UNIT INFORMATION

SGH
3 & 5 ton

100117

Service Literature

SGH036 & 060 With R-454B

The SGH 3 and 5 ton (10.5 and 17.5 kW) units are configure to order units (CTO) with a wide selection of factory installed options. Units are available in the following heating inputs:

SGH036/060 units are available in Standard 2 Stage 53/70 kBtuh (15.5/20.5 kW) and Medium 2 Stage 81/108 kBtuh (23.7/31.6 kW) heating inputs. SGH060 units have an additional High 2 Stage 113/150 kBtuh (33.1/43.9 kW) heating input.

Information contained in this manual is intended for use by qualified service technicians only. All specifications 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.

If the unit must be lifted for service, rig unit by attaching four cables to the holes located in the unit base rail (two holes at each corner). Refer to the installation instructions for the proper rigging technique.

⚠ WARNING

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater).

Do not pierce or burn.

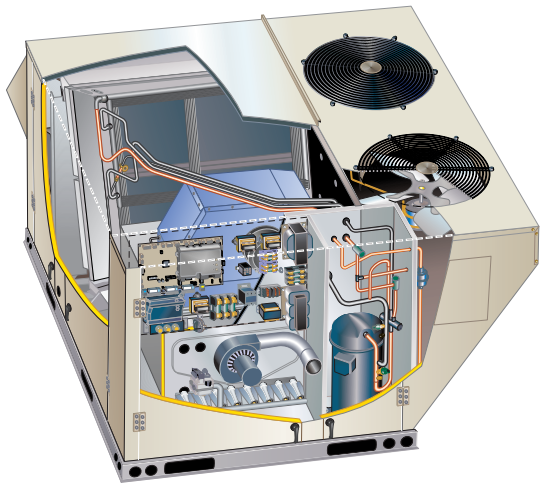
Be aware that refrigerants may not contain an odor.

⚠ WARNING

If this appliance is conditioning a space with an area smaller than TA min or stored in a space with an area smaller than A min as defined by this instruction, then that space must be without continuously operating open flames (e.g. an operating gas appliance) or other potential ignition sources (e.g. an operating electric heater or similar hot surface). A flame-producing device may be installed in the same space if the device is provided with an effective flame arrest system.

⚠ WARNING

Auxiliary devices which may be potential ignition sources shall not be installed in the duct work. Examples of potential ignition sources are hot surfaces with a temperature exceeding 700°C and electric switching components.



False ceilings or drop ceiling may be used as a return air plenum only if the unit being installed has a Refrigerant Detection System installed.

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out with work in confined spaces being avoided.

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

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⚠ WARNING

To prevent serious injury or death:

1- Lock-out/tag-out before performing maintenance.

2- If system power is required (e.g., smoke detector maintenance), disable power to blower, remove fan belt where applicable, and ensure all controllers and thermostats are set to the "OFF" position before performing maintenance.

3- Always keep hands, hair, clothing, jewelry, tools, etc., away from moving parts.

⚠ WARNING

Only Manufacturer approved auxiliary devices are permitted to be installed in this unit.

⚠ CAUTION

Any service personnel installing, decommissioning, or performing maintenance on the unit must be properly trained with A2L refrigerants.

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFC's and HCFC's) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for non-compliance.

⚠ WARNING

- **This appliance must be installed in accordance with local and national wiring regulations.**
- **If the appliance is not fitted with an option for full disconnection from power, a means of disconnection must be incorporated in the fixed wiring in accordance with national and local wiring regulations.**

OPTIONS / ACCESSORIES

Item Description			Order Number	Size 036	Size 060
COOLING SYSTEM					
Corrosion Protection	Coated indoor/outdoor coil assemblies, painted cabinet interior		Factory	O	O
	Coated outdoor coil assembly		Factory	O	O
Drain Pan Overflow Switch			**21Z07**	OX	OX
HEATING SYSTEM					
Combustion Air Intake Extension			**20X99**	X	X
			33W62		
			89L97		
Gas Heat Input	Standard 2 Stage - 53/70 kBtuh input (Low NOx)		Factory	O	O
	Medium 2 Stage - 81/108 kBtuh input (Low NOx)		Factory	O	O
	High 2 Stage - 113/150 kBtuh input (Low NOx)		Factory		O
	Standard 2 Stage - 84.5/130 kBtuh input		Factory		
	Medium 2 Stage - 117/180 kBtuh input		Factory		
	High 2 Stage - 156/240 kBtuh input		Factory		
	Standard 2 Stage - 169/260 kBtuh input		Factory		
	Medium 2 Stage - 234/360 kBtuh input		Factory		
	High 2 Stage - 312/480 kBtuh input		Factory		
LPG/Propane Kits	2 Stage Standard Heat		**21Z24**	X	X
	2 Stage Medium and High Heat		**21Z23**	X	X
	Standard Heat		**14N28**		
	Medium Heat		**14N29**		
	High Heat		**14N30**		
Low Temperature Vestibule Heater	460V - 3 phase		**31A62**	X	X
	575V - 3 phase		**31A63**	X	X
	460V - 3 phase		**31A65**		
	575V - 3 phase		**31A66**		
	460V - 3 phase		**58W29**		
	575V - 3 phase		**58W30**		
Stainless Steel Heat Exchanger			Factory	O	O
Vertical Vent Extension			**31W62**	X	X
			73M72		
			42W16		
BLOWER - SUPPLY AIR					
ECM DirectPlus™, Direct Drive, MSAV® (Multi-Stage Air Volume)		1.5 hp	Factory	O	O
Belt Drive, MSAV® (Multi-Stage Air Volume)		3 hp	Factory		
		5 hp	Factory		
		7.5 hp	Factory		
CABINET					
Combination Coil/Hail Guards			**19H54**	X	X
			19H55		
			13T16		

[1] Order two.

NOTE - Order numbers shown are for ordering field installed accessories.
OX - Configure To Order (Factory Installed) or Field Installed
O = Configure To Order (Factory Installed)
X = Field Installed

OPTIONS / ACCESSORIES

Item Description			Order Number	Size 036	Size 060
CONTROLS					
Commercial Control		LonTalk® Module	Factory	O	O
Dirty Filter Switch			Factory	O	O
[1] Smoke Detectors	Supply or Return (Power board and one sensor)		**10B40**	OX	OX
			10B42		
	Supply and Return (Power board and two sensors)		**10B41**	OX	OX
			10B43		
ELECTRICAL					
Voltage 60 hz		460V - 3 phase	Factory	O	O
		575V - 3 phase	Factory	O	O
GFI Service Outlets (**REQUIRED**)	20 amp non-powered, field-wired (all voltages)		Factory	O	O
Weatherproof Cover for GFI			**10C89**	X	X
INDOOR AIR QUALITY					
Air Filters					
Standard Air Filters		MERV 8 (16 x 20 x 2 - Order 4 per unit)	**54W20**	OX	OX
		MERV 8 (20 x 25 x 2 - Order 4 per unit)	**50W61**		
		MERV 8 (20 x 20 x 2 - Order 12 per unit)	**54W21**		
Healthy Climate® High Efficiency Air Filters		MERV 13 (16 x 20 x 2 - Order 4 per unit)	**52W37**	OX	OX
		MERV 13 (20 x 25 x 2 - Order 4 per unit)	**52W41**		
		MERV 13 (20 x 20 x 2 - Order 12 per unit)	**52W39**		
Replacement Media Filter With Metal Mesh Frame 20 x 20 x 2 Order 12 per unit (includes non-pleated filter media)			**44N60**		
Indoor Air Quality (CO_2) Sensors					
Sensor - Wall-mount, off-white plastic cover with LCD display			**77N39**	X	X
Sensor - Wall-mount, off-white plastic cover, no display			**23V86**	X	X
Sensor - Black plastic case, LCD display, rated for plenum mounting			**87N52**	X	X
Sensor - Black plastic case, no display, rated for plenum mounting			**23V87**	X	X
CO_2 Sensor Duct Mounting Kit - for downflow applications			**23Y47**	X	X
Aspiration Box - for duct mounting non-plenum rated CO_2 sensors (**77N39**)			**90N43**	X	X
HUMIDITROL® CONDENSER REHEAT OPTION					
Humiditrol® Dehumidification Option			Factory	O	O

[1] Factory installed smoke detectors must be ordered for use with either 115V or 24V external power supply only.

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OPTIONS / ACCESSORIES

Item Description		Order Number	Size 036	Size 060
ECONOMIZER				
High Performance Economizer (Approved for California Title 24 Building Standards / AMCA Class 1A Certified)				
ULL Economizer - Includes Outdoor Air Hood		Factory	O	O
(Global Sensor, field provided, order Barometric Relief Dampers separately		**18X87**		
Economizer Controls				
Differential Enthalpy (Not for Title 24)	Order 2	**21Z09**	OX	OX
Global Control	Sensor Field Provided	Factory	O	O
Barometric Relief Dampers				
Barometric Relief Dampers (No Exhaust Hood)		Factory	O	O
Barometric Relief Dampers With Power Exhaust Fans (Exhaust Hood Furnished)		Factory		
Barometric Relief Dampers Without Power Exhaust Fans (No Exhaust Hood)		Factory		
Barometric Relief Dampers Without Power Exhaust Fans (Exhaust Hood Furnished)		Factory		
POWER EXHAUST				
Standard Static		Factory		
OUTDOOR AIR				
Motorized Outdoor Air Dampers with Outdoor Air Hood and Bird Screen		**18X89**		
Manual Outdoor Air Damper with Outdoor Air Hood and Bird Screen		**18X88**		
ROOF CURBS				
Hybrid Roof Curbs, Downflow,		**11F70**	X	X
14 in. height		**11F72**		
	Full Perimeter	**11F74**		
Hybrid Roof Curbs, Downflow		**11F71**	X	X
24 in. height		**11F73**		
	Full Perimeter	**11F75**		
Curb Alignment (Adapter plate mates new unit to existing roof curb for replacement of LGE240)		Factory		

NOTE - Order numbers shown are for ordering field installed accessories.
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O = Configure To Order (Factory Installed)
X = Field Installed

SPECIFICATIONS — DIRECT DRIVE | 3 - 5 TON

Model		SGH036H5E	SGH060H5E
Nominal Tonnage		3	5
Efficiency Type		High	High
Blower Type		MSAV® (Multi-Stage Air Volume) (Direct Drive ECM)	MSAV® (Multi-Stage Air Volume) (Direct Drive ECM)
Cooling Performance	Gross Cooling Capacity - Btuh	37,000	60,300
	[1] Net Cooling Capacity - Btuh	35,500	57,900
	AHRI Rated Air Flow - Cfm	1200/850	1750/1300
	Total Unit Power	2.6	4.7
	[1] SEER2 (Btuh/Watt) - 460V/575V-3ph	17.0	16.1
	[1] EER2 (Btuh/Watt) - 460V/575V-3ph	13.5	12.4
Refrigerant Charge	Refrigerant Type	R-454B	R-454B
	Without Reheat Option	5 lbs. 2 oz.	5 lbs. 6 oz.
	With Reheat Option	5 lbs. 8 oz.	5 lbs. 5 oz.
[2] Sound Rating Number	dBA	67	78
Gas Heating Options Available - See page 23		Standard (2 Stage) Medium (2 Stage)	Standard (2 Stage) Medium (2 Stage) High (2 Stage)
Compressor Type (Number)		Two-Stage Scroll (1)	Two-Stage Scroll (1)
Condenser Coil	Net face area - ft.^{2}	18.7	18.7
	Rows	1	1
	Fins - in.	23	23
Condenser Fan(s)	Motor (number) HP (type)	(2) 1/3 (ECM)	(2) 1/3 (ECM)
	Rpm	340-560	340-860
	Watts	90-136	90-354
	Diameter (Number) - in.	(2) 24	(2) 24
	Blades	3	3
	Total air volume - Cfm	3900	6300
Evaporator Coil	Net face area - ft.^{2}	7.02	7.02
	Rows	1	1
	Fins - in.	20	20
	Condensate drain size (NPT) - in.	(1) 1	(1) 1
	Expansion device type	Balance Port TXV, removable head	
[3] Indoor Blower	Nominal motor HP (type)	1.5 (ECM)	1.5 (ECM)
	Wheel nominal diameter x width - in.	(1) 14 x 5	(1) 14 x 5
Filters	Type of filter	MERV 8 or 13	
	Number and size - in.	(4) 16 x 20 x 2	(4) 16 x 20 x 2
Line voltage data (Volts-Phase-Hz)		460-3-60, 575-3-60	

NOTE - Net capacity includes evaporator blower motor heat deduction. Gross capacity does not include evaporator blower motor heat deduction.

[1] AHRI Certified to AHRI Standard 210/240; 95°F outdoor air temperature and 80°F db/67°F wb entering evaporator air; minimum external duct static pressure.

[2] Sound Rating Number rated in accordance with test conditions included in AHRI Standard 270-95.

[3] Using total air volume and system static pressure requirements determine from blower performance tables rpm and motor output required. Maximum usable output of motors furnished are shown. In Canada, nominal motor output is also maximum usable motor output. If motors of comparable output are used, be sure to keep within the service factor limitations outlined on the motor nameplate.

SPECIFICATIONS - GAS HEAT — 3 TON | 5 TON

Model		036 060	036 060	060
Heat Input Type		**Standard (2 Stage)**	**Medium (2 Stage)**	**High (2 Stage)**
Input Btuh	1st Stage	53,000	81,000	113,000
	2nd Stage	70,000	108,000	150,000
Output Btuh	2nd Stage	57,000	87,000	121,000
Temperature Rise Range - °F		15 - 45	25 - 55	40 - 70
[1] Thermal Efficiency		81%	81%	81%
Gas Supply Connections		3/4 in. NPT	3/4 in. NPT	3/4 in. NPT
Rec. Gas Supply Pressure - Nat./ LPG		7 in. w.g. / 11 in. w.g.		
Gas Supply Pressure Range	Min./Max. (Natural)	4.5 - 10.5 in. w.g.		
	Min./Max. (LPG)	10.8 - 13.5 in. w.g.		

[1] Thermal Efficiency at full input.

HIGH ALTITUDE DERATE

NOTE - Units may be installed at altitudes up to 2000 ft. above sea level without any modifications.
At altitudes above 2000 ft. units must be derated to match information in the table shown.
036-060 Models - At altitudes above 4500 ft. unit must be derated 2% for each 1000 ft. above sea level..
NOTE - This is the only permissible derate for these units.

Model	Heat Input Type	Altitude Feet	Gas Manifold Pressure - in. w.g. (min./max.)		Input Rate Natural Gas Btuh (min./max.)	Input Rate LPG/Propane Btuh (min./max.)
			Natural Gas	LPG/Propane		
036 060	Standard (2 Stage)	0 - 2000	2.0/3.5	5.9/10.5	53,000 / 70,000	53,000 / 70,000
		2001 - 4500	1.7/3.0	5.1/9.0	49,000 / 65,000	49,000 / 65,000
	Medium (2 Stage)	0 - 2000	2.0/3.5	5.9/10.5	81,000 / 108,000	81,000 / 108,000
		2001 - 4500	1.7/3.0	5.19.0	75,000 / 100,000	75,000 / 100,000
060 only	High (2 Stage)	0 - 2000	2.0/3.5	5.9/10.5	113,000 / 150,000	113,000 / 150,000
		2001 - 4500	1.7/3.0	5.1/9.0	104,000 / 139,000	104,000 / 139,000

MINIMUM R454B SPACE AND CFM REQUIREMENTS

Minimum Airflow[1]		
Unit	Q_{min}(CFM)	Q_{min}(m^3h)
SGH036	135	230
/SGH060	142	241
SGH036 W/ Humidtrol	145	247
SGH060 W/ Humidtrol	140	238

[1]The minimum airflow is the lowest cfm allowed during venting option (leak mitigation)

Minimum Room Area of Conditioned Space[2]		
Unit	TA_{min}(ft^2)	TA_{min}(m^2)
SGH036	75.07	6.97
SGH060	78.74	7.31
SGH036 W/ Humidtrol	80.57	7.49
SGH060 W/ Humidtrol	77.64	7.21

[2] The minimum room area of conditioned space is trhe smallest are the unit can service.

Refrigerant Charge R-454B		
Unit	M_c(lbs)	M_c(kg)
SGH036	5.13	2.32
SGH060	5.38	2.44
SGH036 W/ Humidtrol	5.50	2.49
SGH060 W/ Humidtrol	5.30	2.40

Altitude Adjustment Factor[3]									
Halt	0	200	400	600	800	1000	1200	1400	1600
AF	1	1	1	1	1.02	1.05	1.04	1.1	1.12
Halt	1600	1800	2000	2200	2400	2600	2800	3000	3200
AF	1.12	1.15	1.18	1.21	1.25	1.28	1.32	1.36	1.4

[3] Use the Altitude Ajustment Factor to adjust the values in the table above to different altitudes. Find the relevant altitude above sea level in two “Halt” rows and then multiply the value from the table above by the factor number. Example for a SGH036 at 1000 ft. above sea level, multiply 135 by 1.05 to get 141.75Q_{min}

SGH036H5E / SGH060H5E BLOWER PERFORMANCE

NOTE - Blower Table Includes Resistance For Base Unit With Gas Heat, Wet Indoor Coil And Air Filters In Place.

