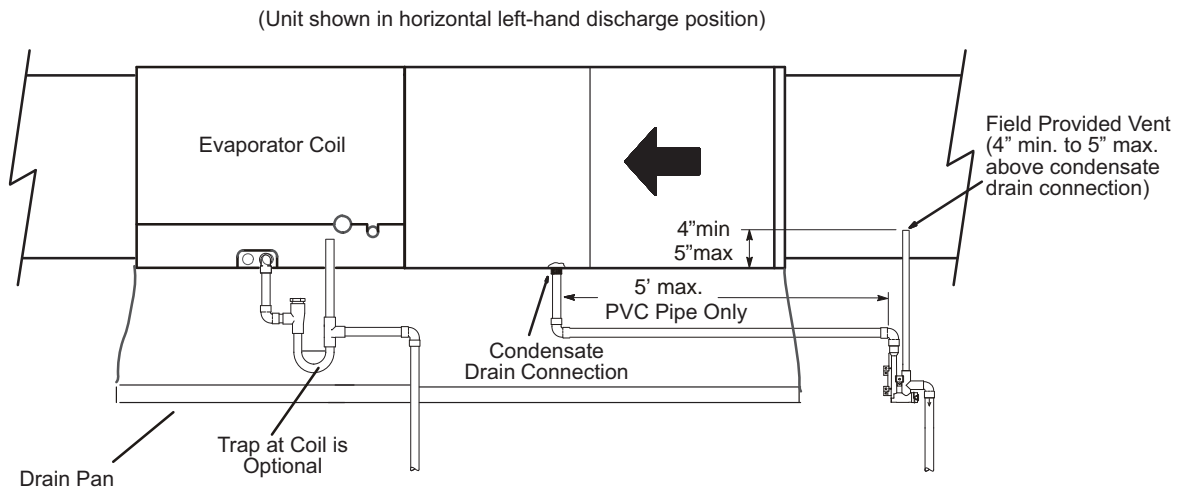
**CAUTION** Do not use copper tubing or existing copper condensate lines for drain line.

- 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; 24 ft. (7.3m) - kit no. 26K69; and 50 ft. (15.2m) - kit no. 26K70.



**Figure 38. Furnace with Evaporator Coil Using a Separate Drain**

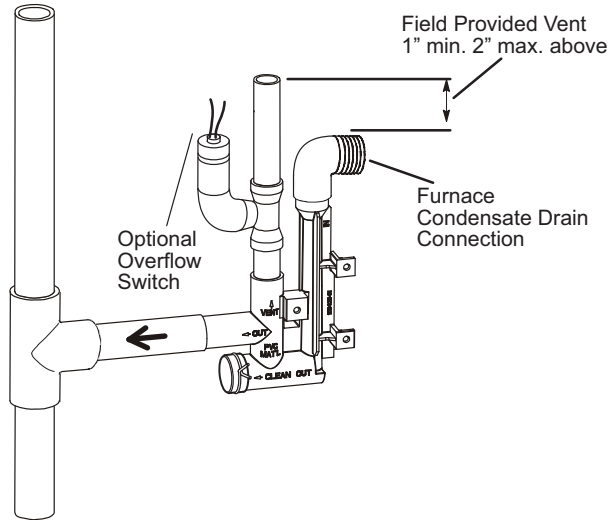


**Figure 39. Furnace with Evaporator Coil Using a Separate Drain**

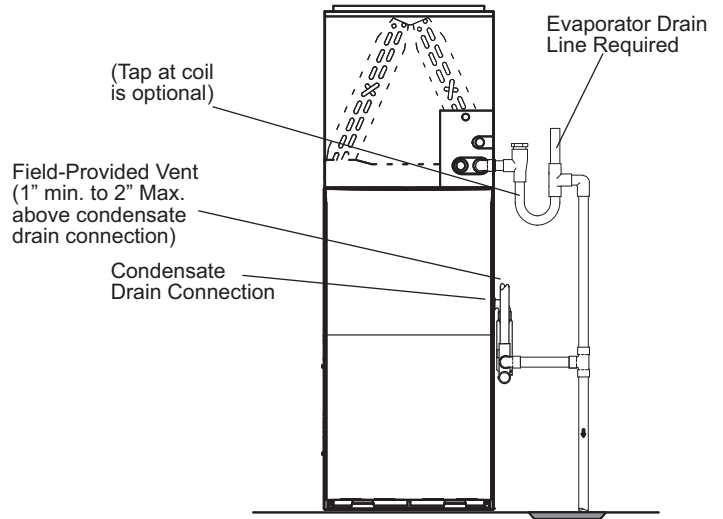
# Service Information

## CONDENSATE PIPING (Cont.)

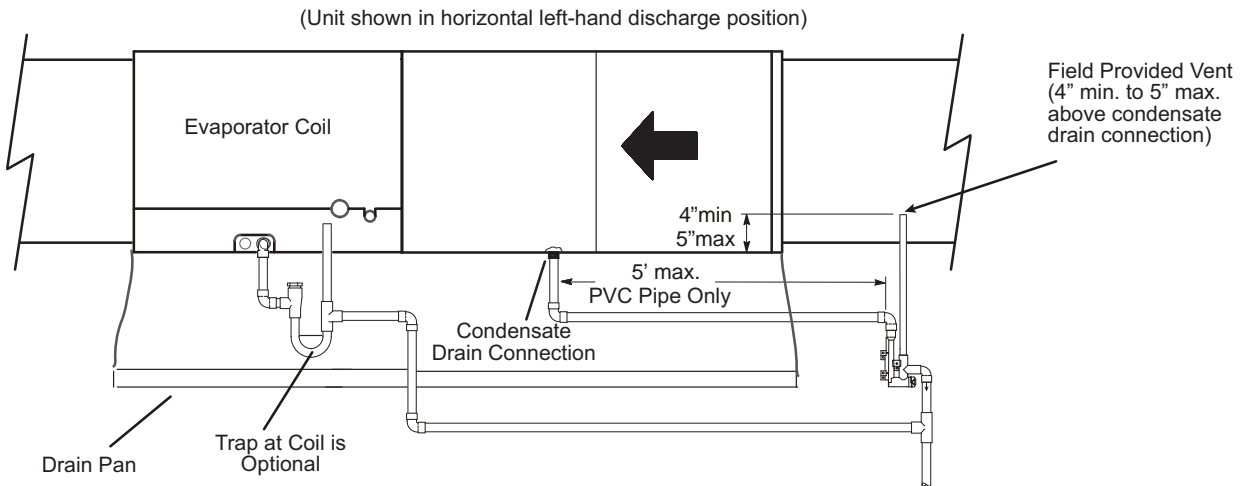
From Evaporator Coil



**Figure 40. Condensate Trap With Optional Overflow Switch**



**Figure 41. Furnace with Evaporator Coil Using a Common Drain**



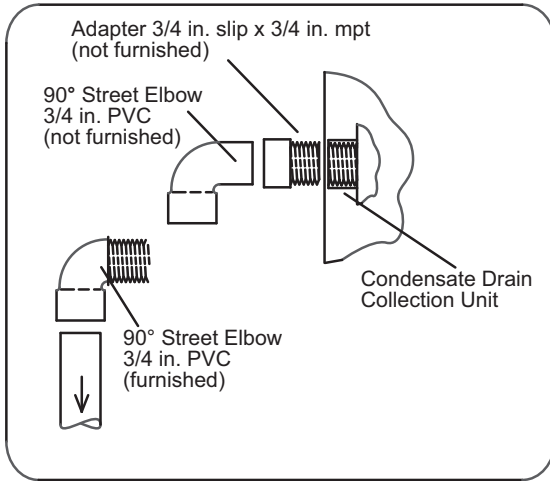
Piping from furnace and evaporator coil must slope down a minimum 1/4" per ft. toward trap

**Figure 42. Furnace with Evaporator Coil Using a Common Drain**

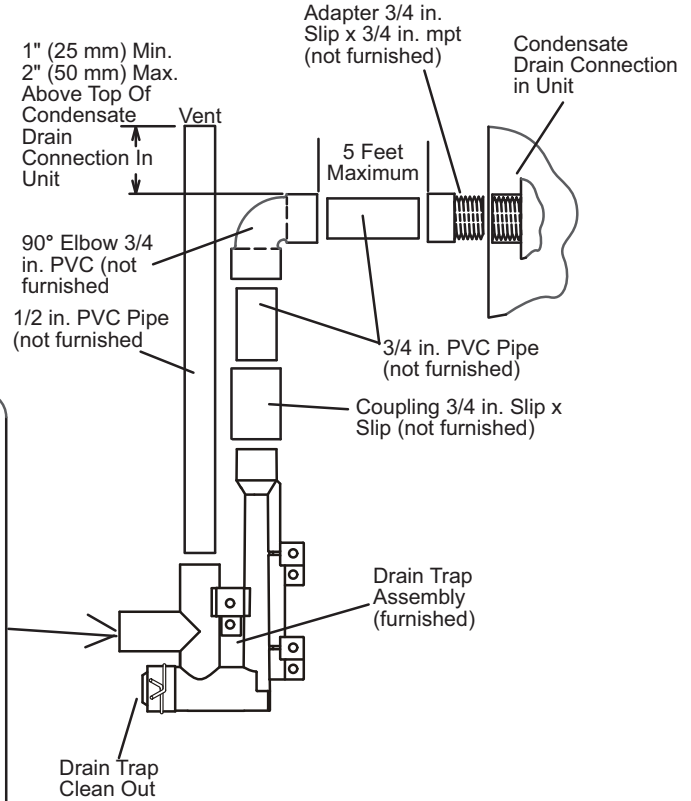
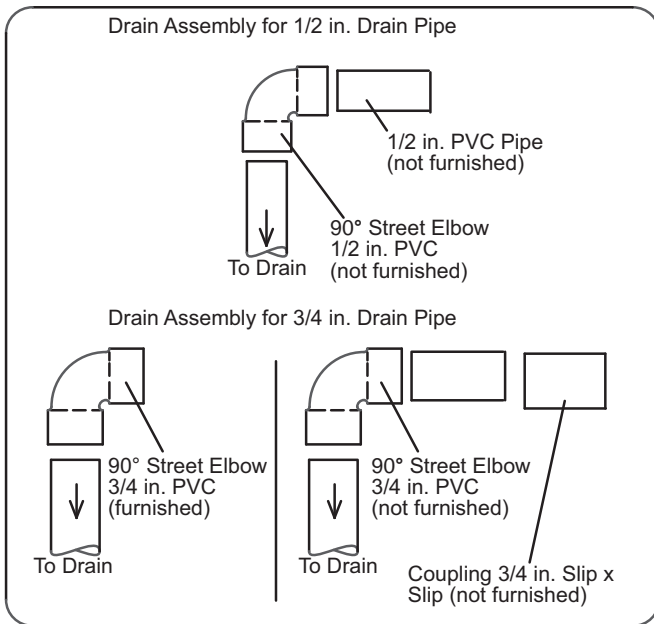
# Service Information

## CONDENSATE PIPING (Cont.)

### Optional Condensate Drain Connection

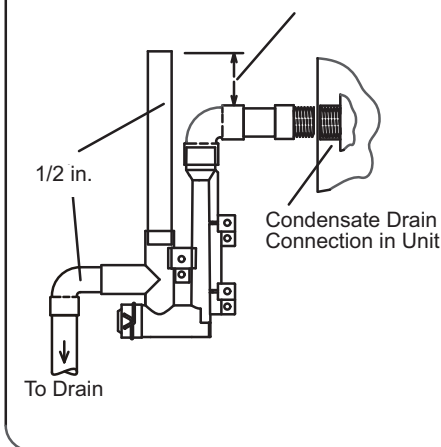


### Optional Drain Piping from Trap



### Drain Trap Assembly with 1/2 in. Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top of Condensate Drain Connection in Unit



### Drain Trap Assembly with 3/4 in. Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top of Condensate Drain Connection in Unit

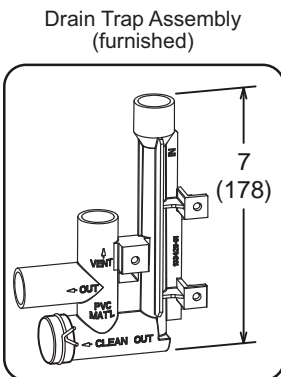
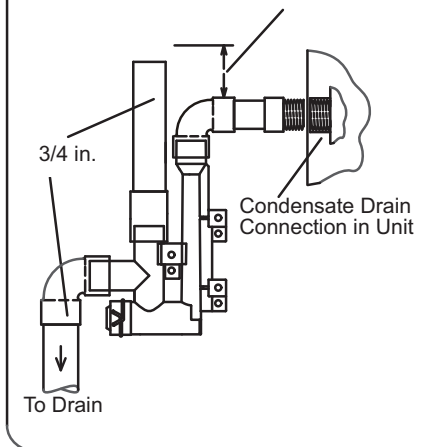


Figure 43. Trap / Drain Assembly Using 1/2" PVC or 3/4" PVC

# Service Information

## 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.

### 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 NF97X\*\*\*V\*\*R 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

NF97X\*\*\*V\*\*R 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.

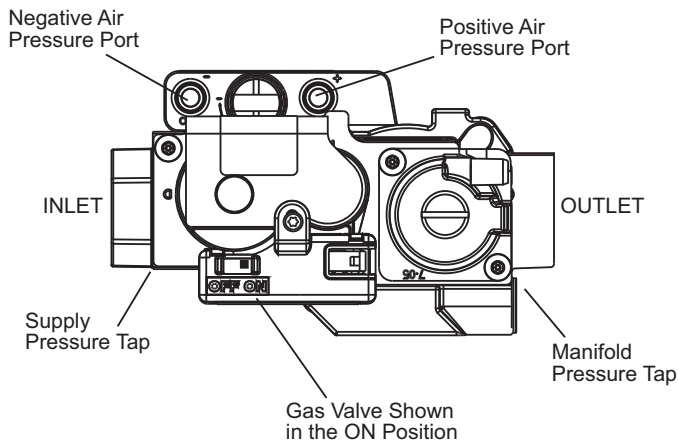
### Priming Condensate Trap

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 44. 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 44**.
  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 44**.
  9. Replace the upper access panel.
  10. Turn on all electrical power 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.

# Service Information

## START-UP (Cont.)

### 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.

## HEATING SYSTEM SERVICE CHECKS

### CSA Certification

All units are CSA design certified without modifications. Refer to the NF97X\*\*\*V\*\*R 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 0.5 psig (14" W.C.). See Figure 45. If the pressure is greater than 0.5 psig (14" W.C.), use the manual shut-off valve before pressure testing to isolate furnace from gas supply.

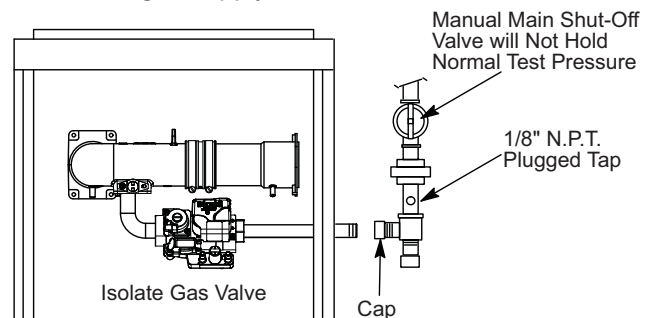


Figure 45.

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

A threaded plug on the inlet side of the gas valve provides access to the supply pressure tap. Remove the threaded plug, install a field-provided barbed fitting and connect a manometer to measure supply pressure. Replace the threaded plug after measurements have been taken. See Table 25 for supply line pressure.

# Service Information

## HEATING SYSTEM SERVICE CHECKS (Cont.)

### Check Manifold Pressure

**▲ IMPORTANT** For safety, connect a shut-off valve between the manometer and the gas tap to permit shut off of gas pressure to the manometer.

To correctly measure manifold pressure, follow the steps below:

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. Start unit on low heat and allow 5 minutes for unit to reach steady state.
3. After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in **Table 24**.
4. Repeat on high heat.
5. 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.
6. Start unit and perform leak check. Seal leaks if found.

Altitude	Unit	Natural	
		Hlgh Fire in. w.c.	Low Fire in. w.c.
0 - 4,500 ft.	040	3.5	1.7
	060		
	080		
4,501 - 7,500 ft.	040	n/a	n/a
	060	2.3	1.2
	080	2.4	1.2

**Table 25. Manifold Pressure (inches w.c.)**

### 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 25** 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
-040	90	180	-	-
-060	60	120	150	300
-080	45	90	112	224
Natural - 1000 btu/cu ft			LP - 2500 btu/cu ft	

**Table 26. Gas Meter Clocking Chart**

**▲ IMPORTANT** For safety, shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to replace pressure tap plug.

### Proper Combustion

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking correct combustion. See sections E- and F-. Take combustion sample beyond the flue outlet. **Table 27** shows acceptable combustions.

Model	CO <sub>2</sub> % for Nat		CO <sub>2</sub> % for LP	
	Low Fire	High Fire	Low Fire	High Fire
-040	6.3 - 7.8	6.3 - 7.8	-	-
-060	6.5 - 8.2	6.5 - 8.2	9.3 - 10.0	9.3 - 10.0
-080	7.2 - 8.4	7.2 - 8.4	9.5 - 10.2	9.5 - 10.2
The maximum carbon monoxide reading should not exceed 100 ppm.				

**Table 27.**

### High Altitude

Units may be installed at altitudes up to 7,500 ft. above sea level. See Table 25 for de-rate manifold values.

# Service Information

## HEATING SYSTEM SERVICE CHECKS (Cont.)

### Proper Ground and Voltage

A poorly grounded furnace can contribute to premature ignitor failure. Use the following procedure to check for ground and voltage to the integrated control.

1. Measure the AC voltage between Line Neutral (spade terminals) and "C" terminal (low voltage terminal block) on the integrated control. See **Figure 46**. A wide variation in the voltage between Line Neutral and "C" as a function of load indicates a poor or partial ground. Compare the readings to **Table 28**. If the readings exceed the maximum shown in **Table 28**, make repairs before operating the furnace.

2. In addition, measure the AC voltage from Line Hot to Line Neutral (spade terminals) on the integrated control. See **Figure 46**. This voltage should be in the range of 97 to 132 Vac.

Furnace Status	Measurement VAC	
	Expected	Mximum
Power On Furnace Idle	0.3	2
CAI / Ignitor Energized	0.75	5
Indoor Blower Energized	Less than 2	10

Table 28.