MINIMUM AIR VOLUME REQUIRED FOR USE WITH SGH036H MODELS WITH MEDIUM 2 STAGE HEAT OPTION - 1475 CFM

Air Volume cfm	EXTERNAL STATIC PRESSURE - In. w.g.																			
	0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
900	1163	129	1253	148	1341	165	1428	181	1512	191	1587	206	1653	232	1714	266	1775	301	1835	333
1000	1315	129	1396	152	1475	174	1552	195	1626	216	1692	242	1752	277	1810	316	1870	351	1928	382
1100	1463	131	1531	164	1599	197	1666	229	1730	261	1791	295	1850	331	1907	367	1964	400	2021	432
1200	1576	173	1640	210	1705	247	1769	283	1832	319	1893	353	1952	387	2010	420	2067	452	2124	485
1300	1683	225	1749	263	1814	300	1878	337	1941	372	2002	407	2061	441	2119	474	2176	507	2235	538
1400	1796	279	1862	317	1927	354	1991	391	2054	427	2114	463	2173	497	2231	530	2289	563	2345	595
1500	1912	332	1977	371	2042	409	2105	446	2168	482	2228	517	2287	552	2345	585	2401	618	2453	652
1600	2037	368	2100	410	2163	452	2224	492	2284	532	2343	570	2399	607	2454	643	2507	679	2553	716
1700	2161	403	2221	453	2280	502	2338	548	2393	594	2445	637	2496	678	2545	718	2592	757	2633	798
1800	2271	463	2329	519	2384	574	2437	625	2487	674	2533	721	2578	765	2621	808	2663	851	2701	892
1900	2372	545	2429	602	2482	657	2533	709	2579	758	2623	805	2665	850	2705	893	2745	936	2782	977
2000	2475	631	2530	687	2582	741	2631	792	2676	840	2718	886	2758	930	2797	973	2836	1015	2872	1056
2100	2582	719	2635	774	2684	827	2731	876	2774	923	2814	968	2853	1011	2892	1054	2928	1095	2964	1136
2200	2694	811	2742	863	2789	914	2833	962	2874	1007	2913	1051	2951	1094	2987	1136	3023	1176	3058	1216
2300	2807	904	2852	954	2896	1002	2937	1048	2976	1093	3013	1136	3050	1177	3085	1218	3119	1258	3153	1298
2400	2921	998	2963	1045	3003	1091	3042	1136	3079	1179	3114	1220	3149	1261	3183	1301	3216	1341	3249	1379
Air Volume cfm	**1.1**		**1.2**		**1.3**		**1.4**		**1.5**		**1.6**		**1.7**		**1.8**		**1.9**		**2.0**	
	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
900	1892	364	1946	393	1997	422	2047	449	2095	476	2141	501	2186	524	2229	546	2271	569	2313	592
1000	1983	413	2036	442	2086	471	2136	498	2184	525	2232	550	2278	575	2322	600	2364	625	2403	653
1100	2076	462	2128	492	2179	521	2229	549	2279	576	2328	603	2375	630	2418	659	2456	689	2489	721
1200	2180	516	2233	546	2285	575	2336	604	2386	632	2434	660	2477	690	2515	721	2547	755	2574	791
1300	2291	569	2343	600	2392	632	2437	663	2482	694	2524	726	2562	759	2595	793	2623	829	2648	866
1400	2397	628	2440	663	2477	701	2511	739	2549	775	2585	810	2619	845	2651	880	2680	916	2709	952
1500	2496	690	2529	732	2554	776	2580	820	2614	858	2648	895	2682	931	2715	965	2747	1000	2779	1034
1600	2589	758	2616	803	2638	851	2662	895	2696	932	2735	958	2775	977	2814	996	2852	1018	2887	1046
1700	2667	841	2694	886	2720	931	2747	974	2782	1008	2825	1022	2870	1026	2913	1035	2951	1056	2982	1096
1800	2736	933	2769	974	2801	1014	2833	1054	2869	1087	2911	1102	2952	1115	2988	1143	3015	1195	3031	1277
1900	2818	1017	2852	1055	2887	1094	2921	1132	2955	1167	2991	1197	3023	1238	3045	1303	3055	1400	3053	1529
2000	2907	1095	2942	1134	2976	1173	3010	1211	3043	1248	3072	1295	3092	1366	3100	1469	3094	1608	3076	1780
2100	2999	1175	3033	1214	3067	1252	3100	1290	3132	1330	3155	1394	3163	1494	3156	1635	3134	1817	3100	2032
2200	3092	1255	3125	1294	3158	1331	3191	1369	3222	1411	3238	1492	3235	1622	3213	1801	3175	2026	3124	2283
2300	3186	1336	3218	1373	3250	1411	3283	1448	3312	1493	3321	1590	3307	1750	3270	1967	3215	2234	3147	2535
2400	3280	1417	3311	1453	3342	1490	3374	1526	3402	1574	3405	1689	3379	1878	3327	2134	3256	2443	3171	2787

BLOWER DATA

FACTORY INSTALLED OPTIONS/FIELD INSTALLED ACCESSORY AIR RESISTANCE - in. w.g.			
Air Volume cfm	**Humiditrol Dehumidification Coil**	**Economizer**	**Filters MERV 13**
036, 060 Size			
800	0.00	0.04	0.05
1000	0.00	0.04	0.07
1200	0.01	0.04	0.07
1400	0.02	0.04	0.07
1600	0.03	0.04	0.07
1800	0.04	0.05	0.07
2000	0.04	0.05	0.08

ELECTRICAL DATA

DIRECT DRIVE | 3 - 5 TON

Model		**SGH036H5E**		**SGH060H5E**	
[1] Voltage - 60Hz		**460V-3ph**	**575V-3ph**	**460V-3ph**	**575V-3ph**
Compressor (Non-Inverter)	Rated Load Amps	4.6	3.5	6.5	4.8
	Locked Rotor Amps	39	28.9	60	41
Outdoor Fan Motor	Full Load Amps (2 ECM)	0.3	0.3	0.7	0.7
	Total	0.6	0.6	1.4	1.4
Service Outlet 115V GFI (Amps)		20	20	20	20
Indoor Blower Motor	HP	1.5	1.5	1.5	1.5
	Type	Direct (ECM)	Direct (ECM)	Direct (ECM)	Direct (ECM)
	Full Load Amps	2.3	2.3	2.3	2.3
[2] Maximum Overcurrent Protection (MOCP)	Unit Only	15	15	15	15
[3] Minimum Circuit Ampacity (MCA)	Unit Only	9	8	12	10

NOTE - All units have a minimum Short Circuit Current Rating (SCCR) of 35kA.

[1] NOTE − Extremes of operating range are plus and minus 10% of line voltage.

[2] HACR type breaker or fuse.

[3] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

SGH036/060 Parts Arrangement

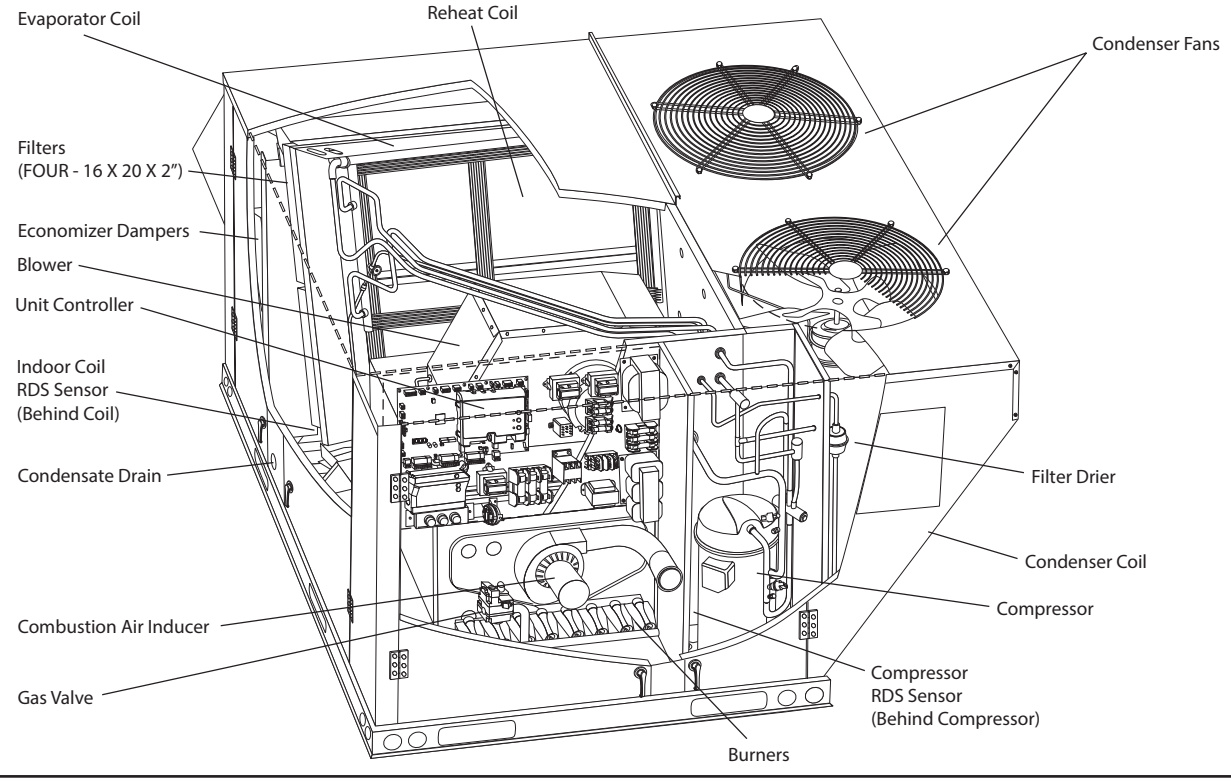


FIGURE 1

SGH036/060 Control Box

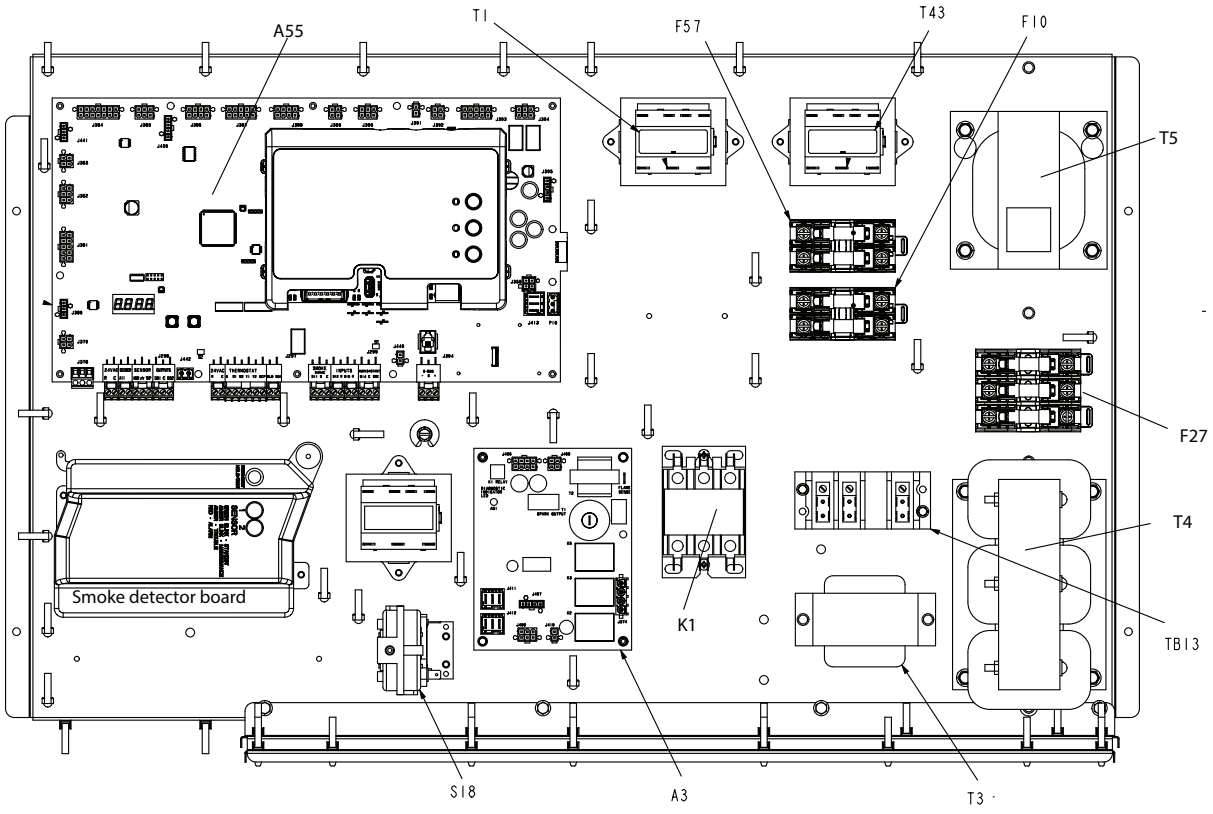


FIGURE 2

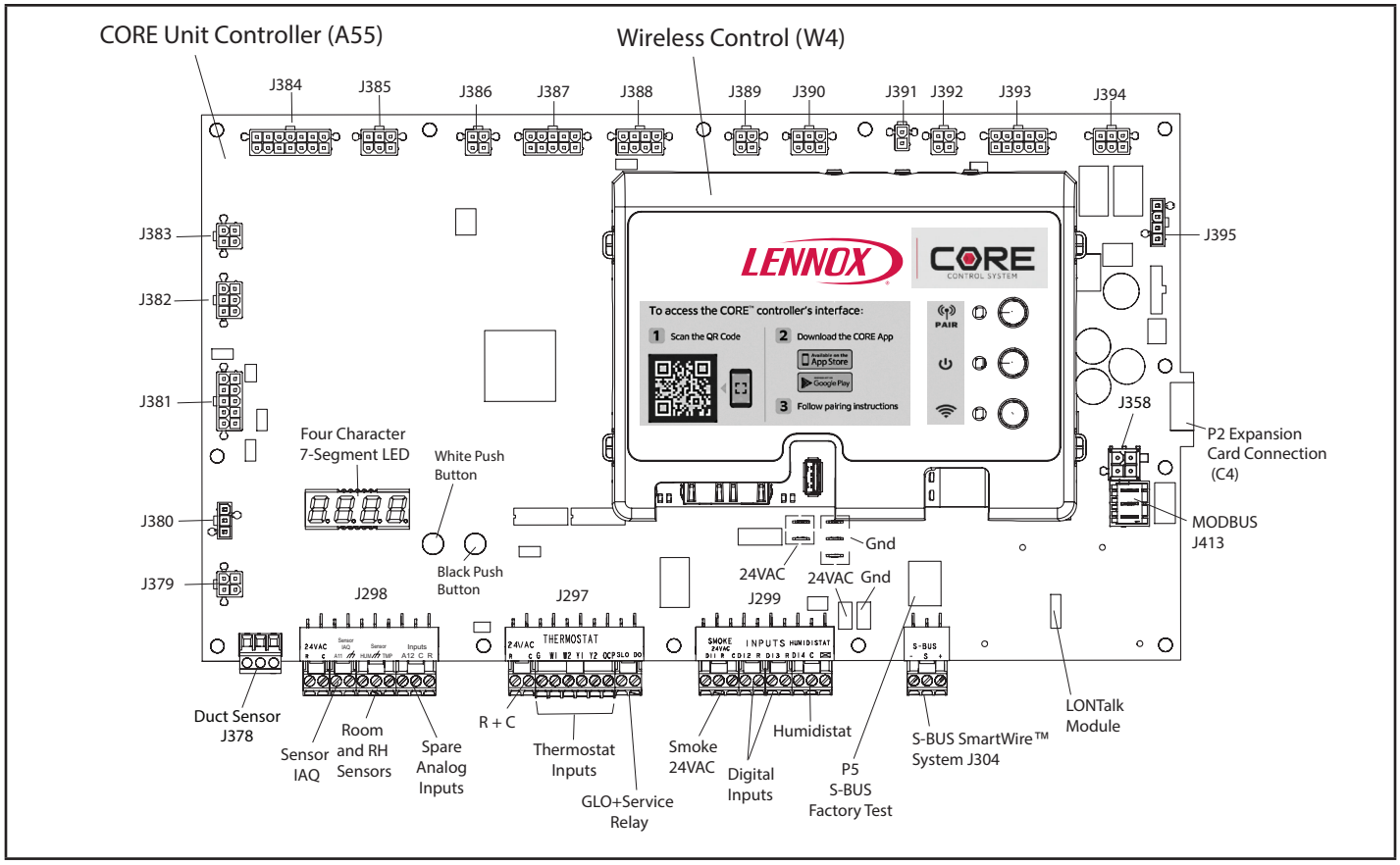


FIGURE 3

I-UNIT COMPONENTS

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ 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.

SGH units are configure to order units (CTO). The SGH unit components are shown in figure 1 and 2. L1, L2, and L3 wiring is color coded; L1 is red/pink, L2 is yellow, and L3 is blue.

A-Control Box Components

SGH control box components are shown in FIGURE 2. The control box is located in the upper portion of the compressor compartment.

1-Circuit Breaker CB10

All units are equipped with circuit breaker CB10. Circuit breaker CB10 is a toggle switch which can be used by the service technician to disconnect power to the unit.

2-Control Transformer T1 (all units)

All SGH series units use a single line voltage to 24VAC leadless transformer mounted in the control box. Transformer supplies power to control circuits in the unit. The transformer is rated at 70VA and is protected by a 3.5 amp circuit breaker (CB8). The 208/230 (Y) voltage transformers use two primary voltage taps, while 460 (G) and 575 (J) voltage transformers use a single primary voltage tap.

3-CAI Transformers T3 (J Voltage units)

All 575 (J) voltage units use one auto voltage to 230VAC transformer mounted in the compressor compartment. The transformer has an output rating of 0.75A. T3 transformer supplies 230 VAC power to combustion air inducer motor (B6).

4-Transformer T43 (all units)

All reheat units and units with phase detection components are equipped with T43 located in the control box. Transformer is rated at 70VA. T43 is connected to line voltage and is powered at all times.

5-Compressor Contactor K1 (all units)

K1 energizes compressor B3 in response to Unit Controller demand. Units use three pole double break contactors with a 24 volt coil.

NOTE-*Contactor K1 is energized by the A55 Unit Controller. Refer to the operation sequence for the control system installed. There may be a 5 minute delay depending on the system installed.*

6-Transformer T5 (G, J Voltage)

All 460 (G) and 575 (J) voltage units use transformer T5 mounted in the control box. T5 is a line voltage to 230V transformer to power the outdoor fan motors. It is connected to line voltage and is powered at all times.

7-Transformer T4 (J Voltage)

All 575 (J) voltage units use transformer T4 mounted in the control box. T4 is a line voltage to 460V transformer to power the indoor blower. It is connected to line voltage and is powered at all times.

8-Gas Relay K72 (two-stage units)

Relay K72 is normally closed and controls combustion air inducer B6. K72 switches the inducer B6 to high speed in response to two-stage heat demand.

9-Combustion Air Prove Switch S18

The combustion air prove switch S18 is a SPST N.O. pressure switch located in the vestibule area. S18 monitors combustion air inducer operation. Switch S18 is wired to the ignition control A3. The switch closes on a negative pressure fall. This negative pressure fall and switch actuation allows the ignition sequence to continue (proves, by closing, that the combustion air inducer is operating before allowing the gas valve to open.) The combustion air prove switch is factory set and not adjustable. The switch will automatically open on a pressure rise at 0.10 $\pm$ 0.05 (24.8 $\pm$ 12.4) (less negative pressure) and close at 0.25 $\pm$ 0.05 (62.3 $\pm$ 12.4) The combustion air prove switch is factory set and not adjustable.

10-Unit Controller A55 (all units)

The Unit Controller provides all unit control functions, unit status information, unit diagnostics, programmable parameters, and USB verification and profile sharing. Refer to the Unit Controller guide provided with the unit. Thermostat wires are connected to J297 on the Unit Controller

11- Fuse F57

Fuse F57 is housed in a fuse block which holds two fuses. F57 provides short circuit protection to the T5 transformer

12- Fuse F27

Fuse F27 is housed in a fuse block which holds three fuses. F27 provides short circuit protection to the T4 transformer.

13- Fuse F10

Fuse F10 is housed in a fuse block which holds two fuses. F10 provides Short Circuit Current Rating protection up to 35kA to components connected to F10.

14- Terminal Strip TB13

TB13 terminal block distributes line voltage power to the line voltage items in the unit.

15-Burner Ignition Control A3

The ignition control provides three main functions: gas valve control, ignition and flame sensing. The unit will usually ignite on the first attempt; however, the ignition attempt sequence provides three trials for ignition before locking out. The lockout time is 5 minutes. After lockout the ignition control automatically resets and provides three more attempts at ignition. Manual reset after lockout requires breaking and remaking power to the ignition control. See FIGURE 4 for a normal ignition sequence and FIGURE 5 for the ignition attempt sequence with retrials (nominal timings given for simplicity). Specific timings for the ignition controls are shown in FIGURE 6.

Flame rectification sensing is used on all SGH units. Loss of flame during a heating cycle is indicated by an absence or low flame signal (0.09 or less microamps). If this happens, the control will immediately restart the ignition sequence and then lock out if ignition is not gained after the third trial.