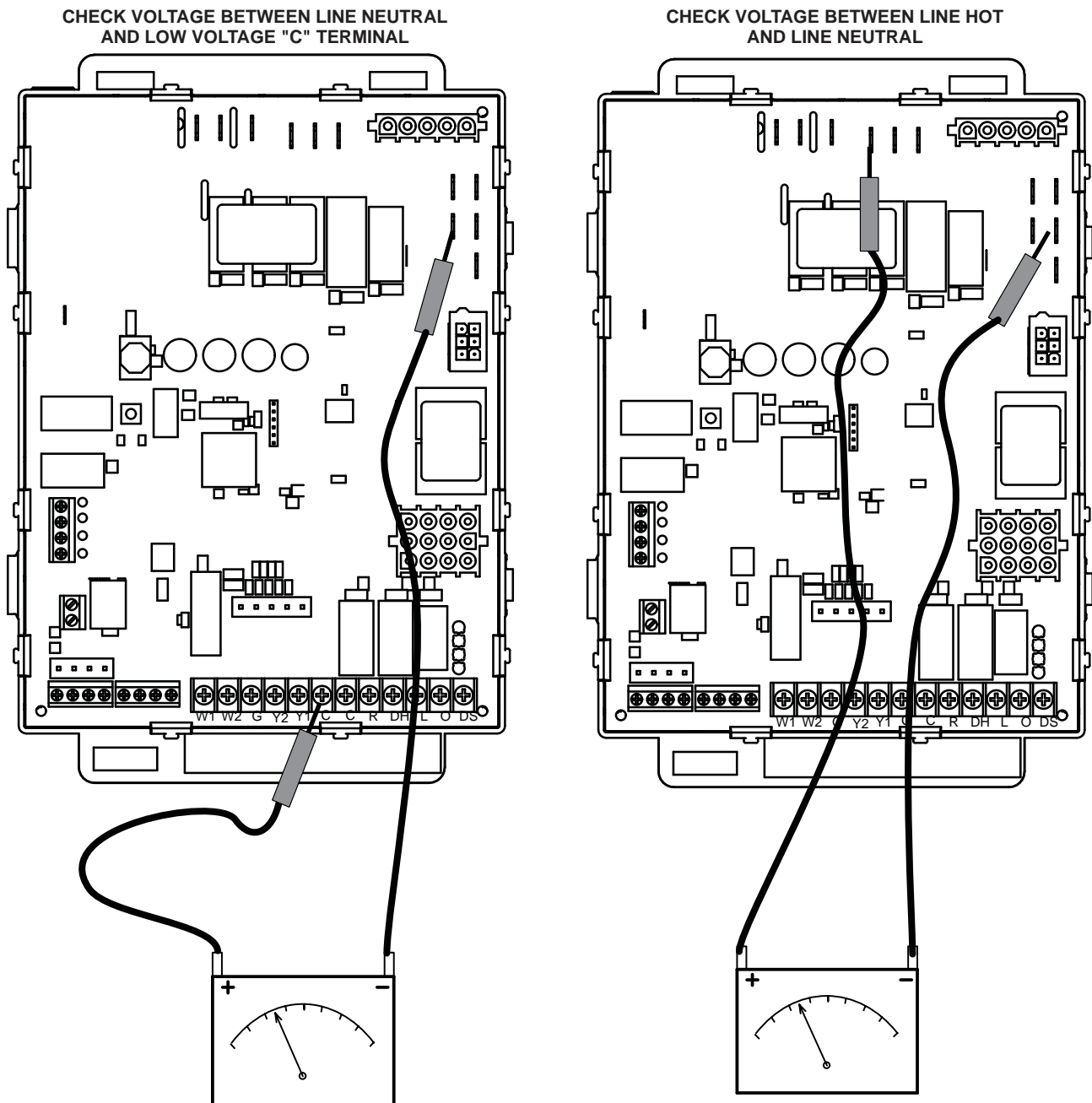


Figure 46.

# Service Information

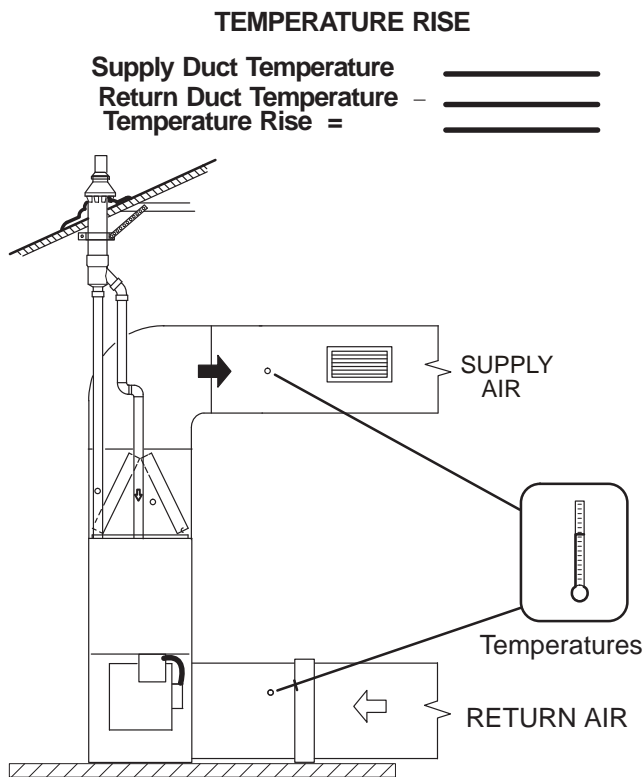
## TYPICAL OPERATING CHARACTERISTICS

### 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

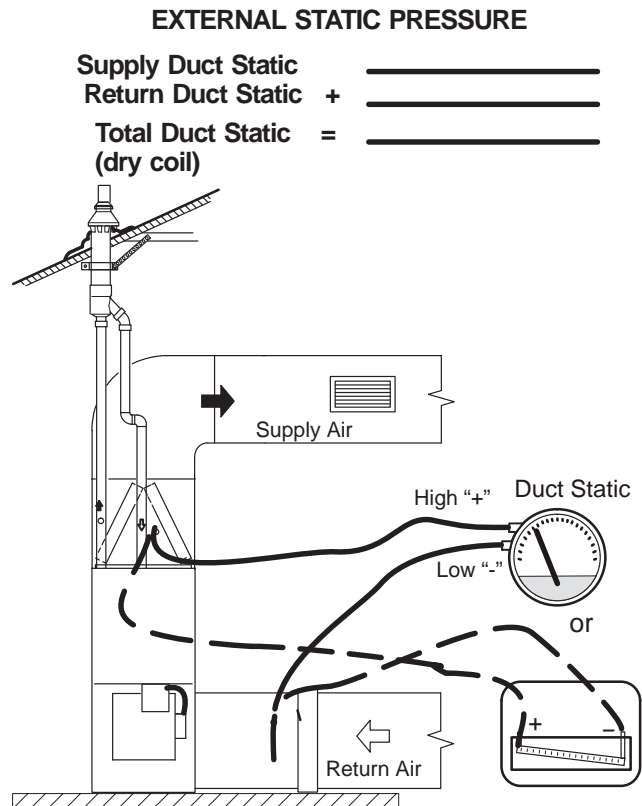
Temperature rise for the units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of "TEMP. RISE °F" listed on the unit rating plate. See **Figure 47**.



**Figure 47. Temperature Rise**

### External Static Pressure

1. Tap locations shown in **Figure 48**.
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. For heating speed (second stage heat speed) external static pressure drop must not be more than 0.8" W.C. For cooling speed (second stage cool speed) external static pressure drop must not be more than 1.0" W.C.
4. Seal the hole when the check is complete.



**Figure 48. External Static Pressure**

# Service Information

## 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 pre-lubricated 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 30** 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)

Table 29.

### 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

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 \_\_\_\_\_

### Winterizing and Condensate Trap Care

1. Turn off power to the furnace.
2. Have a shallow pan ready to empty condensate water.
3. Remove the clean out cap from the condensate trap and empty water. Inspect the trap then reinstall the clean out cap.

### Cleaning the Heat Exchanger and Burner

If cleaning the heat exchanger becomes necessary, follow the below procedures and refer to **Figure 1** and **Figure 49** when disassembling unit. Use papers or protective covering in front of furnace while removing heat exchanger assembly.

1. Turn off both electrical and gas power supplies to furnace.
2. Remove exhaust pipe from appliance adaptor but leave adaptor connected to exhaust coupling. Remove top cap and intake air pipe from side of unit.
3. Label the wires from gas valve, thermal switch, primary limit switch and make-up box then disconnect them.
4. Label then disconnect the wires from gas valve, thermal switch, primary limit switch and make-up box.
5. Disconnect gas supply piping. Remove the screw securing the air fuel plenum and remove along with the air intake assembly as one component.
6. Remove screws from both sides, top and bottom of vestibule panel.
7. Remove heat exchanger. It may be necessary to spread cabinet side to allow more room.

# Service Information

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## 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 pre-lubricated 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 30** 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.

### 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

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 \_\_\_\_\_

### Winterizing and Condensate Trap Care

1. Turn off power to the furnace.
2. Have a shallow pan ready to empty condensate water.
3. Remove the clean out cap from the condensate trap and empty water. Inspect the trap then reinstall the clean out cap.

### Cleaning the Heat Exchanger and Burner

If cleaning the heat exchanger becomes necessary, follow the below procedures and refer to **Figure 1** and **Figure 49** when disassembling unit. Use papers or protective covering in front of furnace while removing heat exchanger assembly.

1. Turn off both electrical and gas power supplies to furnace.
2. Remove exhaust pipe from appliance adaptor but leave adaptor connected to exhaust coupling. Remove top cap and intake air pipe from side of unit.
3. Label the wires from gas valve, thermal switch, primary limit switch and make-up box then disconnect them.
4. Label then disconnect the wires from gas valve, thermal switch, primary limit switch and make-up box.
5. Disconnect gas supply piping. Remove the screw securing the air fuel plenum and remove along with the air intake assembly as one component.
6. Remove screws from both sides, top and bottom of vestibule panel.
7. Remove heat exchanger. It may be necessary to spread cabinet side to allow more room.

# Service Information

## MAINTENANCE (Cont.)

### Cleaning the Heat Exchanger and Burner (Cont.)

8. Back wash using steam. Begin from the burner opening on each tube. Steam must not exceed 275°F.
9. Run a vacuum cleaner over the face of burner. Visually inspect inside the burner. Remove any blockage. Replace gasket between burner plate and air fuel plenum then re-install burner plate.
10. To clean the combustion air inducer visually inspect and using a wire brush clean where necessary. Use compressed air to clean off debris and any rust.
11. Reinstall heat exchanger in vestibule.
12. Reinstall the air fuel plenum and air intake assembly.
13. Reinstall the combustion air inducer assembly. Make note to re-install all screws. Failure to replace all screws may cause leaks. Reconnect all wires.
14. Reconnect top cap and exhaust pipe to combustion air inducer outlet. Reconnect intake air pipe.
15. Reconnect gas supply piping.
16. Turn on power and gas supply to unit.
17. Set thermostat and check for proper operation.
18. Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.

**CAUTION** Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed. Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

19. If a leak is detected, shut gas and electricity off and repair leak.
20. Repeat steps 18 and 19 until no leaks are detected.
21. Replace access panel.

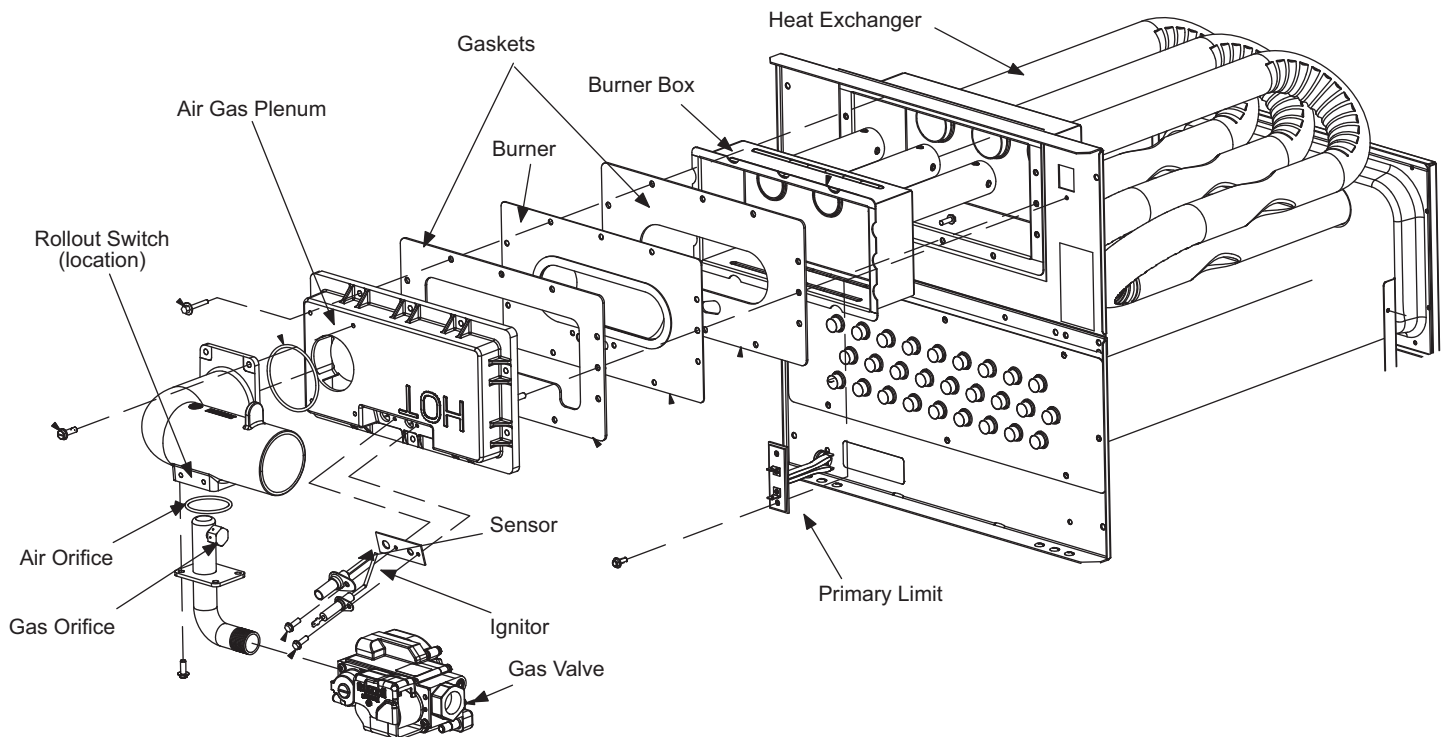


Figure 49. Heating Components

# Service Information

## LOW GWP APPLICATION

**⚠ WARNING** For use with GE Appliances approved evaporator coil and LGWP sensors only. Use original manufacturer recommended LGWP sensors if using non GE Appliances approved evaporator coil.

### Connecting the Furnace Control Board Sensor

See **Figure 52** and follow steps below:

1. Route sensor wire #1 through provided grommet. Form a drip loop below the control board on upflow installations to prevent condensate dripping on the control board.
2. Avoid sharp edges when routing sensor wire during installation.
3. Sensor wire must not block view of 7 segment LED.

Ensure the cable is properly seated into the SENSOR 1 plug (LGWP1). The Molex plug clip should lock into the Molex connection point for a secured connection, as shown below in **Figure 50** Verify the connection is free of dust, debris, and moisture.

**NOTE:** In confined space applications, connect the second sensor to the SENSOR 2 plug (LGWP2). Refer to evaporator coil installation instructions for more detail.



**Figure 50. Single Stage Constant Torque Control**

### Low GWP Dip Switch Settings

Adjust the DIP switch settings to the sensor configuration. Failure to do so will cause faults on power-up. See **Figure 51** and **Table 30**.



**Figure 51.**

Configuration	Switch 1	Switch 2
One (1) sensor, connected to SENSOR 1 plug	OFF (enable)	ON (disable)
Two (2) sensors, connected to SENSOR 1 plug and SENSOR 2 plug	OFF (enable)	OFF (enable)
No sensor (R410A or heat only applications)	ON (disable)	ON (disable)

**Table 30. DIP Switch Settings**

In single sensor configurations, the sensor must be connected to the SENSOR 1 plug (LGWP1). Configurations other than the ones shown in **Table 30** will cause a servicing fault.

Each DIP switch corresponds to a sensor position (i.e., DIP switch 1 to sensor 1; DIP switch 2 to sensor 2). The default factory switch positions are set to OFF (ENABLED) The furnace control board software reads the OFF position as an active sensor. A sensor should be present for the corresponding sensor connector. Setting the DIP switch to ON disables the sensor position.

### Secondary Sensor Requirements

#### Additional Line Sets

If additional refrigerant line joints are present outside of the line set sleeve and a secondary refrigerant detection sensor is required, its installation must comply with the requirements listed in Refrigerant Detection Sensor Kit (27V53). See **Figure 52** for routing the secondary sensor cable through the furnace cabinet.

# Service Information

## LOW GWP APPLICATION (Cont.)

### Non-Low GWP Applications

**▲ WARNING** For Furnace only applications or Furnace replacement in a Non-Low GWP applications, the LOW GWP sensors should be disabled, otherwise the blower will operate continuously. To do this, the Low GWP Dip switches setting for both – Sensor 1 and the Sensor 2 must be moved to the ON position.

### FURNACE CONTROL BOARD LOW GWP MODES OF OPERATION

The modes of operation for the furnace control board are Initializing, Normal, Leak Detected, and Fault.

#### Initializing

The furnace control board is establishing connection with the refrigerant detection sensor and is completing an initial five-minute purge sequence.

#### Normal

The HVAC system is functioning normally. The furnace control board has not detected a refrigerant leak.

#### Leak Detected

When the furnace control board detects a refrigerant leak:

1. The furnace control board shuts off the (R) input (24VAC power) to the thermostat, which de-energizes the outdoor unit compressor and heat sources, such as gas and/or electric strip heat. No heating or cooling demands will be met.
2. The furnace control board activates the blower (high speed). The blower purges refrigerant from the cabinet, plenum, and ductwork.
3. After the furnace control board determines the refrigerant levels are below the safety threshold, the blower will continue to operate for the remainder of the seven (7) -minute cycle.
4. After the blower sequence is complete, the HVAC system resumes normal operation.

**NOTE:** The HVAC system may not maintain a cooling or heating setpoint if a significant leak exists. Any refrigerant leaks that remain unaddressed for an extended time may cause the HVAC system to shut down on a low refrigerant pressure limit condition.

#### Fault

When a Low GWP fault is detected by the furnace control board, the indoor unit blower engages and remains engaged at a constant air flow output until the fault is cleared.

**NOTE:** See Table 4 “Ignition control diagnostic codes”

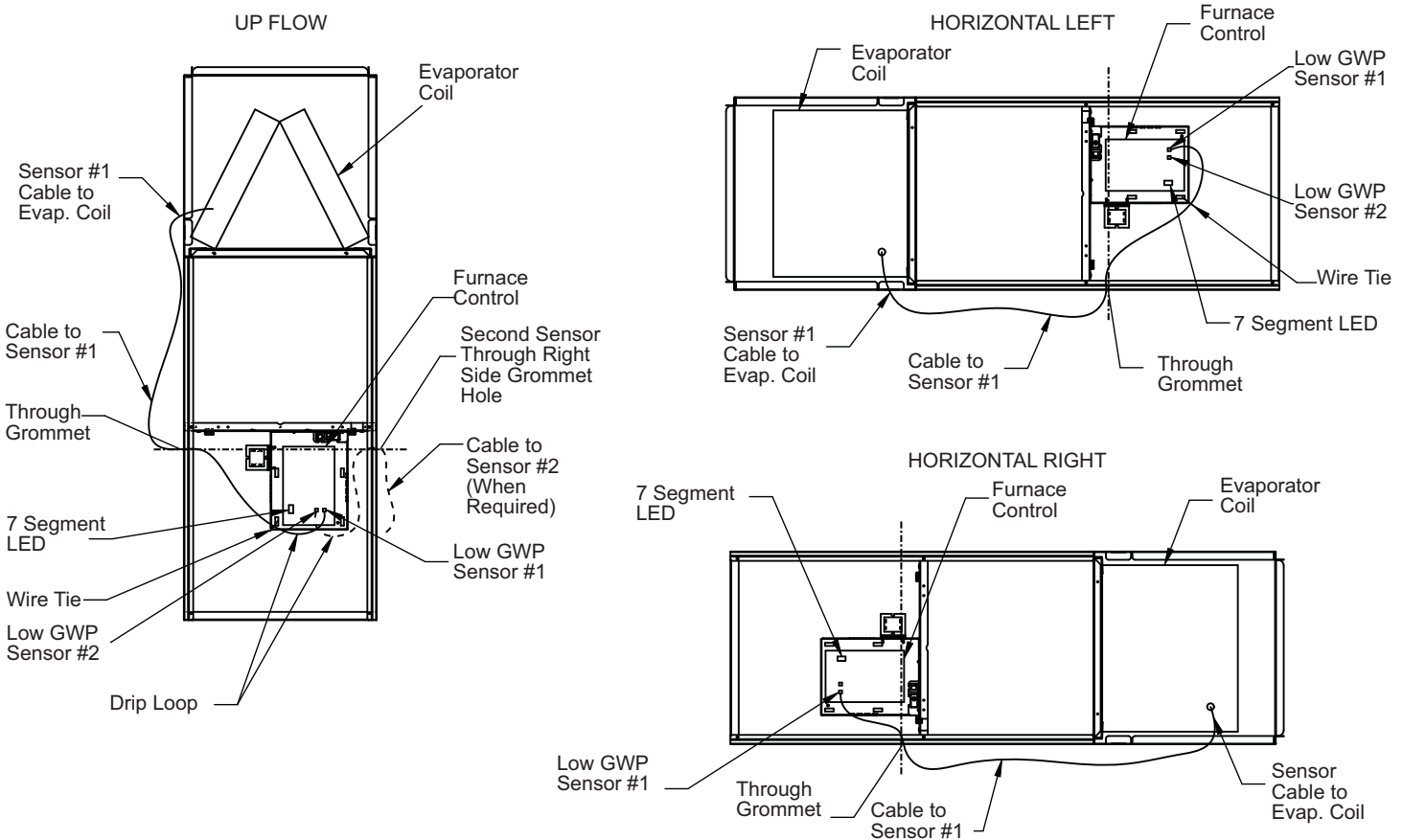


Figure 52.