The control shuts off gas flow immediately in the event of a power failure. Upon restoration of gas and power, the control will restart the ignition sequence and continue until flame is established or system locks out.

On a heating demand, the ignition control is energized by the Unit Controller A55. The ignition control then allows 30 seconds for the combustion air blower to vent exhaust gases from the burners. When the combustion air blower is purging the exhaust gases, the combustion air prove switch is closing proving that the combustion air blower is operating before allowing the ignition control to energize.

When the combustion air prove switch is closed and the delay is over, the ignition control activates gas valve, the spark electrode and the flame sensing electrode. Sparking stops immediately after flame is sensed. The combustion air blower continues to operate throughout the heating demand. If the flame fails or if the burners do not ignite, the ignition control will attempt to ignite the burners up to two more times. If ignition cannot be obtained after the third attempt, the control will lock out. The ignition control is not adjustable. The main control box houses the burner control A3. See FIGURE 2.

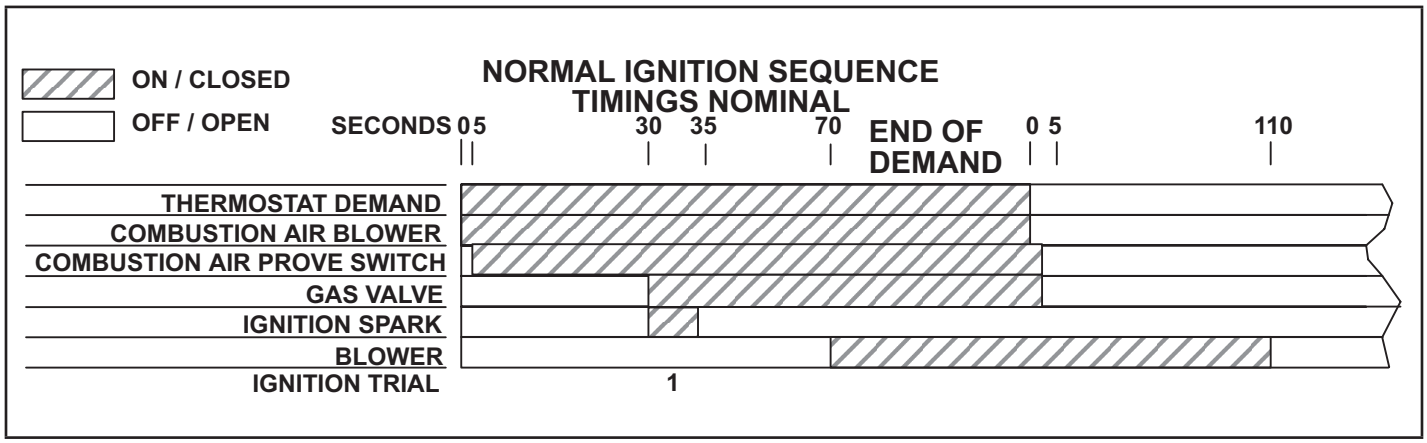


FIGURE 4

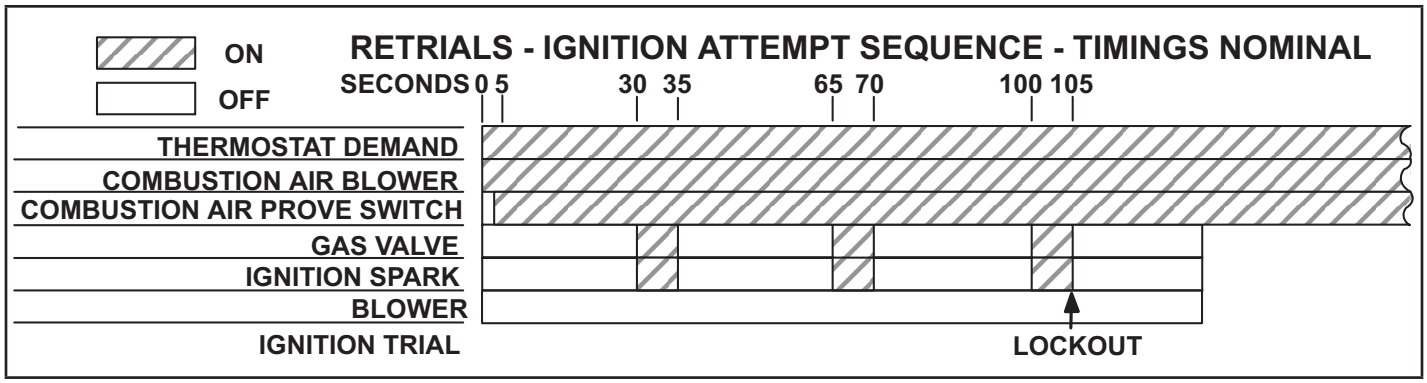


FIGURE 5

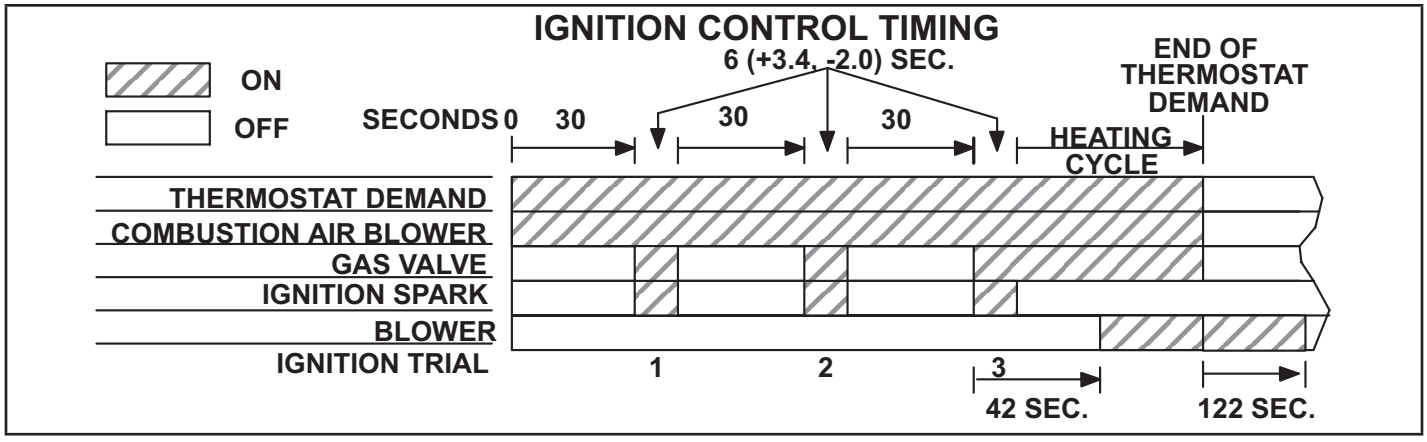


FIGURE 6

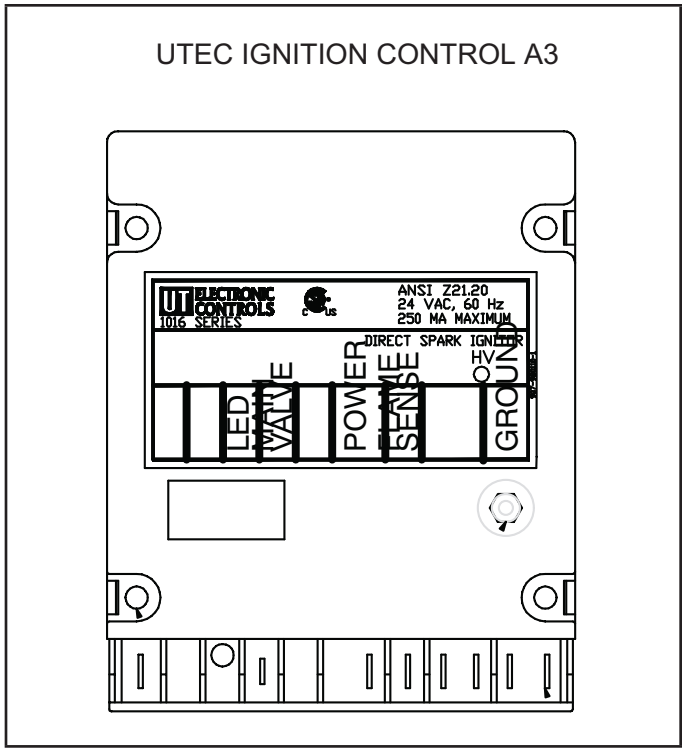


FIGURE 7

The ignition control provides three main functions: gas valve control, ignition, and flame sensing. The control has a green LED to show control status (TABLE 1).

TABLE 1

LED Flashes	Indicates
Steady Off	No power or control hardware fault.
Steady On	Power applied. Control OK.
3 Flashes	Ignition lockout from too many trials.
4 Flashes	Ignition lockout from too many flame losses within single call for heat.
5 Flashes	Control hardware fault detected.

Flame rectification sensing is used on all SGH units. Loss of flame during a heating cycle is indicated by an absence of flame signal (0 microamps). If this happens, the control will immediately restart the ignition sequence and then lock out if ignition is not gained after the third trial. See System Service Checks section for flame current measurement.

The control shuts off gas flow immediately in the event of a power failure. Upon restoration of gas and power, the control will restart the ignition sequence and continue until flame is established or system locks out.

Operation

On a heating demand, the ignition control checks for a closed limit switch. Once this check is complete and conditions are correct, the ignition control then allows 30 seconds for the combustion air inducer to vent exhaust gases from the burners. When the combustion air inducer is purging the exhaust gases, the combustion air prove switch closes proving that the combustion air inducer is operating before allowing the ignition control to energize. When the combustion air prove switch is closed and the delay is over, the ignition control activates the gas valve, the spark electrode and the flame sensing electrode. At the start of the ignition sequence, the adjustable 40 second (default) indoor blower delay period begins. Sparking stops immediately after flame is sensed or at the end of the 8 second trial for ignition. If flame is not sensed, the ignition control will wait 5 minutes before attempting ignition again. The unit will usually ignite on the first trial and A3 allows three trials for ignition before locking out. The lockout time is 1 hour. After lockout, the ignition control automatically resets and provides three more attempts at ignition.

Manual reset after lockout requires holding the A55 Unit Controller left arrow key until the Unit Controller resets. See the Unit Controller manual provided with the unit. Once the flame is sensed, the ignition control then proceeds to “steady state” mode where all inputs are monitored to ensure the limit switch, rollout switch and prove switch are closed as well as flame is present. When the heat call is satisfied the gas valve and combustion air inducer are de-energized. An adjustable 120-second (default) blower off delay begins.

B-Cooling Components

See FIGURE 8 for compressor and cooling components. Units are equipped with a draw-through type condenser fan. All units are equipped with direct drive blowers which draw air across the evaporator during unit operation.

Cooling may be supplemented by a factory- or fieldinstalled economizer. The evaporator is slab type and uses a thermostatic expansion valve as the primary expansion device. In all units each compressor is protected by a crankcase heater, high pressure switch and low pressure switch. Additional protection is provided by the low ambient switch and diagnostic sensor.

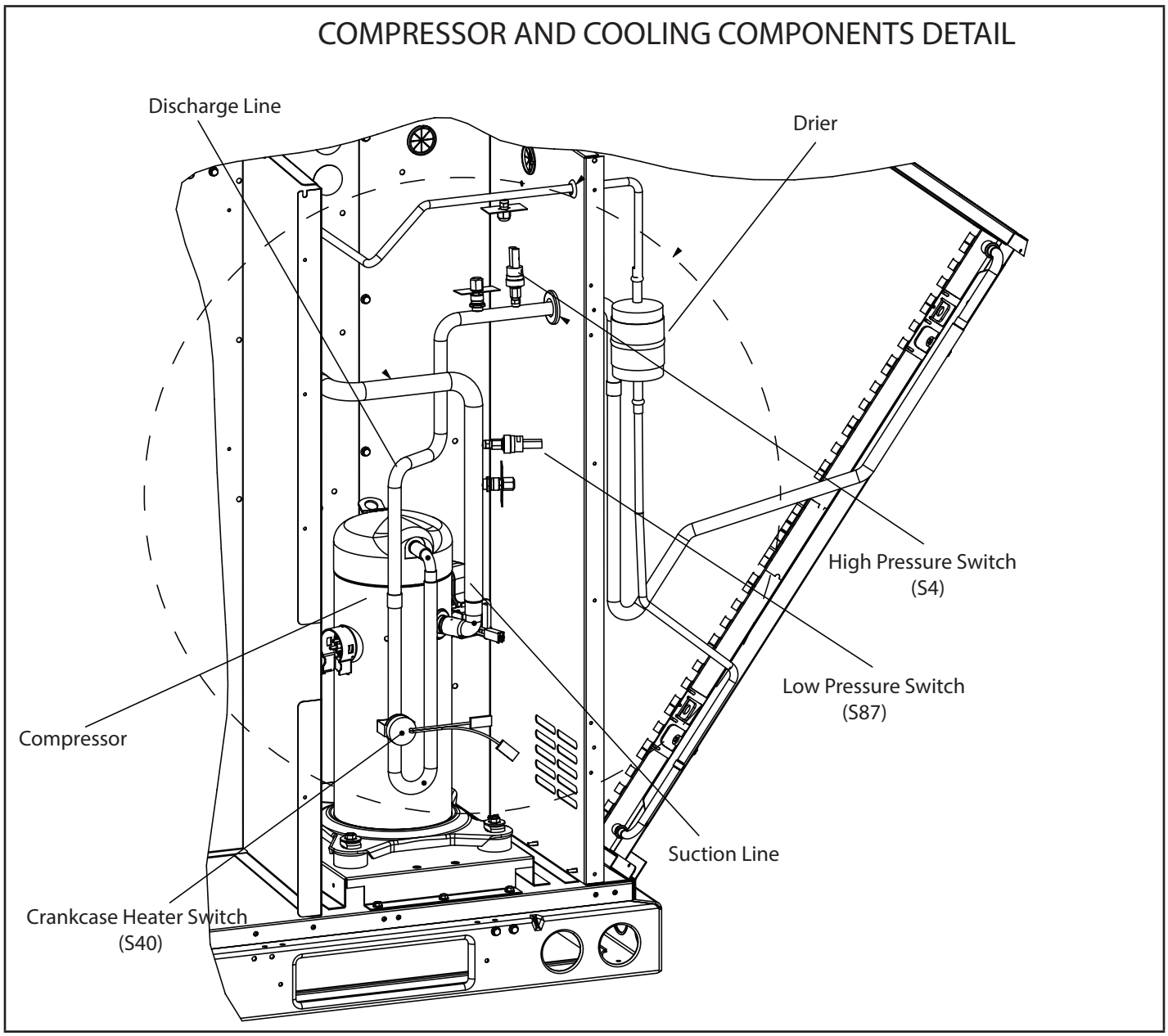


FIGURE 8

1-Compressors B1 (all units)

SCH units are equipped with with one two-stage scroll compressor. Compressors are supplied by various manufacturers. Compressor electrical specifications vary by manufacturer and type. See SPECIFICATIONS and ELECTRICAL DATA in this manual.

⚠ WARNING

Electrical shock hazard. Compressor must be grounded. Do not operate without protective coverover terminals. Disconnect power before removing protective cover. Discharge capacitors before servicing unit. Failure to follow these precautions could cause electrical shock resulting in injury or death.

Compressor B1 is energized by a corresponding compressor contactor.

NOTE-*Refer to the wiring diagram section for specific unit operation.*

2-High Pressure Switch S4

The high pressure switch is an auto-reset SPST N.C. switch which opens on a pressure rise. All SCH units are equipped with this switch. The switch is located in the compressor discharge line. S4 is wired in series with the compressor contactor coil.

When discharge pressure rises to 640 ± 10 psig (4413± 69 kPa) (indicating a problem in the system) the switch opens and the compressor is de-energized (the economizer can continue to operate). When discharge pressure drops to 475 ± 20 psig (3275 ± 138 kPa) the pressure switch will close.

Main control A55 has a three-strike counter before locking out. This means the control will allow three high pressure trips per one thermostat demand. The control can be reset by breaking and remaking the thermostat demand or manually resetting the control.

3-Low Pressure Switch S87

The low pressure switch is an auto-reset SPST N.O. switch (held N.C. by refrigerant pressure) which opens on a pressure drop. All units are equipped with this switch. The switch is located in the compressor suction line.S87 is wired directly to the main control module A55. The main control module A55 governs the low pressure switches by shunting the switches during start up until pressure is stabilized.

After the shunt period, the control has a three-strike counter during first thermostat demand before the compressor is locked out. The control is reset by breaking and remaking the thermostat demand or manually resetting the control.

When suction pressure drops to 40 ± 5 psig (276 ± 34 kPa) (indicating low pressure), the switch opens and the compressor is de-energized. The switch automatically resets when pressure in the suction line rises to 90 ± 5 psig (620 ± 34 kPa).

4-Filter Drier

SGH units have a filter drier located in the liquid line of the refrigerant circuit upstream of the TXV in the blower compartment. The drier removes contaminants and moisture from the system.

5-Condenser Fans B4 & B5

Units are equipped with electronically commutated condenser fan motors (ECM). The ECM motors are wired directly to 230VAC power. The motors do not operate until a pulse width modulated (PWM) control signal is sent from the A55 Unit Controller. The PWM signal determines the condenser fan speed. Fans B4 and B5 run on low speed with a Y1 demand and on high speed with a Y2 demand. Both low and high voltage plugs are located in the control compartment in the indoor section of the unit. Condenser fan motors B4 & B5 high voltage plugs are J86 & J87 respectively. Low voltage plugs are J336 & J337 respectively. Refer to wiring diagrams to identify plugs.

If an ECM fan is not operating

1 - Using a VAC meter, check the high voltage at the appropriate motor plug (J86 or J87). High voltage must be present before checking for low voltage.

2 - Using the duty cycle (%) or a VDC meter setting, check for low voltage (J336 or J337) from the unit controller.

NOTE - *The VDC reading may fluctuate. This is normal for a PWM signal.*

6-Crankcase Heater HR1 & Thermostat S40

The compressor is protected by a crankcase heater HR1 and thermostat S40. The purpose of the crankcase heater is to prevent liquid from accumulating in the compressor. The crankcase heater and compressor never run at the same time. Thermostat S40 is located on the compressor discharge line and will open when discharge line temperature reaches 94°, de-energizing HR1. Once temperature drops down to 74° the thermostat closes energizing HR1.

7-Temperature Thermistor

RT46 and RT48

Units are equipped with two factory-installed thermistors (RT46 and RT48) located on different points on the refrigerant circuit.

The thermistors provide the Unit Controller with constant temperature readings of two specific locations on the refrigeration circuit. These temperatures are used as feedback in certain modes of unit operation. In addition, the Unit Controller uses these temperatures to initiate alarms such as loss of condenser or evaporator airflow and loss of charge.

The SGH036 and 060 units use the RT46 sensor on the indoor evaporator coil, and the RT48 sensor on the outdoor condenser coil. Each thermistor must be specifically placed for proper unit operation and to initiate valid alarms. See TABLE 2 for proper locations.

TABLE 2

THERMISTOR LOCATION		
Unit	**Sensor**	**Figure**
036, 060 Indoor Coil	RT46	FIGURE 9
036, 060 Outdoor Coil	RT48	FIGURE 10

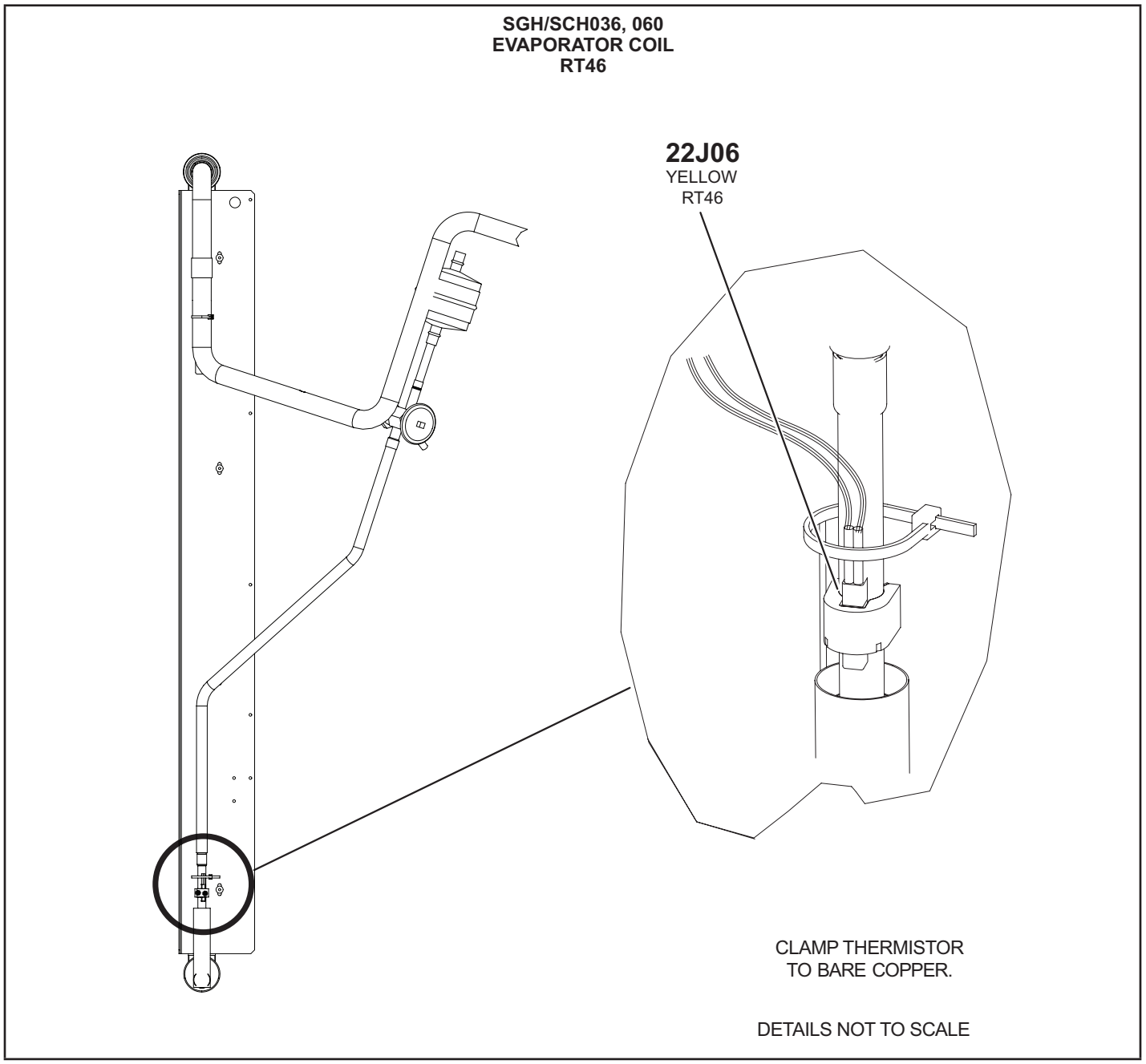


FIGURE 9

SGH/SCH036, 060
CONDENSER COIL
RT48

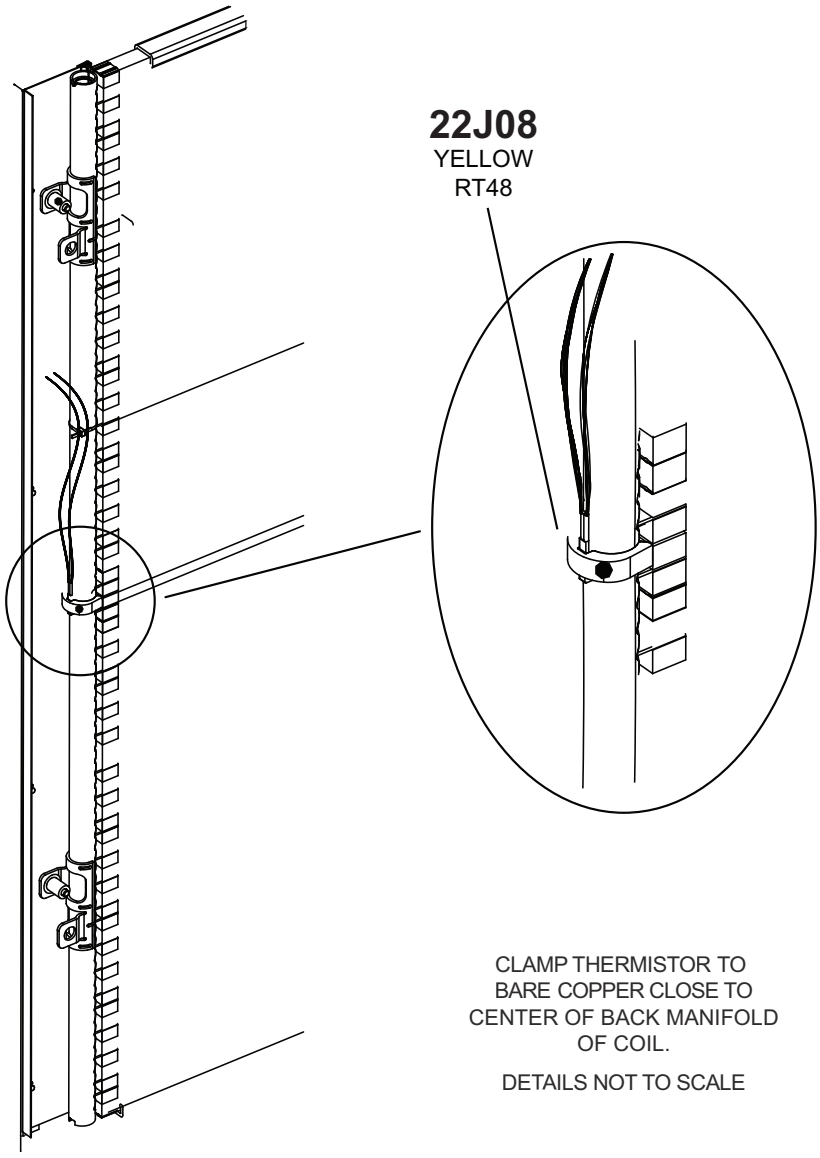


FIGURE 10

8-RDS Sensors RT58, RT59

Units are equipped with factory-installed RDS Sensors located on different points on the unit. The RDS sensors provide the Unit Controller with continuous readings for leaked refrigerant concentration levels and sensor health status (Good or Fault). These readings are used to modify unit operation to disperse the leaked refrigerant and to remove possible ignition sources. In addition, the Unit Controller uses these readings to initiate alarms to alert the operator of a refrigerant leak or faulty sensor(s). Refrigerant Sensors and Detection Systems shall only be replaced with approved parts from the manufacturer.

Each sensor must be specifically placed for proper unit operation and to initiate valid alarms. To identify sensor locations see TABLE 3.

TABLE 3

RDS Sensor Figures

Model	Qty.	Type	Figure
SGH036/060	2 sensors	RT58 INDOOR SENSOR	FIGURE 11
		RT59 COMPRESSOR SENSOR	FIGURE 12

036-060 INDOOR COIL RDS SENSOR LOCATION

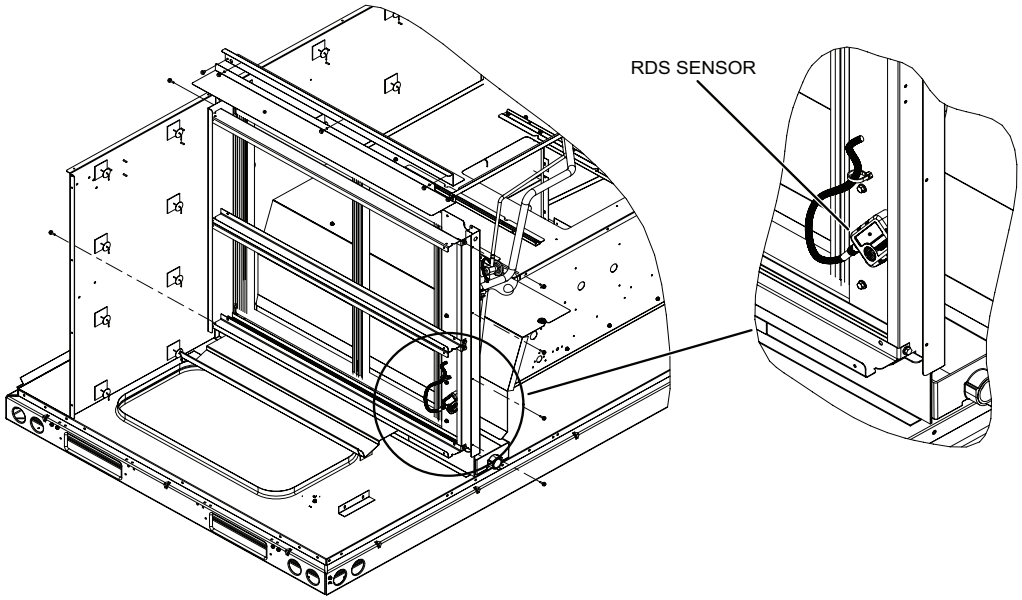


FIGURE 11

SGH 036-060 COMPRESSOR RDS SENSOR LOCATION

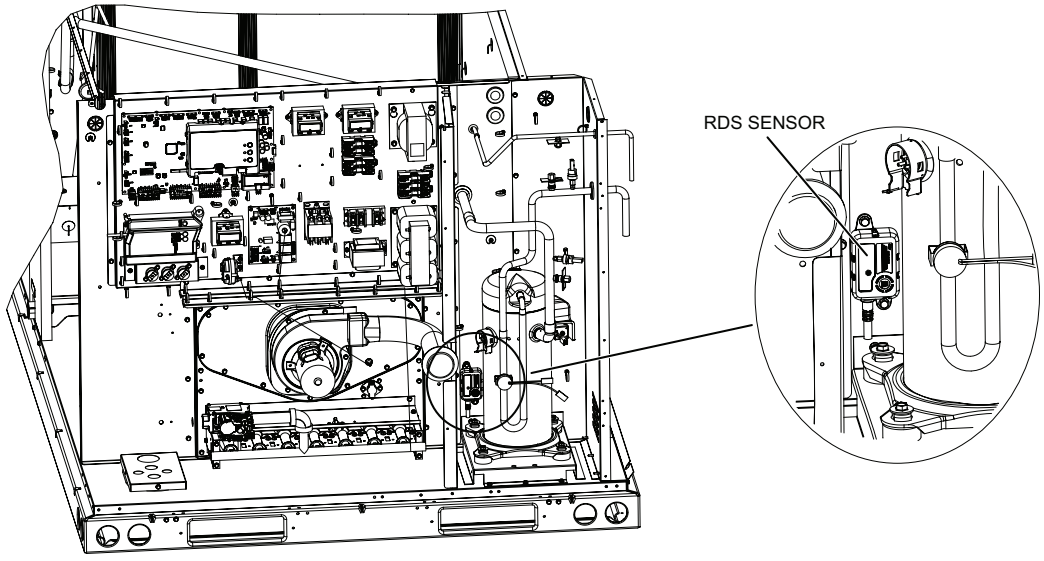


FIGURE 12

C-Blower Compartment

The blower housing can be removed for cleaning and inspection. In addition, removing blower allows access to the heat exchanger tubes for inspection.

Line and low voltage make-up in all models is located in the upper corner of the blower compartment. Electrical entrance is made through the base pan of the unit or through the corner mullion for horizontal position units. Low voltage connections can be accessed by removing the blower compartment front panel. High voltage can be accessed through the makeup box cover on corner mullion.

In all models, the evaporator coil, expansion valve and drain pan can be accessed by removing the blower compartment end panel.

1-Blower Wheel (all units)

Units are equipped with a direct drive blower assembly with a backward inclined blower wheel.

2-Indoor Blower Motor B3 (all units)

Units are equipped with a direct drive blower assembly with a three-phase, variable speed, direct drive blower motor.

⚠ IMPORTANT

Three phase scroll compressors must be phased sequentially for correct compressor and blower rotation.

Follow "COOLING START-UP" section of installation instructions to ensure proper compressor and blower operation.

A-Blower Operation

Direct Drive Units - To check for proper voltage phasing, measure compressor suction and discharge pressures. Make sure suction pressure decreases and discharge pressure increases on start-up. Checking blower rotation is not a valid method of determining voltage phasing for incoming power.

Units Equipped With Factory-Installed Voltage or Phase Detection -

The Unit Controller checks the incoming power during start-up (A55 P394-1 and P394-02). If the voltage, phase, or frequency is incorrect, the Unit Controller will display an alarm and the unit will not start. After line voltage is corrected, the Unit Controller will energize the unit after five (default) minutes.

While line voltage is continually checked by the Unit Controller, the voltage phasing is not. If one or more phases is interrupted, power to one or more transformers is interrupted and the unit is shut down by either the Unit Controller or the corresponding transformer.

Initiate blower demand at thermostat according to instructions provided with thermostat. Unit will cycle on thermostat demand.

1 - Blower operation is manually set at the thermostat subbase fan switch. With fan switch in ON position, blowers will operate continuously.

2 - With fan switch in AUTO position, the blowers will cycle with demand. Blowers and entire unit will be off when system switch is in OFF position.

B-Blower Access

1 - Loosen the reusable wire tie which secures the controls and high voltage blower wiring to the blower housing.

2 - Remove and retain screws in front and on either side of blower housing. Pull frame toward outside of unit. See FIGURE 13.

3 - Slide frame back into original position when finished servicing. Reattach the blower wiring in the previous location on the blower housing using the wire tie.

4 - Replace retained screws in front and on either side of the blower housing.

C-Determining Unit CFM

1 - Measure the indoor blower motor RPM. Air filters must be in place when measurements are taken.

2 - With all access panels in place, measure static pressure external to unit (from supply to return). Blower performance data is based on static pressure taken in locations shown in FIGURE 14.

NOTE - *Static pressure readings can vary if not taken where shown.*

3 - Referring to BLOWER DATA tables (table of contents), use static pressure and RPM readings to determine unit CFM.