# Service Information

## LOW GWP APPLICATION (Cont.)

### LGWP Test Button Functionality

The furnace control board is equipped with a Test/Reset push button. The Test button can be used to perform several functions, depending on the mode of operation of the furnace control board.

**Table 31** lists the functions of the Test button during each mode of operation.

Mode of Operation	Press the Test Button to:
Normal	Trigger a leak detection response. Verify all equipment is wired correctly into the furnace blower control board (after installation).
Leak Detected	Reset the furnace control board to a normal mode of operation after a previous leak has been detected and purged from the HVAC system
Fault	Reset the furnace control board after troubleshooting and resolving a fault condition. If the fault is not resolved, the furnace control board will enter the Fault mode again.

**Table 31. LGWP Test Button Function**

**Table 32** lists the additional functions of the Test Button while the furnace control board is functioning within the states of Initializing, Monitoring, Leak Detection, Servicing and Fault.

State	Press	Action
Initializing	Short	Skips remaining pre-purge after sensors are recognized by the furnace control board
Initializing	Long	Reset control
Monitoring	Short	Clear purge-counter if prior mitigation has occurred; Test mitigation
Monitoring	Long	Reset control
Mitigating	Short	If testing mitigation, end test
Servicing	Short	Reevaluate fault condition - if cleared return to monitoring, otherwise update indicator
Servicing	Long	Reset control
Fault	Short	Reevaluate fault condition - if cleared return to monitoring, otherwise update indicator
Fault	Long	Reset control

**Table 32. LGWP Test Button Function**

### External Alarm

(For applications with external alarms wired directly to the furnace control board)

The furnace control board triggers the external alarm system when it enters Leak Detected mode. For alarm notifications, the furnace control board provides a dry relay contact that is rated 3A at 30 VAC/DC.

### Thermostat Compatibility

Thermostats that preserve memory settings are compatible with the furnace control board. Examples include:

- Battery-powered thermostats
- Analog Thermostat
- Late-model programmable thermostats

**NOTE:** Early-generation digital and programmable thermostats may not retain the operation mode and temperature setpoints after a power outage.

The following scenarios are likely to occur when home occupants are not available to adjust the thermostat setpoints as the system is recovering from leak detection and resuming normal operation:

- Heating could be lost during a cold night
- Cooling could be lost during a hot day
- The thermostat could reset to an incorrect temperature setpoint.

### Start Up Procedure

The furnace control board is equipped with a LGWP Test/Reset button, see Test Button Functionality. After the furnace control board has been mounted and wired, restore power to the HVAC system. The system will then run through a purge sequence for five minutes. After the purge sequence is complete, proceed to testing cooling demand and heating demand.

### Cooling Demand

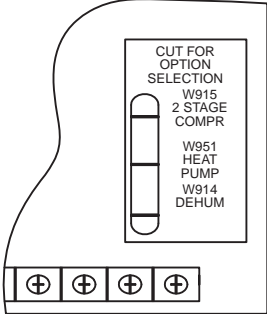
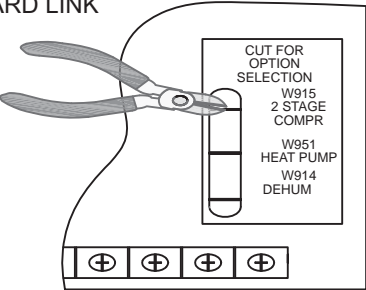
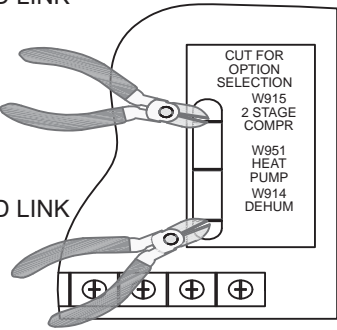
1. Prompt a cooling demand at the thermostat.
2. Press the LGWP Test button on the furnace control board.  
The system then executes a leak detection response.
3. Observe the following sequence:
  - a. The LED indicator for leak detection. See **Table 4** "Ignition control diagnostic codes"
  - b. The blower powers up.
  - c. The outdoor compressor powers down.
4. Press the LGWP Test button to terminate the simulated Leak Detected mode upon test completion

### Heating Demand

1. Prompt a heating demand at the thermostat.
2. Press the LGWP Test button on the furnace control board.  
The system then executes a leak detection response.
3. Observe the following sequence:
  - a. The LED indicator for leak detection. See **Table 4** "Ignition control diagnostic codes".
  - b. The blower powers up.
  - c. The gas burners power down.
  - d. The outdoor compressor powers down.
4. Press the LGWP Test button to terminate the simulated Leak Detected mode upon test completion.

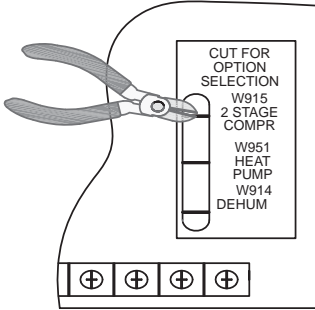
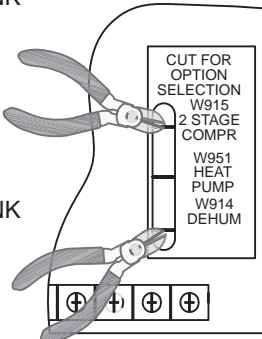
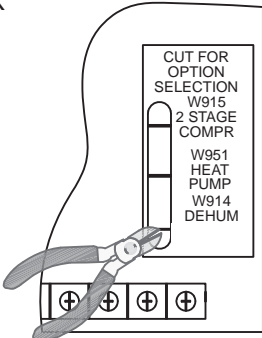
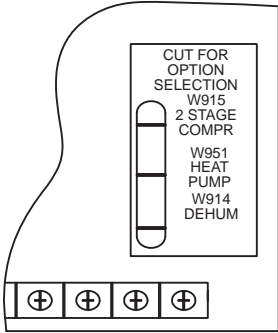
The installation of the furnace control board is complete after both sequences are successfully completed.

# Service Information

Thermostat	DIP Switch Settings and On-Board Links		Wiring Connections																																	
	DIP Switch 1 Thermostat Heating Stages	On Board Links Must Be Cut To Select System Options																																		
1 Heat / 1 Cool <b>NOTE:</b> Use DIP switch 2 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.	ON	DO NOT CUT ANY ON-BOARD LINKS 	<table border="0"> <tr> <td><b>S1</b></td> <td><b>FURNACE</b></td> <td><b>OUTDOOR</b></td> </tr> <tr> <td><b>T'STAT</b></td> <td><b>TERM. STRIP</b></td> <td><b>UNIT</b></td> </tr> <tr> <td></td> <td>DH/DS</td> <td></td> </tr> <tr> <td>(W2)</td> <td>(W2)</td> <td></td> </tr> <tr> <td>(W1)-----</td> <td>(W1)</td> <td></td> </tr> <tr> <td>(R)-----</td> <td>(R)-----*</td> <td>(R)</td> </tr> <tr> <td>(G)-----</td> <td>(G)</td> <td></td> </tr> <tr> <td>(C)-----</td> <td>(C)-----</td> <td>(C)</td> </tr> <tr> <td></td> <td>(Y2)</td> <td></td> </tr> <tr> <td>(Y)-----</td> <td>(Y1)-----</td> <td>(Y)</td> </tr> <tr> <td></td> <td>(O)</td> <td></td> </tr> </table>	<b>S1</b>	<b>FURNACE</b>	<b>OUTDOOR</b>	<b>T'STAT</b>	<b>TERM. STRIP</b>	<b>UNIT</b>		DH/DS		(W2)	(W2)		(W1)-----	(W1)		(R)-----	(R)-----*	(R)	(G)-----	(G)		(C)-----	(C)-----	(C)		(Y2)		(Y)-----	(Y1)-----	(Y)		(O)	
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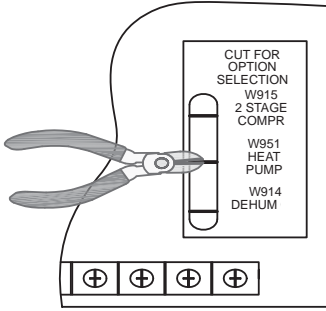
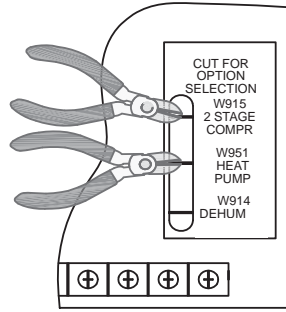
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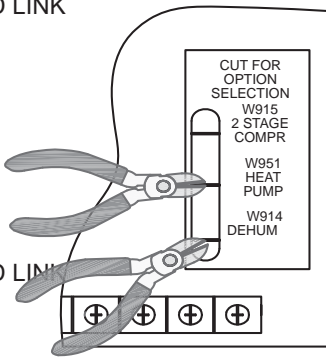
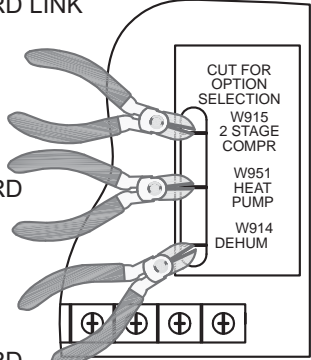
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# Service Information

## SEQUENCE OF OPERATION

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

**▲ 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**  **Electric Shock hazard.**

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

### Electronic Ignition

The two-stage, variable speed integrated control used in NF97X\*\*\*V\*\*R units has an added feature of an internal lockout control. The feature serves as an automatic reset device for ignition control lockout caused by ignition failure. After one hour of continuous thermostat demand for heat, the lockout will break and remake thermostat demand to the furnace and automatically reset the control to begin the ignition sequence.