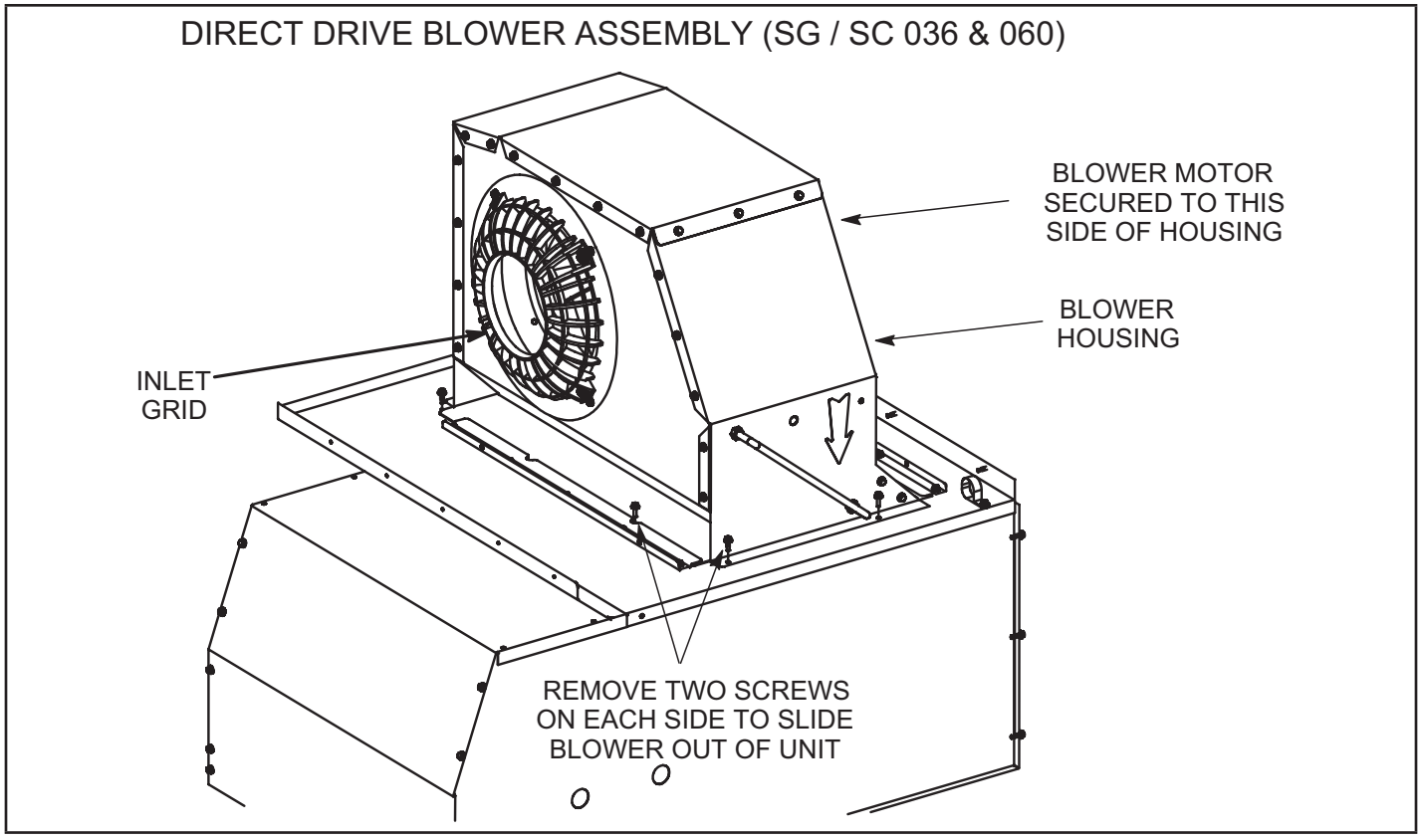


FIGURE 13

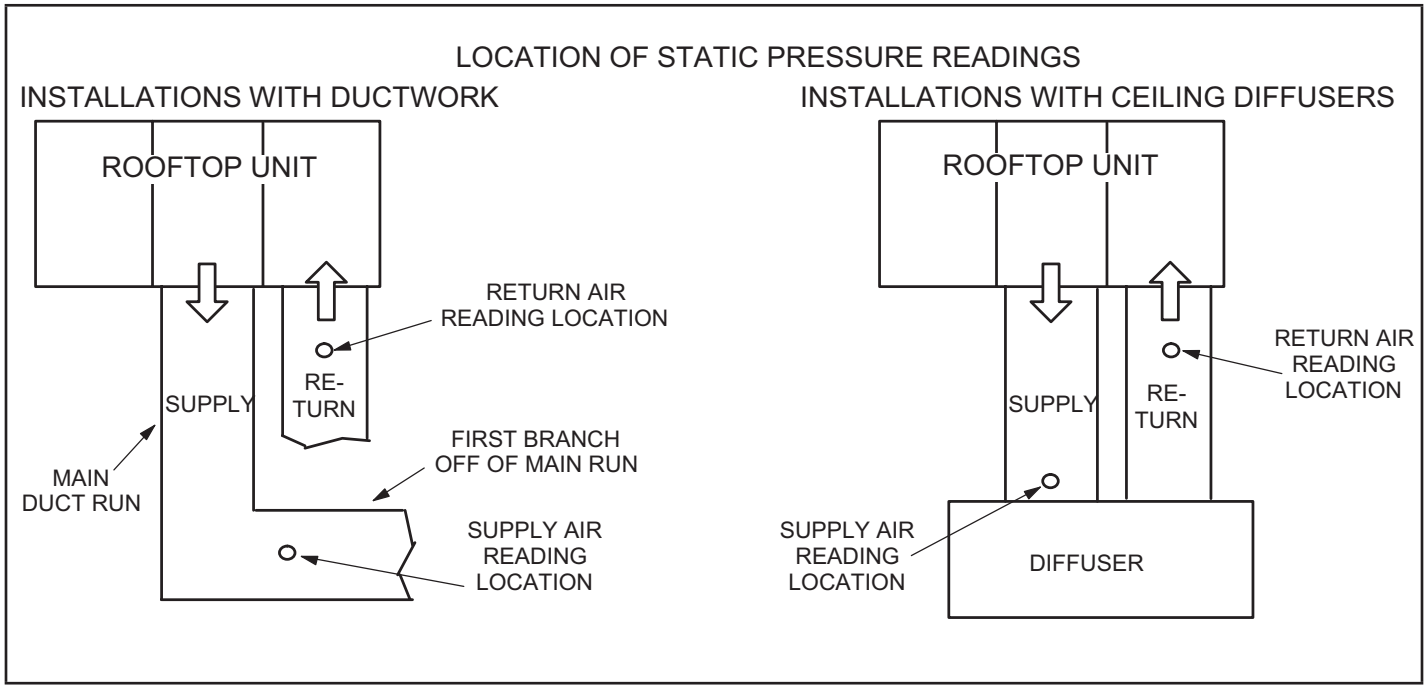


FIGURE 14

D-GAS HEAT COMPONENTS

SGH036/060 units are available in Standard 2 Stage - 70 kBtuh and Medium 2 Stage - 108 kBtuh heat sizes. SGH060 has an additional High 2 Stage - 150 kBtuh heat size. All heat sizes come standard with Low NOx inserts

1-Heat Exchanger (FIGURE 15)

SGH units use aluminized steel inshot burners with matching tubular aluminized or optional stainless steel heat exchangers and a two-stage redundant gas valve. SGH036 units use either a 3 (70 kBtuh) or 5 (108 kBtuh) tube/burner assembly. SGH060 units use either a 3 (70 kBtuh), 5 (108 kBtuh), or 7 (150 kBtuh) tube/burner assembly. Each burner uses a burner venturi to mix gas and air for proper combustion. Combustion takes place at each tube entrance. As hot combustion gases are drawn upward through each tube by the combustion air blower, exhaust gases are drawn out the top and fresh air/gas mixture is drawn in at the bottom. Heat is transferred to the air stream from all surfaces of the heat exchanger tubes. The supply air blower, controlled by the main control panel A55, force air across all surfaces of the tubes to extract the heat of combustion.

The shape of the tubes ensures maximum heat exchange. The gas valve accomplishes staging by allowing more or less gas to the burners as called for by heating demand.

2-Primary High Temperature Limit S10

S10 is the primary high temperature limits for gas heat. Primary limit S10 is wired in series to the main control panel A55 which energizes burner control (A3). Its N.C. contacts open to de-energize the ignition control when excessive temperature is reached in the blower compartment.

3-Flame Rollout Limit S47

Flame rollout limit S47 is a SPST N.C. high temperature limit located just above the burner air intake opening in the burner enclosure. See figure 14. S47 is wired to the main control panel A55. When S47 senses flame rollout (indicating a blockage in the combustion air passages), the flame rollout limit trips, and the ignition control immediately closes the gas valve.

Limit S47 is factory preset to open at 350F $\pm$ 14F (177C $\pm$ 7.7C) on a temperature rise. All flame rollout limits are manual reset.

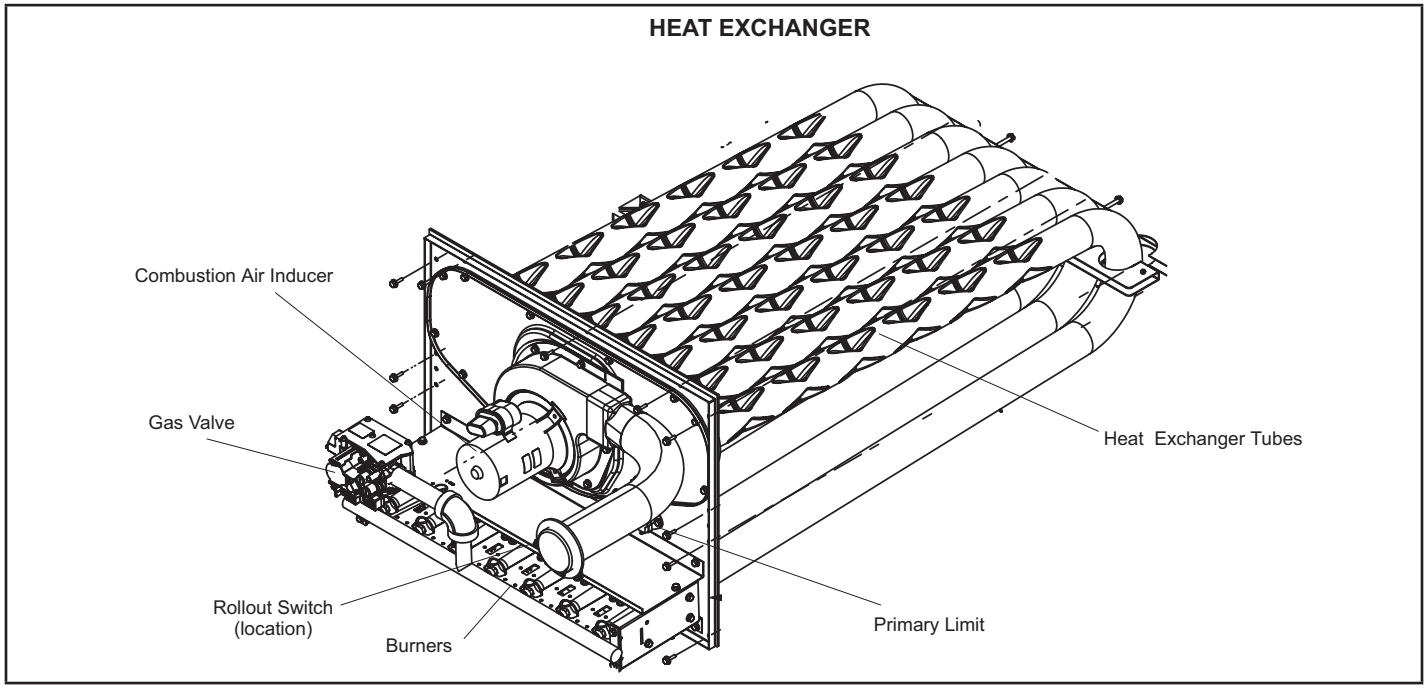


FIGURE 15

4-Burner Assembly (FIGURE 16)

The burners are controlled by the spark electrode, flame sensing electrode, gas valve and combustion air blower. The spark electrode, flame sensing electrode and gas valve are directly controlled by ignition control. Ignition control and combustion air blower is controlled by main control panel A55.

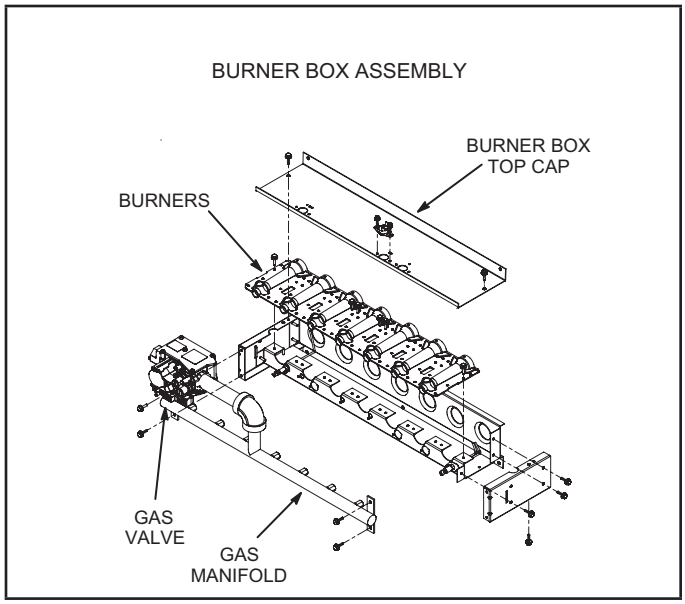


FIGURE 16

Burners

All units use inshot burners. Burners are factory set and do not require adjustment. A peep hole with cover is furnished in the heating access panel for flame viewing. Always operate the unit with the access panel in place. Burners can be removed individually for service. Burner maintenance and service is detailed in the SERVICE CHECKS sections of this manual.

Orifice

Each burner uses an orifice which is precisely matched to the burner input. The orifice is threaded into the manifold and supports the burner. Remove the two screws securing the burner and slide off of the orifice for service.

NOTE- *Do not use thread sealing compound on the orifices. Using thread sealing compound may plug the orifices.*

Each orifice and burner are sized specifically to the unit. Refer to Lennox Repair Parts Listing for correct sizing information.

5-Combustion Air Inducer B6

Combustion air inducer B6 provides fresh air to the burners while clearing the combustion chamber of exhaust gases. The inducer begins operating immediately upon receiving a thermostat demand and is de-energized immediately when thermostat demand is satisfied.

On a heating demand (W1), the A55 Unit Controller through the ignition control A3 initiates the heating cycle. A3 then allows 30 seconds for the combustion air inducer to vent exhaust gases from the burners. When the combustion air inducer is purging the exhaust gases, the combustion air prove switch closes, proving that the combustion air inducer is operating before allowing the ignition sequence to continue.

When the combustion air prove switch is closed (See Control Panel Components for S18 Prove Switch) and the delay is over, the A55 Unit Controller through the ignition control activates the appropriate stage operator of the gas valve, the spark and the flame sensing electrode. Sparking stops immediately after flame is sensed or at the end of the eight second trial for ignition. On two stage natural gas units the inducer will operate on low speed for first stage heat (W1) and ramp up to high speed for second stage heat (W2).

The inducer uses a 208/230V or 460V single-phase PSC motor and a 5.24in. x 0.96in. (120mm x 33.3mm) blower wheel. The motor operates at 3300RPM and is equipped with auto-reset overload protection. Two-speed units have reduced RPM for low speed.

Blowers are supplied by various manufacturers. Ratings may vary by manufacturer. Specific blower electrical ratings can be found on the unit rating plate.

The combustion air inducer motors in all SGH units require run capacitors. Capacitor C3 is connected to combustion air inducer B6. Ratings will be on side of capacitor or combustion air motor nameplate.

All inducer motors are sealed and cannot be oiled. The blower cannot be adjusted but can be disassembled for cleaning.

6-Gas Valve GV1

Gas valve GV1 is a two stage redundant gas valve used in all SGH units.. First stage (low fire) is quick opening (on and off in less than 3 seconds). Second stage is quick opening. On a call for first stage heat (low fire), the valve is energized by the ignition control simultaneously with the spark electrode. On a call for second stage heat (high fire), the second stage operator is energized directly from A55. The valve is adjustable for both high fire and low fire. A manual shut-off lever is provided on the valve for shut-off. Manual shut-off lever immediately closes both stages without delay. FIGURE 17 shows gas valve components..

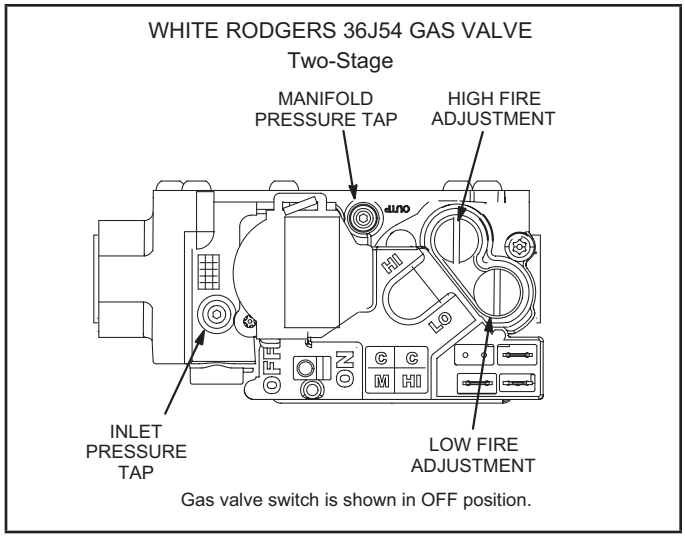


FIGURE 17

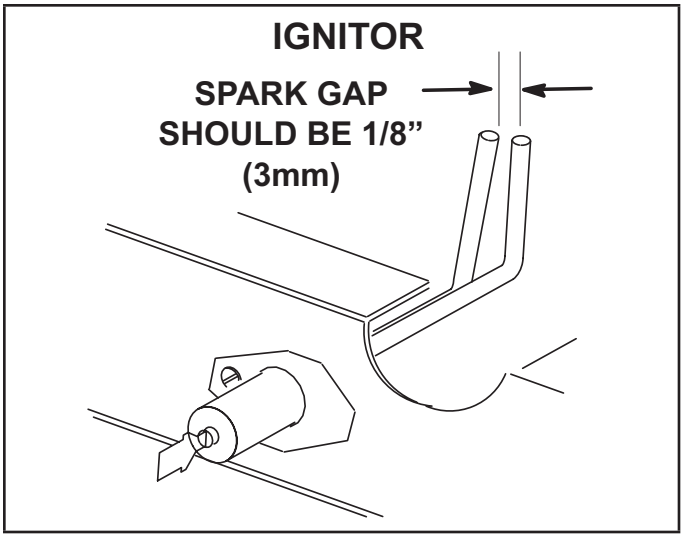


FIGURE 18

7-Spark Electrodes

An electrode assembly is used for ignition spark. The electrode is mounted through holes on the right end of the burner support. The electrode tip protrudes into the flame envelope of the adjacent burner. The electrode assembly is fastened to burner supports and can be removed for service without removing any part of the burners.

During ignition the spark electrode ignites the right burner. See FIGURE 18. Flame travels from burner to burner until all are lit.

The spark electrode is connected to the ignition control by a 8 mm silicone-insulated stranded high voltage wire. The wire uses 1/4" (6.35 mm) female quick connect on the electrode end and female spark plug-type terminal on the ignition control end.

NOTE- *In order to maximize spark energy to electrode, high voltage wire should touch unit cabinet as little as possible.*

8-Flame Sensors

A flame sensor is located on the left side of the burner box. See FIGURE 19. The sensor is mounted through a hole in the burner support and the tip protrudes into the flame envelope of the right most burner. The sensor assembly is fastened to burner supports and can be removed for service without removing any part of the burners.

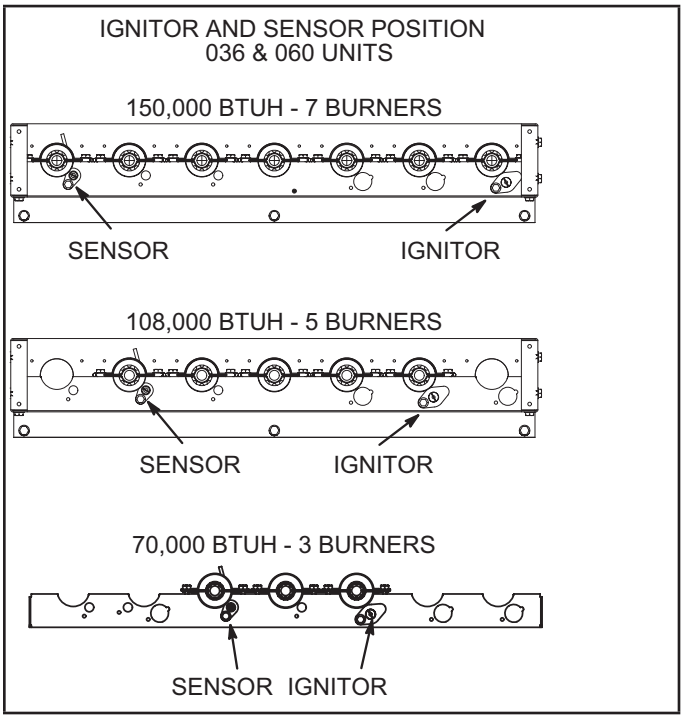


FIGURE 19

When flame is sensed by the flame sensor (indicated by microamp signal through the flame) sparking stops immediately. During operation, flame is sensed by current passed along the ground electrode (located on the spark electrode), through the flame and into the sensing electrode. The ignition control allows the gas valve to stay open as long as a flame signal (current passed through the flame) is sensed.

II-PLACEMENT AND INSTALLATION

Make sure the unit is installed in accordance with the installation instructions and all applicable codes. See accessories section for conditions requiring use of the optional roof mounting frame (S1CURB1101).

III-CHARGING and START UP

A-Preliminary and Seasonal Checks

1 - Make sure that unit is installed in accordance with the installation instructions and applicable codes.

2 - Inspect all electrical wiring, both field and factory installed, for loose connections. Tighten as required.

3 - Check to ensure that refrigerant lines do not rub against the cabinet or against other refrigerant lines.

4 - Check voltage at disconnect switch. Voltage must be within range listed on nameplate. If not, consult power company and have voltage condition corrected before starting unit.

5 - Refer to unit diagram located on inside of compressor access door for unit wiring.

6 - Adjust blower belt according to “Blower Operation and Adjustments” section.

7 - Make sure filters are in place before start-up.

B-Refrigerant Charge and Check - All-Aluminum Coil

***WARNING**-Do not exceed nameplate charge under any condition.*

This unit is factory charged and should require no further adjustment. If the system requires additional refrigerant, reclaim the charge, evacuate the system, and add required nameplate charge.

Refrigerant Charge R-454B		
Unit	M_c(lbs)	M_c(kg)
SGH036	5.13	2.32
SGH060	5.38	2.44
SGH036 W/ Humidtrol	5.50	2.49
SGH060 W/ Humidtrol	5.30	2.40

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed and, since flammability is a consideration, the following procedure shall be adhered to:

- Safely remove refrigerant following local and national regulations,
- Evacuate the circuit,
- Purge the circuit with inert gas,
- Evacuate,
- Purge with inert gas,
- Open the circuit

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems. Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating unit is earthed prior to charging the system with refrigerant.
    - Label the system when charging is complete (if not already).
    - Extreme care shall be taken not to overfill the refrigerating unit.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

- When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely. When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i. e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure- relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

- The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants includ-ing, when applicable, flammable refrigerants. In ad-dition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manu-facturer if in doubt.
- The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.
- If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

NOTE - *System charging is not recommended below 60F (15C). In temperatures below 60F (15C), the charge must be weighed into the system.*

If weighing facilities are not available, or to check the charge, use the following procedure:

IMPORTANT - Charge unit in standard cooling mode.

1 - Make sure outdoor coil is clean. Attach gauge manifolds and operate unit at full CFM in cooling mode with economizer disabled until system stabilizes (approximately five minutes). Make sure all outdoor air dampers are closed.

2 - Compare the normal operating pressures to the pressures obtained from the gauges. Check unit components if there are significant differences.

3 - Measure the outdoor ambient temperature and the suction pressure. Refer to the charging curve to determine a target liquid temperature.

Note - *Pressures are listed for sea level applications.*

4 - Use the same thermometer to accurately measure the liquid temperature (in the outdoor section).

- If measured liquid temperature is higher than the target liquid temperature, add refrigerant to the system.
- If measured liquid temperature is lower than the target liquid temperature, recover some refrigerant from the system.

5 - Add or remove charge in increments. Allow the system to stabilize each time refrigerant is added or removed.

6 - Continue the process until measured liquid temperature agrees with the target liquid temperature. Do not go below the target liquid temperature when adjusting charge. Note that suction pressure can change as charge is adjusted.

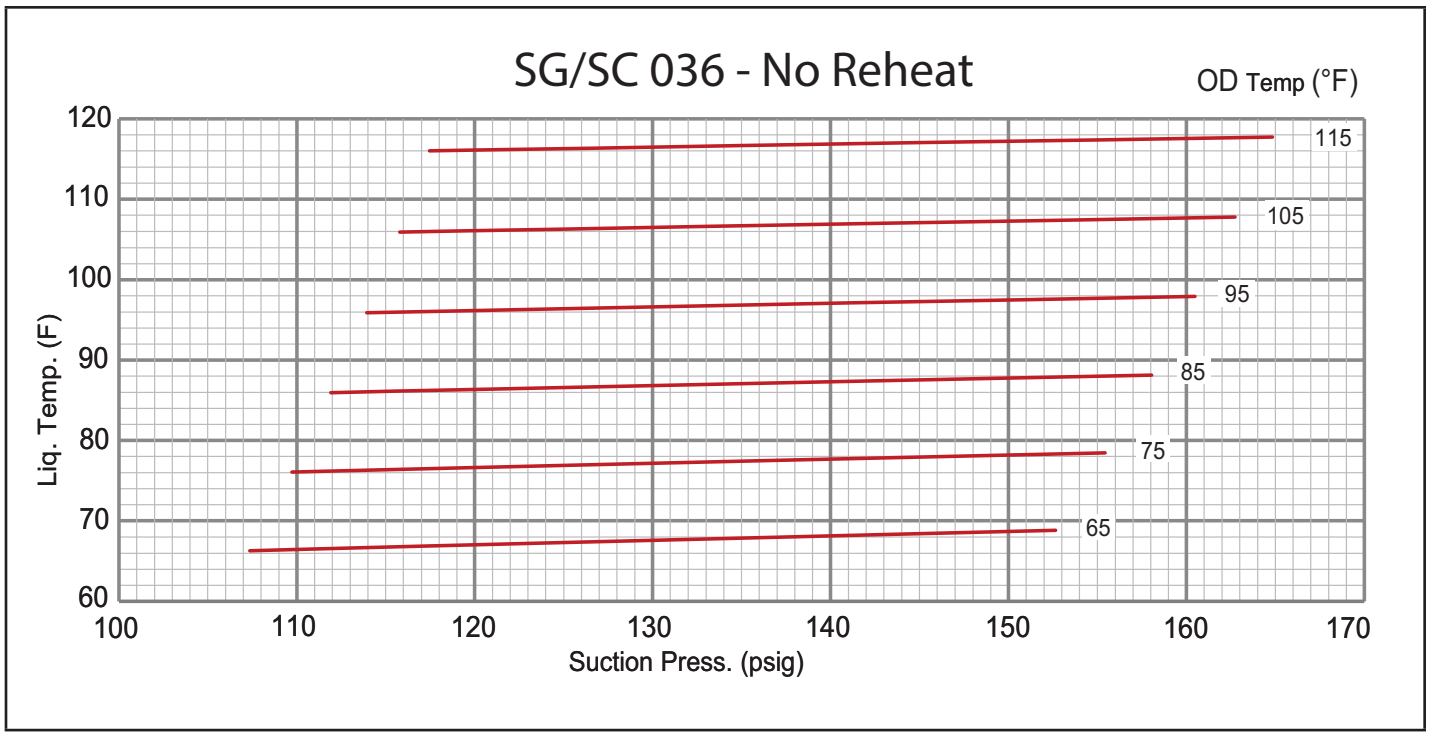
7 - Example: At 95°F outdoor ambient and a measured suction pressure of 130psig, the target liquid temperature is 97°F. For a measured liquid temperature of 106°F, add charge in increments until measured liquidtemperature agrees with the target liquid temperature.

TABLE 4

SG/SC 036 Normal Operating Pressures - No Reheat - 581193-01											
Outdoor Coil Entering Air Temperature											
65°F		75°F		85°F		95°F		105°F		115°F	
Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)
107	220	110	256	112	297	114	342	116	392	117	447
116	222	118	259	121	300	123	345	125	396	126	451
134	227	136	264	139	306	141	352	143	403	145	459
153	232	155	270	158	312	160	359	163	411	165	467

TABLE 5

SG/SC 036 Normal Operating Pressures - Reheat - 581194-01											
Outdoor Coil Entering Air Temperature											
65°F		75°F		85°F		95°F		105°F		115°F	
Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)
107	220	110	256	112	297	114	342	116	392	117	447
116	222	118	259	121	300	123	345	125	396	126	451
134	227	136	264	139	306	141	352	143	403	145	459
153	232	155	270	158	312	160	359	163	411	165	467


SG/SC 036 - No Reheat
OD Temp (°F)
115
105
95
85
75
65
120
110
100
90
80
70
60
Liq. Temp. (F)
100
110
120
130
140
150
160
170
Suction Press. (psig)

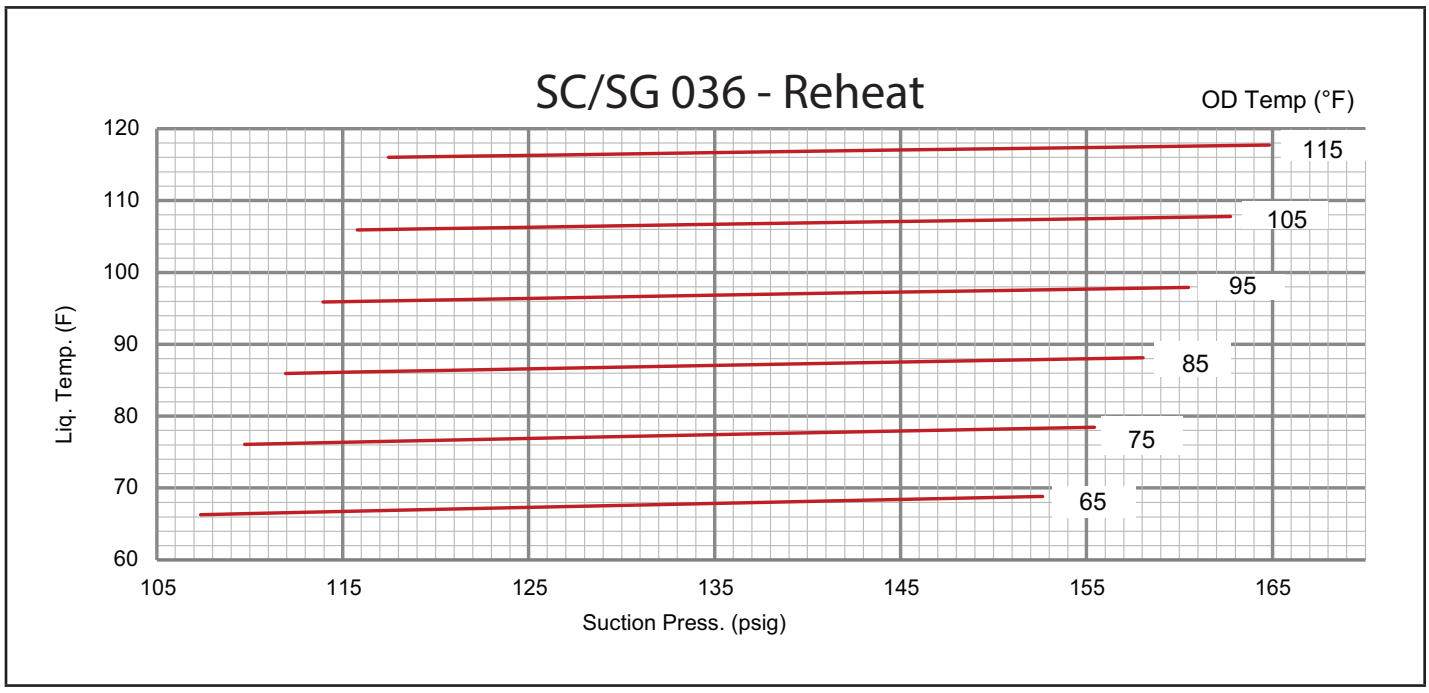
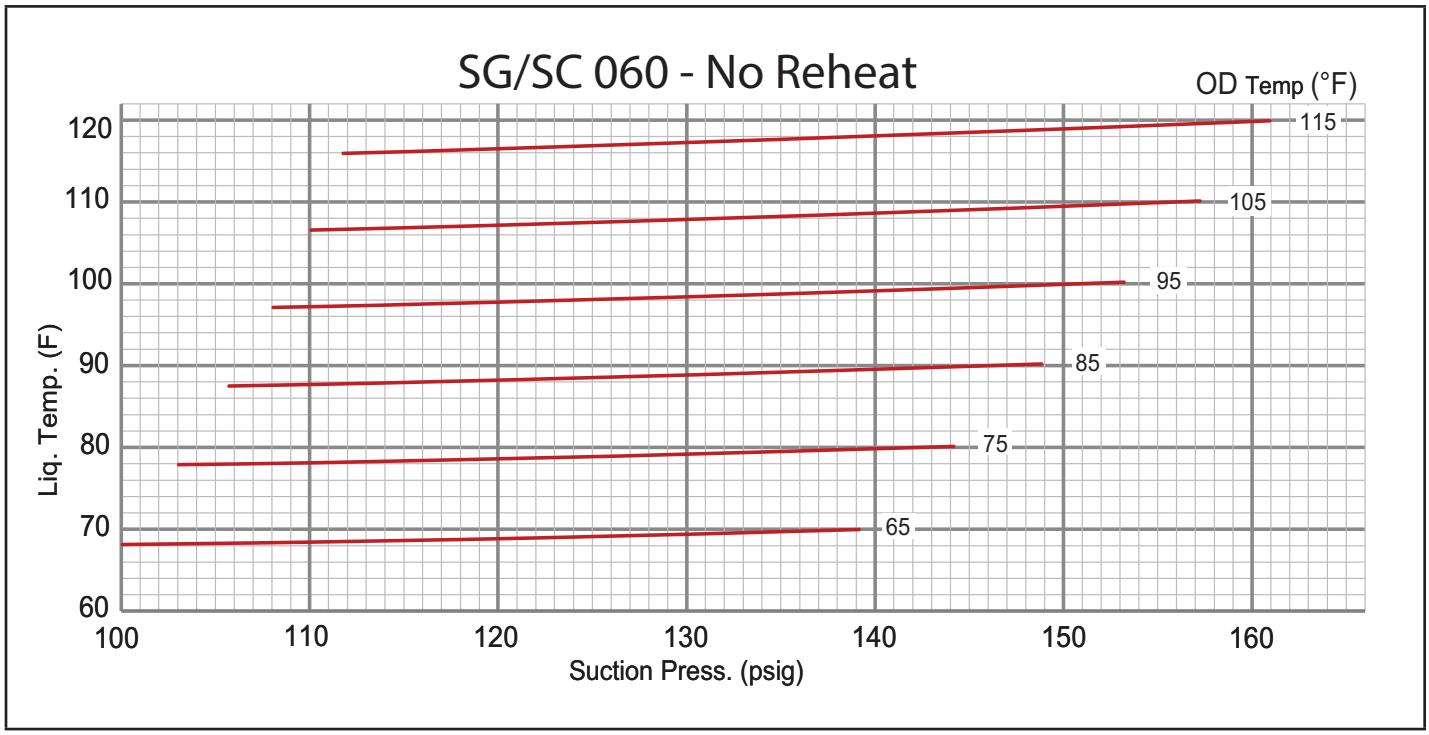

SC/SG 036 - Reheat
OD Temp (°F)
115
105
95
85
75
65
120
110
100
90
80
70
60
Liq. Temp. (F)
105
115
125
135
145
155
165
Suction Press. (psig)

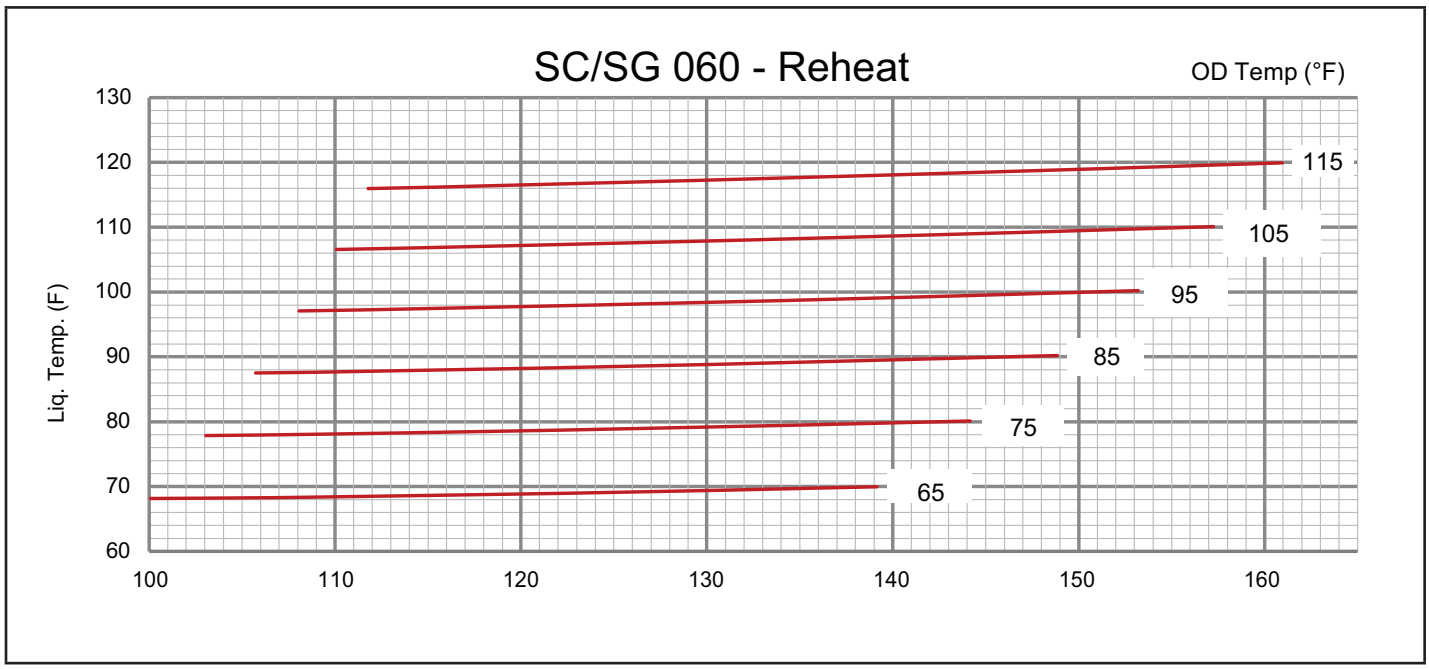
TABLE 6

SG/SC 060 Normal Operating Pressures - No Reheat - 581195-01											
Outdoor Coil Entering Air Temperature											
65°F		75°F		85°F		95°F		105°F		115°F	
Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)
100	229	103	265	106	306	108	352	110	404	112	462
107	230	110	266	114	308	116	354	119	406	121	464
122	236	127	272	130	313	134	360	137	412	140	470
139	243	144	280	149	322	153	369	157	421	161	479

TABLE 7

SG/SC 060 Normal Operating Pressures - Reheat - 581196-01											
Outdoor Coil Entering Air Temperature											
65°F		75°F		85°F		95°F		105°F		115°F	
Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)	Suct (psig)	Disc (psig)
100	229	103	265	106	306	108	352	110	404	112	462
107	230	110	266	114	308	116	354	119	406	121	464
122	236	127	272	130	313	134	360	137	412	140	470
139	243	144	280	149	322	153	369	157	421	161	479





C-Cooling Start Up

IMPORTANT-The crankcase heater must be energized for 24 hours before attempting to start compressor. Set thermostat so there is no demand to prevent compressor from cycling. Apply power to unit.

1 - Set fan switch to AUTO or ON and move system selection switch to cool. Adjust thermostat to a setting below room temperature to bring on the compressor. Compressor will start and cycle on demand from thermostat.

2 - The refrigerant circuit is charged with R-454B refrigerant. See unit rating plate for type of refrigerant and correct amount of charge.

3 - Refer to Cooling Operation and Adjustment section for proper method to check refrigerant charge.

Three Phase Scroll Compressor Voltage Phasing

Three phase scroll compressors must be phased sequentially to ensure correct compressor and blower rotation and operation. Compressor and blower are wired in phase at the factory

1 - Observe suction and discharge pressures and blower rotation on unit start-up.

2 - Suction pressure must drop, discharge pressure must rise, and blower rotation must match rotation marking.

If pressure differential is not observed or blower rotation is not correct:

3 - Disconnect all remote electrical power supplies

4 - Reverse any two field-installed wires connected to the line side of S48 disconnect, CB10 circuit breaker, or TB2 terminal strip.

5 - Make sure the connections are tight.

Discharge and suction pressures should operate at their normal start-up ranges.

R-454B Refrigerant

Units charged with R-454B refrigerant operate at much higher pressures than R-22. The expansion valve and liquid line drier provided with the unit are approved for use with R-454B. Do not replace them with components designed for use with R-22.

R-454B refrigerant is stored in a *blank* cylinder.

Manifold gauge sets used with systems charged with R-454B refrigerant must be capable of handling the higher system operating pressures. The gauges should be rated for use with pressures of 0-800 on the high side and a low side of 30” vacuum to 250 psi with dampened speed to 500 psi. Gauge hoses must be rated for use at up to 800 psi of pressure with a 4000 psi burst rating.

⚠ IMPORTANT

Mineral oils are not compatible with R-454B. If oil must be added, it must be a polyol ester oil.

D-Heating Start-Up

FOR YOUR SAFETY READ BEFORE LIGHTING

BEFORE LIGHTING 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.