**NOTE:** The ignition control thermostat selection DIP switch is factory-set in the “TWO-STAGE” position.

### Applications Using a Two-Stage Thermostat

See **Figure 54** for ignition control sequence.

#### A - Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 OFF in “Two-Stage” Position (Factory Setting)

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 low speed.
2. Once the control receives a signal that the low pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in low speed.  
**NOTE:** If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.
3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at low speed.

4. After the 20-second warm-up period has ended, the gas valve is energized on low fire (first stage) 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 on the low fire heating speed, the HUM contacts close energizing the humidifier and 120V ACC terminal is energized. 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 initiates a 30-second second-stage recognition delay.

**NOTE:** If the indoor thermostat is set on CONTINUOUS FAN ON mode, the furnace will light on high fire (second-stage) for 60 seconds to improve heat exchanger warm up. After 60 second warm-up period, furnace will switch to low fire (first-stage).

6. At the end of the recognition delay, the integrated control energizes the combustion air inducer at high speed. The control also checks the high fire (secondstage) pressure switch to make sure it is closed. The high fire (second stage) gas valve is energized and the indoor blower motor is energized for operation at the high fire heating speed.
7. When the demand for high fire (second stage) heat is satisfied, the combustion air inducer is switched to the low-fire heating speed and the high-fire (second stage) gas valve is de-energized. The low-fire (first stage) gas valve continues operation. The indoor blower motor is switched to the low-fire heating speed.
8. When the thermostat demand for low-fire (first 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 5-second post-purge period.
9. When the combustion air post-purge period is complete, the inducer, the HUM contacts as well as the 120V ACC terminals are de-energized. The indoor blower is de-energized at the end of the off delay.

# Service Information

## SEQUENCE OF OPERATION (Cont.)

### Applications Using a Single-Stage Thermostat

See Figure 55 for ignition control sequence.

#### A - Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 OFF in "Two-Stage" Position (Factory Setting)

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 low speed.
2. Once the control receives a signal that the low pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in low speed.  
**NOTE:** If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.
3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at low speed.

4. After the 20-second warm-up period has ended, the gas valve is energized on low fire (first stage) 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 on the low fire heating speed and the HUM contacts are energized. The integrated control also initiates a second-stage on delay (factoryset 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 high speed. The control also checks the high fire (second stage) pressure switch to make sure it is closed. The high fire (second stage) gas valve is energized and the indoor blower motor is energized for operation at the high fire heating speed.
6. When the thermostat heating demand is satisfied, the combustion air inducer begins a 5-second low speed post-purge. The field-selected indoor blower off delay begins. The indoor blower operates at the low-fire heating speed.
7. When the combustion air post-purge period is complete, the inducer, the HUM contacts as well as the 120V ACC terminals are de-energized. The indoor blower is de-energized at the end of the off delay.