Use only your hand to push the gas control lever. Never use tools. If the lever will not move or turn by hand, do not try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

This unit is equipped with an automatic spark ignition system. There is no pilot. In case of a safety shutdown, move thermostat switch to OFF and return the thermostat switch to HEAT to reset ignition control.

⚠ WARNING

Danger of explosion. Can cause injury or death. Do not attempt to light manually. Unit has a direct spark ignition system.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

SMOKE POTENTIAL

The heat exchanger in this unit could be a source of smoke on initial firing. Take precautions with respect to building occupants and property. Vent initial supply air outside when possible.

Placing Unit In Operation

⚠ WARNING

Danger of explosion and fire. Can cause injury or product or property damage. You must follow these instructions exactly.

Gas Valve Operation for Honeywell VR8305Q (FIGURE 20)

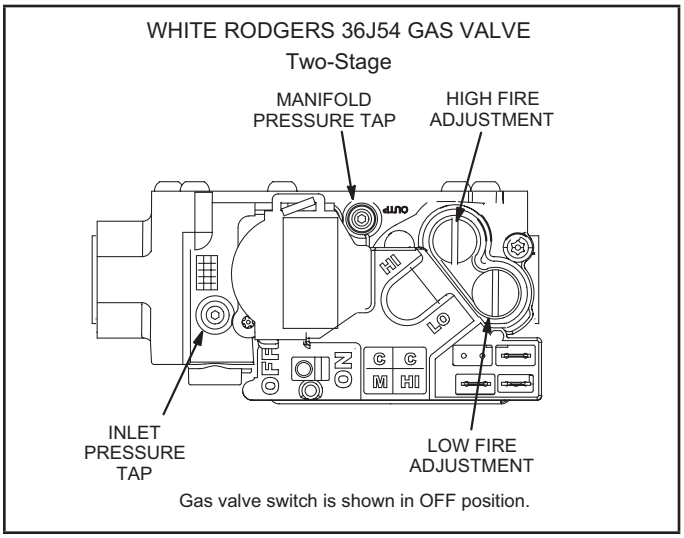


FIGURE 20

1 - Set thermostat to lowest setting.
2 - Turn off all electrical power to furnace.
3 - This furnace is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
4 - Open or remove the heat section access panel.
5 - Move the lever on the gas valve to OFF. Do not force.
6 - Wait five (5) 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 the next step.
7 - Move the lever on the gas valve to ON. Do not force.
8 - Close or replace the heat section access panel.
9 - Turn on all electrical power to furnace.
10 - Set thermostat to desired setting.
11 - The combustion air inducer will start. The burners will light within 40 seconds.
12 - If the furnace does not light the first time (gas line not fully purged), it will attempt up to two more ignitions before locking out.
13 - If lockout occurs, repeat steps 1 through 10.
14 - If the furnace will not operate, follow the instructions "Turning Off Gas to Furnace" and call your service technician or gas supplier.

Turning Off Gas to Furnace

1 - If using an electromechanical thermostat, set to the lowest setting.
2 - Before performing any service, turn off all electrical power to the furnace.
3 - Open or remove the heat section access panel.
4 - Move the lever on the gas valve to OFF.
5 - Replace heat section access panel.

IV- SYSTEMS SERVICE CHECKS

A-SGH Heating System Service Checks

All SGH units are ETL and CSA design certified without modification.

Before checking piping, check with gas company or authorities having jurisdiction for local code requirements. Refer to the SGH Installation, Operation and Adjustments instruction for more information.

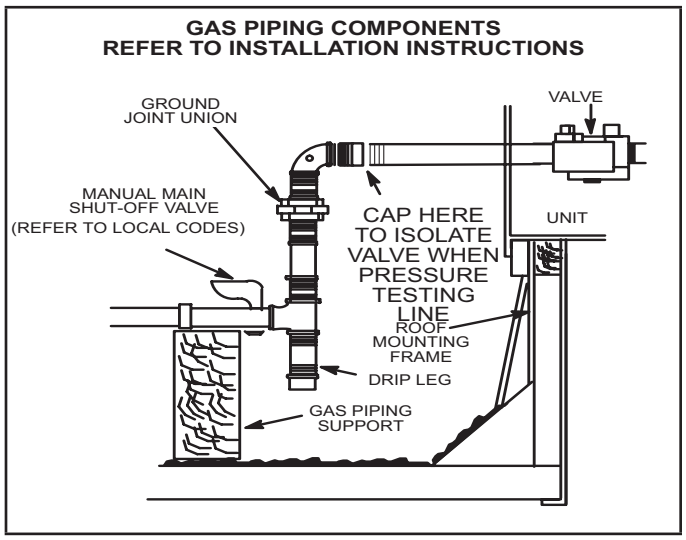


FIGURE 21

1-Gas Piping

Gas supply piping must not allow more than 0.5”W.C. (124.3 Pa) drop in pressure between the gas meter and the unit. Supply gas pipe must not be smaller than the unit gas connection. Refer to installation instructions for details.

2-Testing Gas Piping

NOTE-*In case emergency shutdown is required, turn off the main manual shut-off valve and disconnect the main power to the 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. (3481 Pa)]. See FIGURE 21.

When checking piping connection for gas leaks, use the preferred means. Common kitchen detergents can cause harmful corrosion on various metals used in gas piping. The use of specialty Gas Leak Detector is strongly recommended. It is available through Lennox under part number 31B2001.

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

3-Testing Gas Supply Pressure

When testing gas supply pressure, connect test gauge to the inlet pressure tap (field provided - FIGURE 21). Test supply gas pressure with unit firing at maximum rate (both stages energized).

Make sure the reading falls within the range of the following values. Low pressure may result in erratic operation or “underfire.” High pressure can result in permanent damage to the gas valve or “overfire.” Operating pressure at the unit gas connection must be within ranges shown in TABLE 8.

TABLE 8

Operating Pressures @ Unit Gas Connection	
Natural Gas	LP/Propane
4.7”-10.5	11.0”-13.0

On multiple unit installations, each unit should be checked separately while operating at maximum rate, beginning with the one closest to the supply gas main and progressing to the one furthest from the main. Multiple units should also be tested with and without the other units operating. Supply pressure must fall within the range listed in the previous paragraph.

4-Check and Adjust Manifold Pressure

After line pressure has been checked and adjusted, check manifold pressure. Move test gauge to the manifold outlet pressure tap located on unit gas valve GV1. See FIGURE 20 for location of pressure tap on the gas valve.

The manifold pressure is factory set and should not require adjustment. If manifold pressure is incorrect and attempts to adjust fail, the valve must be replaced. Refer to FIGURE 20 for location of gas valve (manifold pressure) adjustment screw.

See TABLE 9 for normal operating manifold pressure. The valve is adjustable for both high fire and low fire.

All gas valves are factory adjusted. The gas valve should completely and immediately cycle off in the event of gas or power failure. The manual shut-off knob can be used to immediately shut off gas supply.

TABLE 9

Operating Manifold Pressure			
Natural		LP	
Low	High	Low	High
2.0 $\pm$ 0.3” W.C.	3.5 $\pm$ 0.3” W.C.	5.9” $\pm$ 0.3” W.C	10.5” $\pm$ 0.5” W.C.

⚠ CAUTION

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

Manifold Adjustment Procedure

1 - Connect test gauge to the outlet pressure tap on the gas valve. Start the unit (call for second stage heat) and allow five minutes for the unit to reach steady state.

2 - While waiting for the unit to stabilize, notice the flame. The flame should be stable without flashback and should not lift from the burner heads. Natural gas should burn basically blue with some clear streaks. L.P. gas should burn mostly blue with some clear yellow streaks.

3 - After allowing the unit to stabilize for five minutes, record the manifold pressure and compare to the values given for gas supply pressure (above).

⚠ IMPORTANT

Disconnect heating demand as soon as an accurate reading has been obtained.

5-Proper Gas Flow

1 - Operate unit at least 15 minutes before checking gas flow. Determine the time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time).

2 - Divide the number of seconds by two and compare to the time in TABLE 10. If manifold pressure is correct and rate is incorrect, check gas orifices for proper size and restriction.

3 - Remove temporary gas meter if installed.

NOTE- T*o obtain accurate reading, shut off all other gas appliances connected to meter.*

6-High Altitude Derate

NOTE - *Units may be installed at altitudes up to 2000 ft.*

above sea level without any modifications.

At altitudes above 2000 ft. units must be derated to match information in TABLE 11. At altitudes above 4500 ft. unit must be derated 2% for each 1000 ft. above sea level.

NOTE-*This is the only permissible derate for these units.*

7-Inshot Burner

Periodically examine burner flames for proper appearance during the heating season. Before each heating season examine the burners for any deposits or blockage which may have occurred.

1 - Turn off both electrical power and gas supply to unit.

2 - Open burner compartment access panel.

3 - Remove and retain screws securing burner box top cap.

TABLE 10

GAS METER CLOCKING CHART				
Unit Input Rate (Btuh)	Seconds for One Revolution			
	Natural		LP/Propane	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
75,000	48	96	120	240
105,000	34	69	86	171
125,000	29	58	72	144
130,000	28	55	69	138
150,000	24	48	60	120
180,000	20	40	50	100
240,000	15	30	38	75
260,000	14	28	35	69
360,000	10	20	25	50
480,000	8	15	19	38
Natural-1000 btu/cu ft			LP-2500 btu/cu ft	

Note: Table assumes standard temperature (60°F), pressure (30in.Hg.) and fuel heating values (Btuh/Ft.3). Apply pressure corrections in altitudes above 2000 ft.

TABLE 11

Model	Altitude-ft.	Gas Manifold Pressure in. w.g.	
		Natural	LP/Propane
036	2001-4500	3.4	9.0
060	2001-4500	1.6 - 3.4	5.5-9.0

8-Heat Exchanger

To Access or Remove Heat Exchanger From Unit:

1 - Turn off gas and electric power.

2 - Remove access panel(s) and unit center mullions.

3 - Disconnect combustion air blower. Draw wires through divider panel to allow for clearance of vest panel. Remove access panel(s) and unit center mullions.

4 - Remove screws supporting heat exchanger.

5 - To install heat exchanger, reverse procedure. Be sure to secure all wires and check plumbing and burner plate for airtight seal. Screws must be torqued to 35 in.-lbs. (4N.m) to ensure proper operation. Re-caulk corners of vest panel

9-Flame Sensing

Flame current is an electrical current which passes from the ignition control through the sensor electrode during unit operation.

The current passes from the sensor through the flame to the ground to complete a safety circuit. The electrodes should be located so the tips are at least 1/2” (12.7 mm) inside the flame envelope. Do not bend electrodes. To measure flame current, follow the procedure below:

⚠ WARNING

Electric shock hazard. Electrodes are not field-adjustable. Any alterations to the electrode can cause injury, death, or property damage.

1 - Disconnect power to unit.

2 - Remove lead from sensing electrode and install a 0-50 DC microamp meter in series between the sensing electrode and the sensing lead.

3 - Reconnect power and adjust thermostat for heating demand.

4 - After flame is established signal should be 0.5 to 1.0 . Drop out signal is 0.09.

5 - Disconnect power to unit before disconnecting meter. Make sure sensor wire is securely reconnected before reconnecting power to unit.

NOTE-*If the meter scale reads 0, the leads are reversed. Disconnect power and reconnect leads for proper polarity.*

10-Combustion Air Inducer

A combustion air proving switch checks combustion air inducer operation before allowing power to the gas controller.

Gas controller will not operate if inducer is obstructed. Under normal operating conditions, the combustion air blower wheel should be checked and cleaned prior t the heating season.

However, it should be examined periodically during the heating season to establish an ideal cleaning schedule. With power supply disconnected, the condition of the blower wheel can be determined by looking through the vent opening.

Cleaning Combustion Air Inducer

1 - Shut off power supply and gas to unit.

2 - Disconnect pressure switch air tubing from combustion air inducer port.

3 - Remove and retain screws securing combustion air inducer to flue box. Remove and retain two screws from bracket supporting vent connector. See FIGURE 22.

4 - Clean blower wheel blades with a small brush and wipe off any dust from housing. Clean accumulated dust from front of flue box cover.

5 - Return combustion air blower motor and vent connector to original location and secure with retained screws. It is recommended that the combustion air inducer gasket be replaced during reassembly.

6 - Clean combustion air inlet louvers on heat access panel using a small brush.

COMBUSTION AIR INDUCER CLEANING

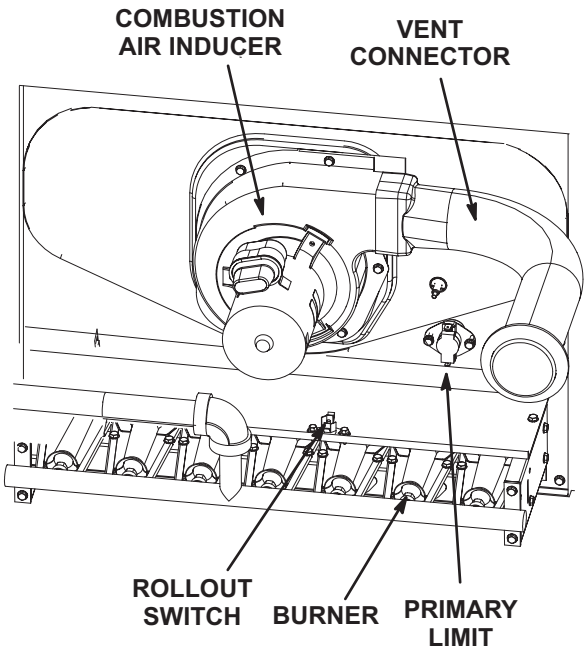


FIGURE 22

E-Flue Passageway and Flue Box

1 - Remove combustion air inducer assembly as described in the previous section.

2 - Remove flue box cover. Clean with a wire brush as required.

3 - Clean tubes with a wire brush.

4 - Reassemble the unit. The flue box cover gasket and combustion air inducer gasket should also be replaced during reassembly.

Prior to beginning work on systems containing refrigerant, checking that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects, taking into account the effects of aging or continual vibration from sources such as compressors or fans.

B-Cooling System Service Checks

SGH units are factory charged and require no further adjustment; however, charge should be checked periodically. See section III.

V-MAINTENANCE

The unit should be inspected once a year by a qualified service technician.

⚠ WARNING

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

⚠ IMPORTANT

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

⚠ WARNING

Any service personnel installing, decommissioning, or performing maintenance on the unit must be properly trained with A2L refrigerants

Prior to beginning work on systems containing refigerant to ensure the risk of ignition is minimized:

- All work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.
- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i. e. non-sparking, adequately sealed or intrinsically safe.
- If any hot work is to be conducted on the refrigerating equipment or any associated parts, the appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.
- No person carrying out work in relation to a refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.
- Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work.

A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

- Where electrical components are being changed, service technicians shall be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance. The following checks shall be applied to installations using flameable refrigerants as applicable:

1 - The actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.

2 - The ventilation machinery and outlets are operating adequately and are not obstructed.

3 - If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.

4 - Markings on the equipment should be visible and legible. Markings and signs that are illegible shall be corrected.

5 - Refrigerating pipes or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

- For systems containing refigerant all repair and maintenance to electrical components shall include initial safety checks and component inspection procedures such as that capacitors are discharged in a safe manner to avoid possibility of sparking, that no live electrical components and wiring are exposed while charging, recovering, or purging the system, and that there is continuity of earth bonding. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used that is reported to the owner of the equipment, so all parties are advised.

NOTE - *Sealed electrical components shall be replaced, not repaired.*

NOTE - *Intrinsically safe components must be replaced, not repaired*

- Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work. If a leak is suspected, all naked flames shall be removed/extinguished. If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.
- When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

  a. Safely remove refrigerant following local and national regulations,

  b. Evacuate the circuit,

  c. Purge the circuit with inert gas,

  d. Evacuate,

  e. Purge with inert gas,

  f. Open the circuit.
- The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems. Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

A-Filters

SCH units are equipped with (4) 16” X 20” X 2” filters and can accept 4” filters. Filters should be checked monthly and replaced when necessary with filters of like kind and size. Take note of air flow direction marking on filter frame when reinstalling filters.

NOTE - Filters must be U.L.C. certified or equivalent for use in Canada.

B-Lubrication

All motors used in SCH units are prelubricated; no further lubrication is required.

C-Supply Air Blower Wheel

Annually inspect supply air blower wheel for accumulated dirt or dust. Turn off power before attempting to remove access panel or to clean blower wheel.

D-Evaporator Coil

Inspect and clean coil at beginning of each season. Clean using mild detergent or commercial coil cleanser. Check condensate drain pan and line, if necessary. Flush coil and condensate drain with water taking care not to get insulation, filters and return air ducts wet. Check connecting lines and coil for evidence of oil and refrigerant leaks.

E-Condenser Coil

Clean condenser coil annually with detergent or commercial coil cleaner and inspect monthly during the cooling season. Check connecting lines and coil for evidence of oil and refrigerant leaks.

NOTE-If owner complains of insufficient cooling, the units refrigerant charge should be checked. See section III.

F-Electrical

1 - Check all wiring for loose connections.

2 - Check for correct voltage at unit (unit operating).

3 - Check amp-draw on both condenser fan motor and blower motor.

Fan Motor Rating Plate ____ Actual _____

Indoor Blower Motor Rating Plate____ Actual____

VI-ACCESSORIES

A-S1CURB Mounting Frame

When installing either the SCH units on a combustible surface for downflow discharge applications, the Lennox S1CURB71101 14-inch or S1CURB73101 24-inch height roof mounting frame is used. The roof mounting frames are recommended in all other applications but not required. If the SCH units are not mounted on a flat (roof) surface, they MUST be supported under all edges and under the middle of the unit to prevent sagging. The units MUST be mounted level within 1/16” per linear foot or 5mm per meter in any direction.

The assembled mounting frame is shown in FIGURE 23. Refer to the roof mounting frame installation instructions for details ofproper assembly and mounting. The roof mounting frame MUST be squared to the roof and level before mounting. Plenum system MUST be installed before the unit is set on the mounting frame. Typical roof curbing and flashing is shown in FIGURE 24. Refer to the roof mounting frame installation instructions for proper plenum construction and attachment.