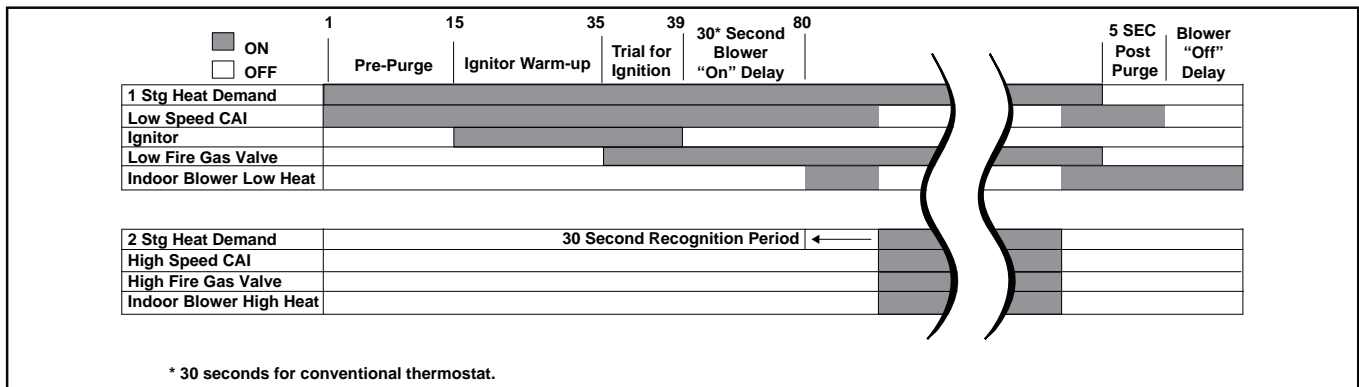


Figure 54. Heating Operation with Two Stage Thermostat

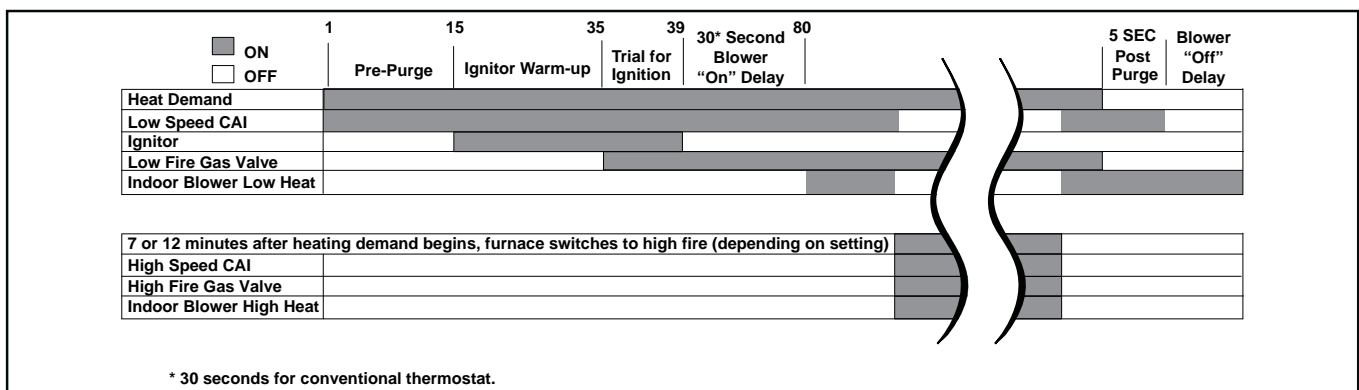


Figure 55. Heating Operation with Single Stage Thermostat

# Service Information

## Program Unit Capacity Size Modes

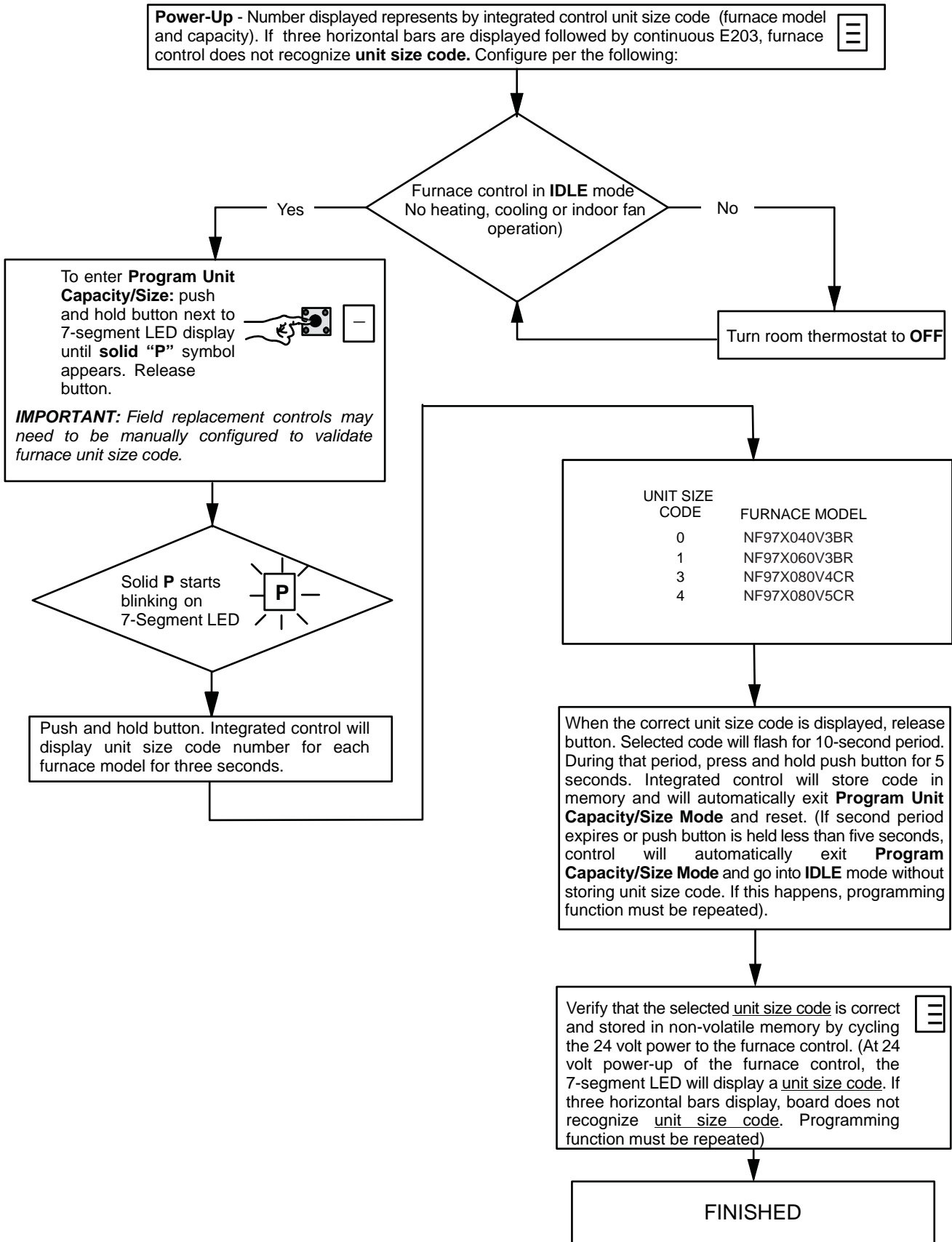
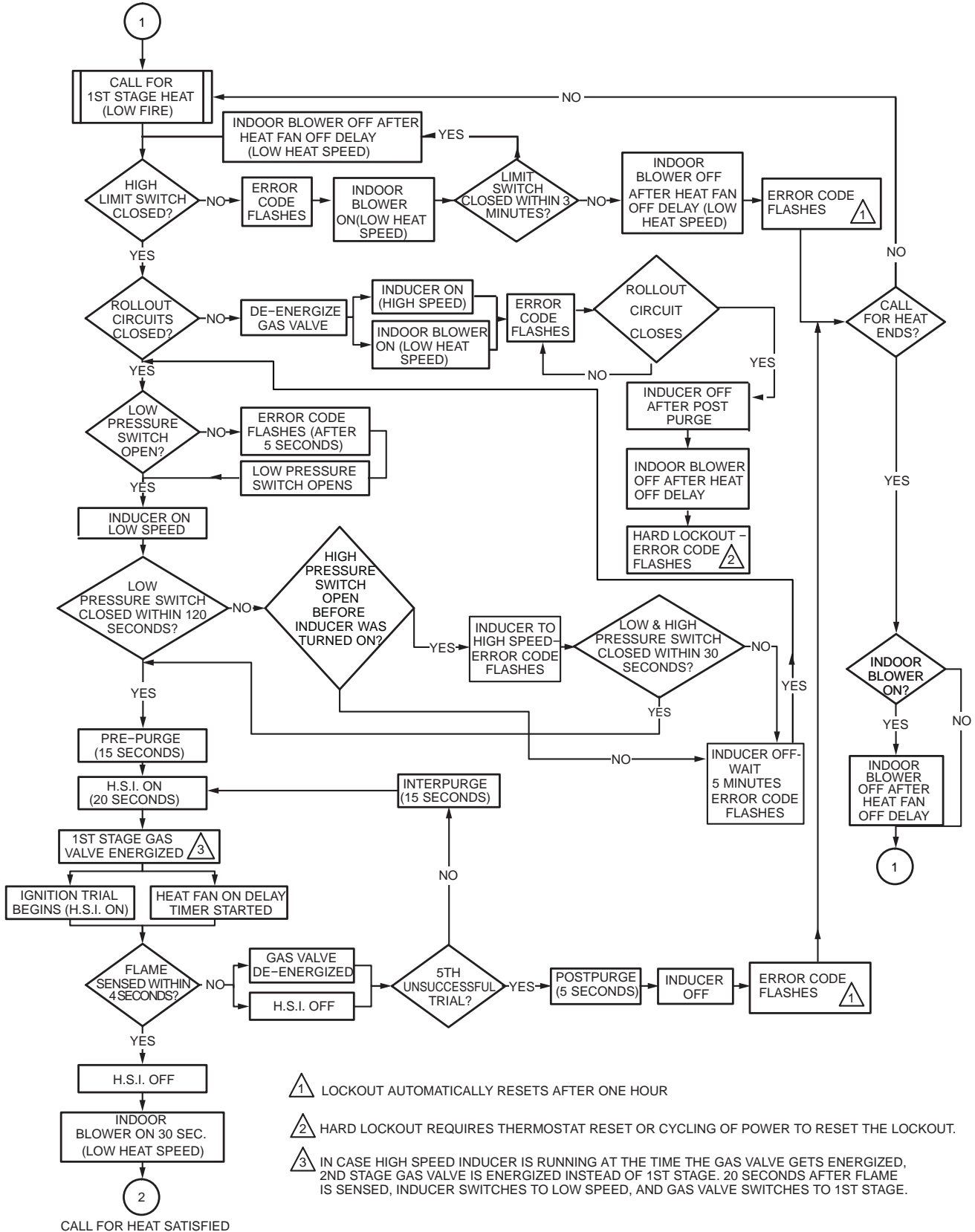


Figure 56. Program Unit Capacity/Size Mode

# Service Information

## TROUBLESHOOTING - Heating Sequence of Operation

CALL FOR FIRST-STAGE HEAT



1 LOCKOUT AUTOMATICALLY RESETS AFTER ONE HOUR

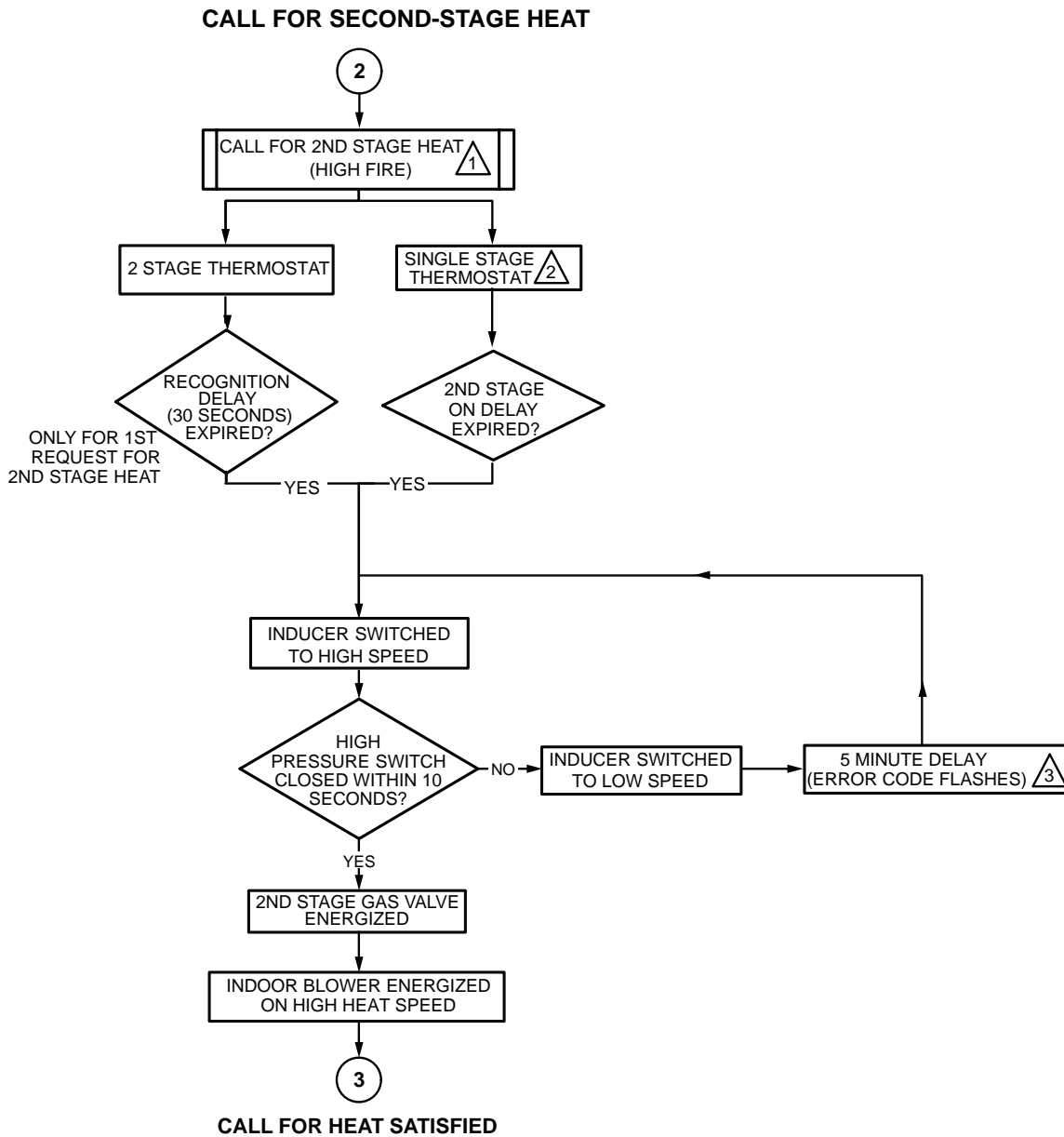
2 HARD LOCKOUT REQUIRES THERMOSTAT RESET OR CYCLING OF POWER TO RESET THE LOCKOUT.

3 IN CASE HIGH SPEED INDUCER IS RUNNING AT THE TIME THE GAS VALVE GETS ENERGIZED, 2ND STAGE GAS VALVE IS ENERGIZED INSTEAD OF 1ST STAGE. 20 SECONDS AFTER FLAME IS SENSED, INDUCER SWITCHES TO LOW SPEED, AND GAS VALVE SWITCHES TO 1ST STAGE.

Figure 57. Troubleshooting: Heating Sequence of Operation

# Service Information

## TROUBLESHOOTING - Heating Sequence of Operation



- 1 SYSTEM WILL ALWAYS LIGHT ON LOW FIRE, EVEN IF 2ND STAGE HEAT IS IN PLACE.
- 2 WHEN USED WITH A SINGLE STAGE THERMOSTAT, SET SW1 TO THE ON POSITION IN DIP SWITCH S4.
- 3 IF THE HIGH FIRE PRESSURE SWITCH DOES NOT CLOSE WITHIN 5 ATTEMPTS, THE SYSTEM WILL OPERATE AT LOW FIRE FOR THE REMAINDER OF THE CALL FOR HEAT REQUEST.

Figure 58. Troubleshooting: Heating Sequence of Operation

# Service Information

## TROUBLESHOOTING - Heating Sequence of Operation

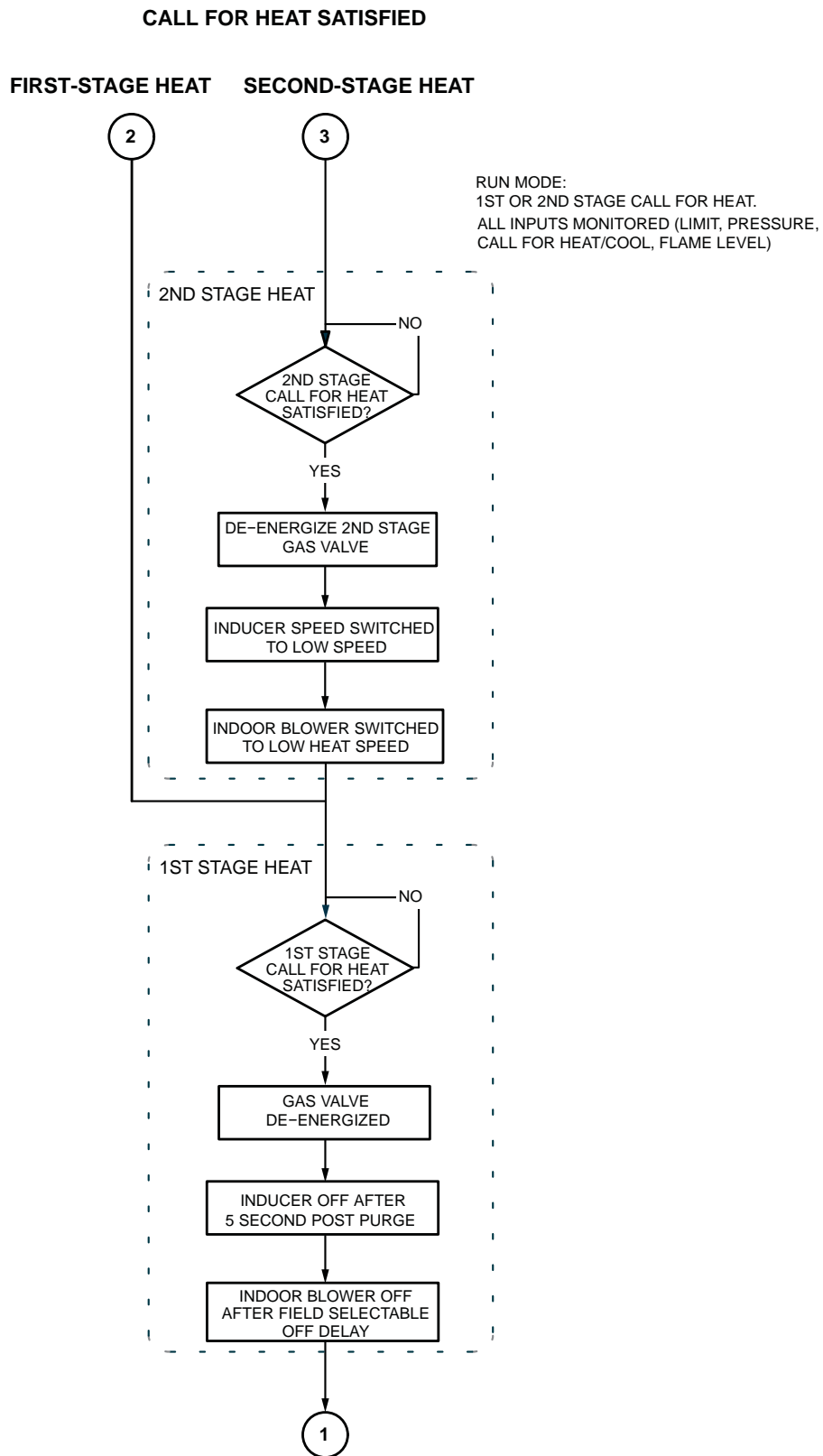


Figure 59. Troubleshooting: Heating Sequence of Operation

# Service Information

## TROUBLESHOOTING - Cooling Sequence of Operation

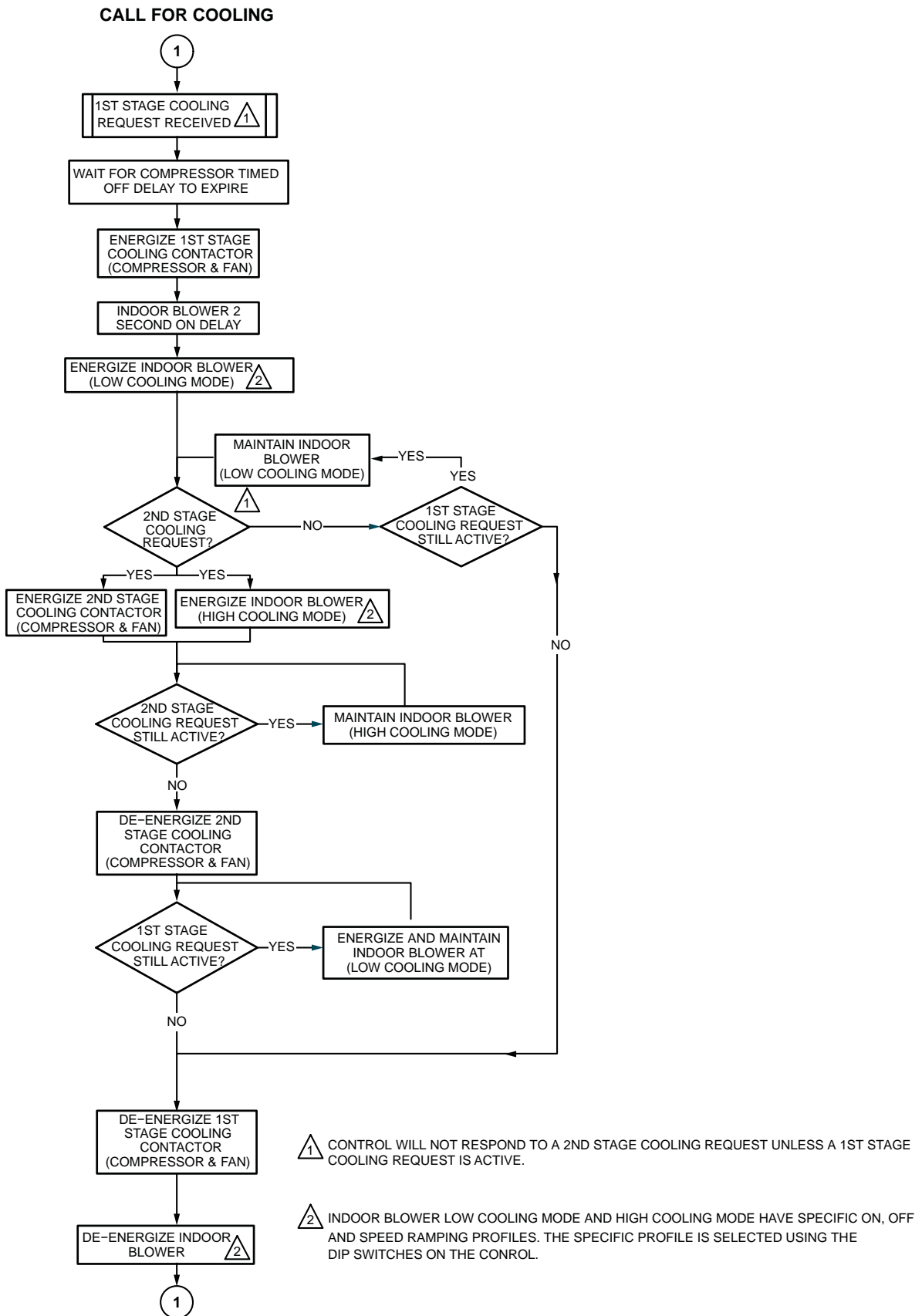


Figure 60. Troubleshooting: Cooling Sequence of Operation

# Service Information

## TROUBLESHOOTING - Continuous Fan Sequence of Operation

### CALL FOR FAN

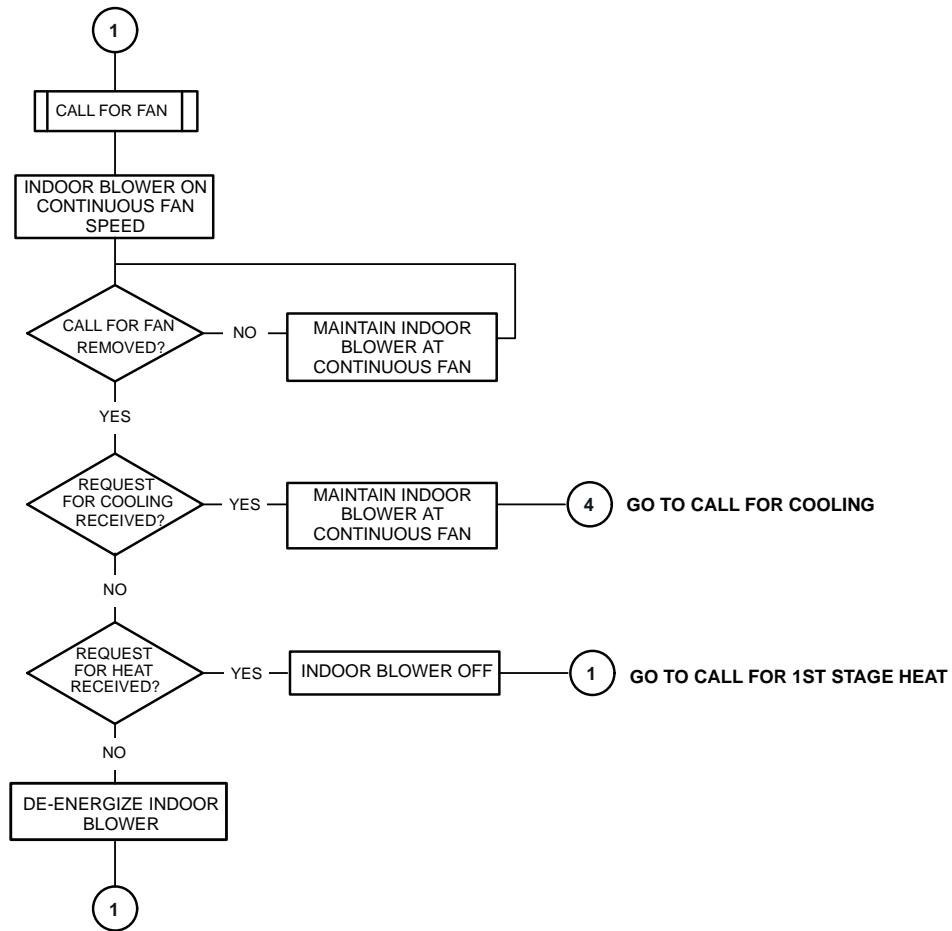


Figure 61. Troubleshooting: Continuous Fan Sequence of Operation

# Notes

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# Notes

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**GE APPLIANCES**

All specifications and illustrations subject to change without notice and without incurring obligations.

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