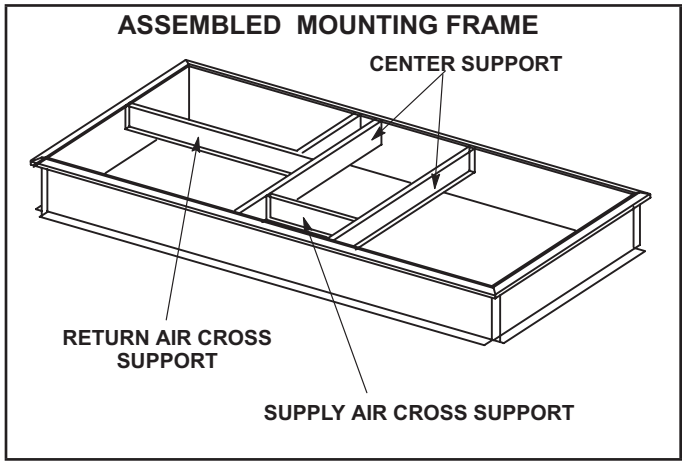


FIGURE 23

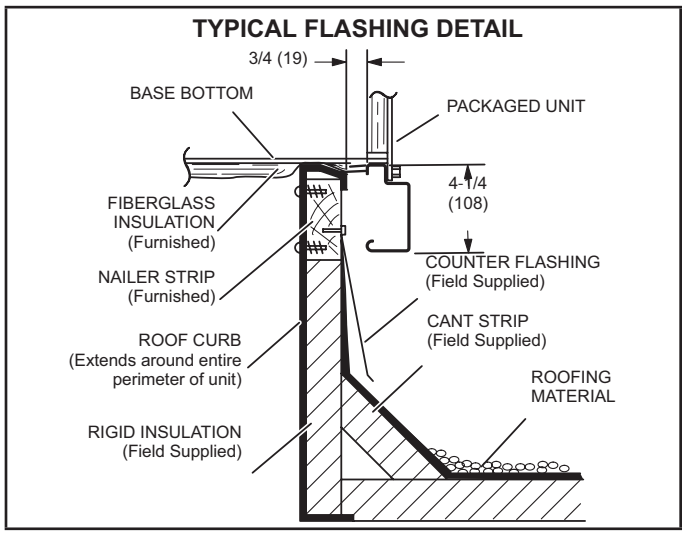


FIGURE 24

B-Outdoor Air Dampers

Dampers are manually operated to allow up to 25 percent outside air into the system at all times. See FIGURE 25.

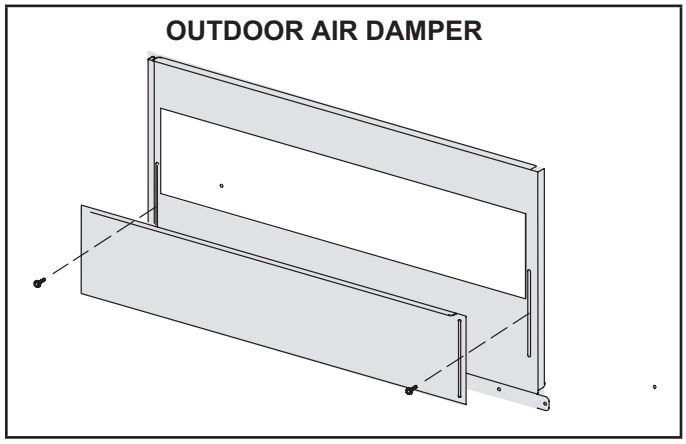


FIGURE 25

C-Economizer (Factory Installed)

Units may contain an optional economizer. The economizer uses outdoor air for free cooling when the outdoor temperature and/or humidity is suitable. The economizer is controlled by the A55 Unit Controller.

D- Gravity Exhaust Dampers

Gravity exhaust dampers may be used in downflow and horizontal air discharge applications. Gravity exhaust dampers are installed in the return air duct.

The dampers allow exhaust air to be discharged from the system when an economizer and/or power exhaust is operating. Gravity exhaust dampers also prevent outdoor air infiltration during unit off cycle. See installation instructions for more detail.

E-Control Systems

The A55 Unit Controller provides all control function for the rooftop unit. Default operation requires a standard room thermostat or direct digital controller (DDC). The A55 can also control the unit from a zone temperature sensor. The A55 Unit Controller is a network controller when daisychained to the L Connection® Network Control System. For ease of configuration, the A55 can be connected to a PC with Unit Controller PC software installed.

F-Smoke Detectors A171, A172, A173

Photoelectric smoke detectors are a factory- and field-installed option. The smoke detectors can be installed in the supply air section (A172), return air section (A171), or in both the supply and return air section. Smoke detection control module (A173) is located below the control panel. Wiring for the smoke detectors are shown on the temperature control section (C) wiring diagram in back of this manual.

The Smoke Detector Transformer T31 a 120VAC to 24VAC transformer that supplies power to the smoke detector board A173.

G-Blower Proving Switch S52

The blower proving switch monitors blower operation and locks out the unit in case of blower failure. The switch is N.O. and closes at 0.14" W.C. (34.9 Pa) The switch is mounted on the side of the front of the blower enclosure.

H-Indoor Air Quality (CO2) Sensor A63

The indoor air quality sensor monitors CO2 levels and reports the levels to the main control module A55. The board adjusts the economizer dampers according to the CO2 levels. The sensor is mounted next to the indoor thermostat or in the return air duct. Refer to the indoor air quality sensor installation instructions for proper adjustment.

I-Drain Pan Overflow Switch S149 (optional)

The overflow switch is used to interrupt cooling operation when excessive condensate collects in the drain pan. The N.O. overflow switch is controlled by A55 Prodigy board located in the unit control panel. When the overflow switch closes, 24VAC power is interrupted and after a five-second delay unit compressors are de-energized.

Once the condensate level drops below the set level, the switch will open. After a five-minute delay the compressor will be energized.

J-Dirty Filter Switch S27

The dirty filter switch senses static pressure increase indicating a dirty filter condition. The switch is N.O. and closes at 1" W.C. (248.6 Pa) The switch is mounted on the side of the economizer. Wiring for the dirty filter switch is shown on the temperature control section (C) wiring diagram in back of this manual.

K-LP / Propane Kit

A natural to LP / propane gas changeover kit is required for gas conversion on SGH036/060 series units. The kit includes a gas valve and burner orifices.

L-Factory Installed Hot Gas Reheat (option)

General

Hot gas reheat units provide a dehumidifying mode of operation. These units contain a reheat coil adjacent to and downstream of the evaporator coil. Reheat coil solenoid valve L14, routes hot discharge gas from the compressor to the reheat coil. Return air pulled across the evaporator coil is cooled and dehumidified; the reheat coil adds heat to supply air.

See FIGURE 26 for reheat refrigerant routing.

L14 Reheat Coil Solenoid Valve

When Unit Controller input (Unit Controller J298-5 or J299-8) indicates room conditions require dehumidification, L14 reheat valve is energized (Unit Controller P394-3 or P394-) and refrigerant is routed to the reheat coil.

Reheat Setpoint

Reheat is factory-set to energize when indoor relative humidity rises above 60% (default). The reheat setpoint can be adjusted by changing Unit Controller Settings - Control menu. A setting of 100% will operate reheat from an energy management system digital output.

Reheat will terminate when the indoor relative humidity falls 3% (57% default) or the digital output de-energizes. The reheat deadband can be adjusted at Settings - Control menu.

Check-Out

Test reheat operation using the following procedure.

1 - Make sure reheat is wired as shown in wiring section.
2 - Make sure unit is in local thermostat mode.
3 - Use Unit Controller key pad to elect SERVICE > TEST > DEHUMIDIFIER.

The blower and compressor (reheat) should be operating. DEHUMIDIFIER 1 ON will be appear on the Unit Controller display.

4 - Press BACK on the Unit Controller display to stop the testing mode.

Default Reheat Operation

During reheat mode free cooling is locked out.

No Y1 demand but a call for dehumidification:

Compressor is operating, blower is on, and the reheat valve is energized.

Y1 demand:

Compressor is operating, blower is on, and the reheat valve is energized.

Y2 demand:

Compressor is operating, blower is on, and the reheat valve is de-energized.

IMPORTANT - Free cooling does not operate during reheat.

For other reheat control options, refer to the Unit Controller manual.

Additional Cooling Stages

Units are shipped from the factory to provide two stages of cooling.

Three stages of cooling is available in zone sensor mode. Three stages of cooling is also available by installing a transfer relay and a three-stage thermostat. Refer to the Main Control Operation section in the Unit Controller manual when using the transfer relay

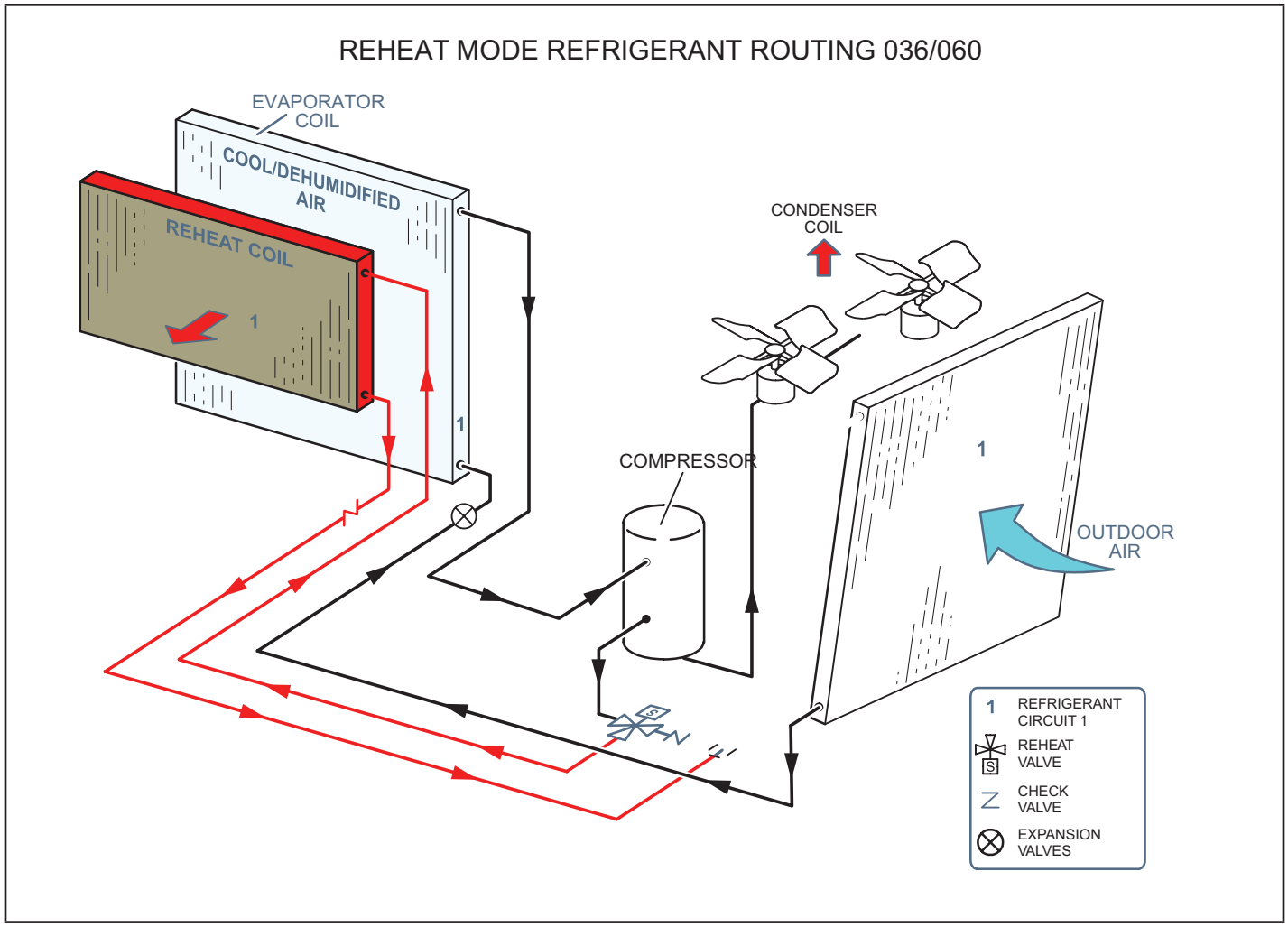
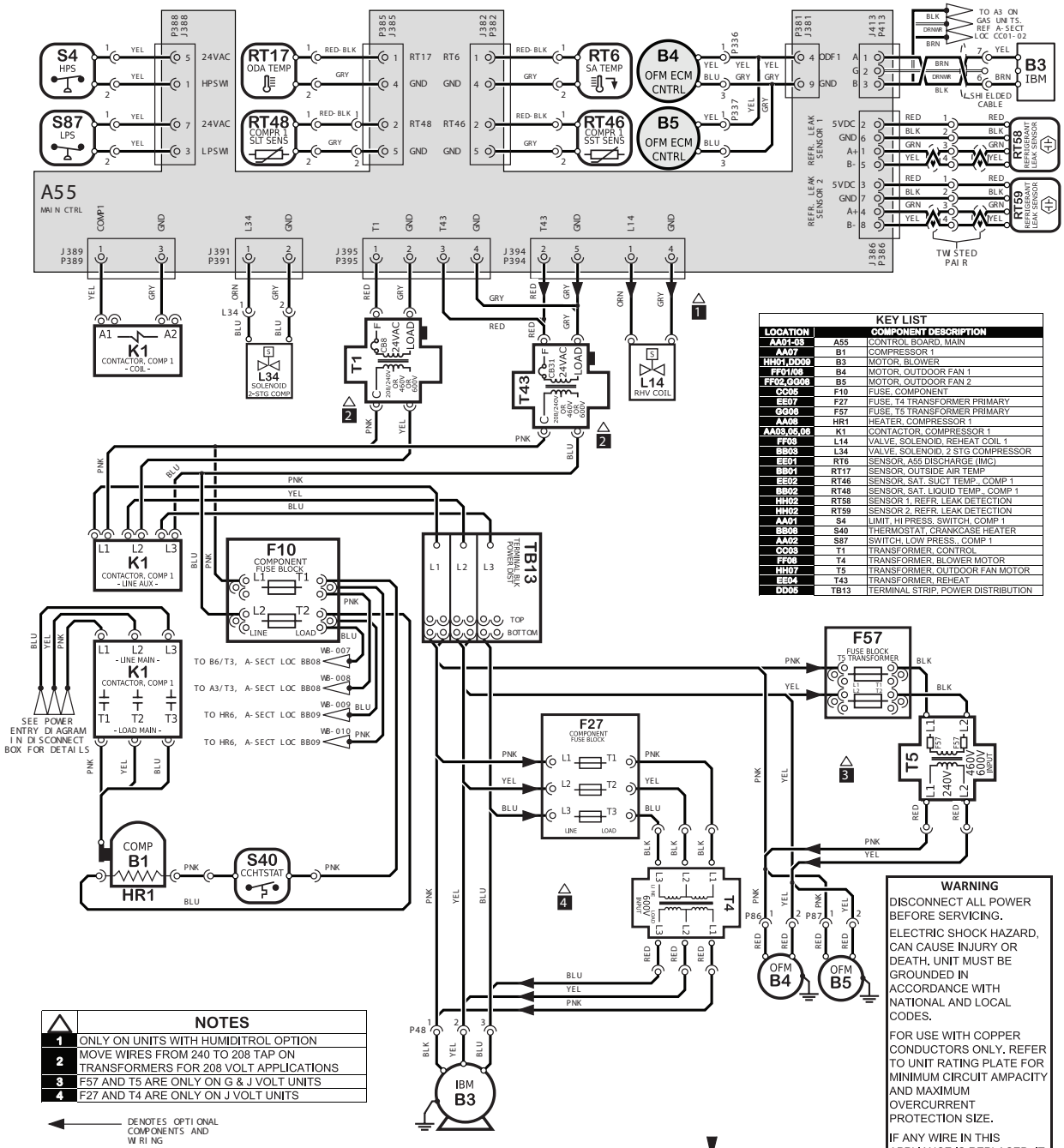

REHEAT MODE REFRIGERANT ROUTING 036/060
EVAPORATOR COIL
COOL/DEHUMIDIFIED AIR
REHEAT COIL
1
1
CONDENSER COIL
COMPRESSOR
1
OUTDOOR AIR
1 REFRIGERANT CIRCUIT 1
REHEAT VALVE
CHECK VALVE
EXPANSION VALVES

FIGURE 26

VII- WIRING DIAGRAMS / SEQUENCE OF OPERATION

SGH036 / 060 COOLING



KEY LIST	
LOCATION	COMPONENT DESCRIPTION
AA01-03	A55 CONTROL BOARD, MAIN
AA07	B1 COMPRESSOR 1
HH01,DD09	B3 MOTOR, BLOWER
FF01/08	B4 MOTOR, OUTDOOR FAN 1
FF02,GG08	B5 MOTOR, OUTDOOR FAN 2
CC02	F10 FUSE, COMPONENT
EE07	F27 FUSE, T4 TRANSFORMER PRIMARY
GG06	F57 FUSE, T5 TRANSFORMER PRIMARY
AA08	HR1 HEATER, COMPRESSOR 1
AA03,05,08	K1 CONTACTOR, COMPRESSOR 1
FF09	L14 VALVE, SOLENOID, REHEAT COIL 1
BB03	L34 VALVE, SOLENOID, 2 STG COMPRESSOR
EE01	RT6 SENSOR, A55 DISCHARGE (IMC)
BB01	RT17 SENSOR, OUTSIDE AIR TEMP
EE02	RT46 SENSOR, SAT. SUCT TEMP., COMP 1
BB02	RT48 SENSOR, SAT. LIQUID TEMP., COMP 1
HH02	RT58 SENSOR 1, REFR. LEAK DETECTION
HH02	RT59 SENSOR 2, REFR. LEAK DETECTION
AA01	S4 LIMIT, HI PRESS. SWITCH, COMP 1
BB06	S40 THERMOSTAT, CRANKCASE HEATER
AA02	S87 SWITCH, LOW PRESS., COMP 1
CC03	T1 TRANSFORMER, CONTROL
FF03	T4 TRANSFORMER, BLOWER MOTOR
HH07	T5 TRANSFORMER, OUTDOOR FAN MOTOR
EE04	T43 TRANSFORMER, REHEAT
DD05	TB13 TERMINAL STRIP, POWER DISTRIBUTION

NOTES	
1	ONLY ON UNITS WITH HUMIDITROL OPTION
2	MOVE WIRES FROM 240 TO 208 TAP ON TRANSFORMERS FOR 208 VOLT APPLICATIONS
3	F57 AND T5 ARE ONLY ON G & J VOLT UNITS
4	F27 AND T4 ARE ONLY ON J VOLT UNITS

DENOTES OPTIONAL COMPONENTS AND WIRING

WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.

IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS.

HEATING	COOLING	COOLING	ACCS	ACCS
SECTION A	SECTION B	SECTION B5	SECTION C	SECTION D

WIRING DIAGRAM FLOW

Model: SC, SG – 036H, 060H COOLING

Voltage: All Voltages

Supersedes: XXXXXX-XX Form No: 538404-01 Rev: 000

SGH036 / 060 Sequence of Operation

Power:

1 - |Line voltage from unit disconnect energizes transformer T1. T1 provides 24VAC power to the A55 Unit Controller. A55 provides 24VAC to the unit cooling, heating and blower controls.

2 - Line voltage from unit disconnect provides voltage to compressor crankcase heaters HR1 (through discharge line thermostat) and compressor contactor K1. Voltage is distributed directly to blower motor B3 and outdoor fan motors B4 and B5.

Blower Operation:

The A55 Unit Controller receives a demand from thermostat terminal G. A55 energizes blower motor circuit follows:

3 - A55, through motor control board energizes blower B3 via programmed motor settings. Motor settings are fieldadjustable.

First-Stage Cooling

4 - A55 Unit Controller receives a Y1 and G cooling demand and energizes blower B3 in low speed.

5 - After A55 proves n.c. low pressure switch S87, n.c. freezestat S49, and n.c. high pressure switch S4, compressor contactor K1 is energized.

6 - N.O. contacts K1-1 close energizing the compressor B1. On two-speed systems (3, 4, and 5 tons) compressor is energized on low speed.

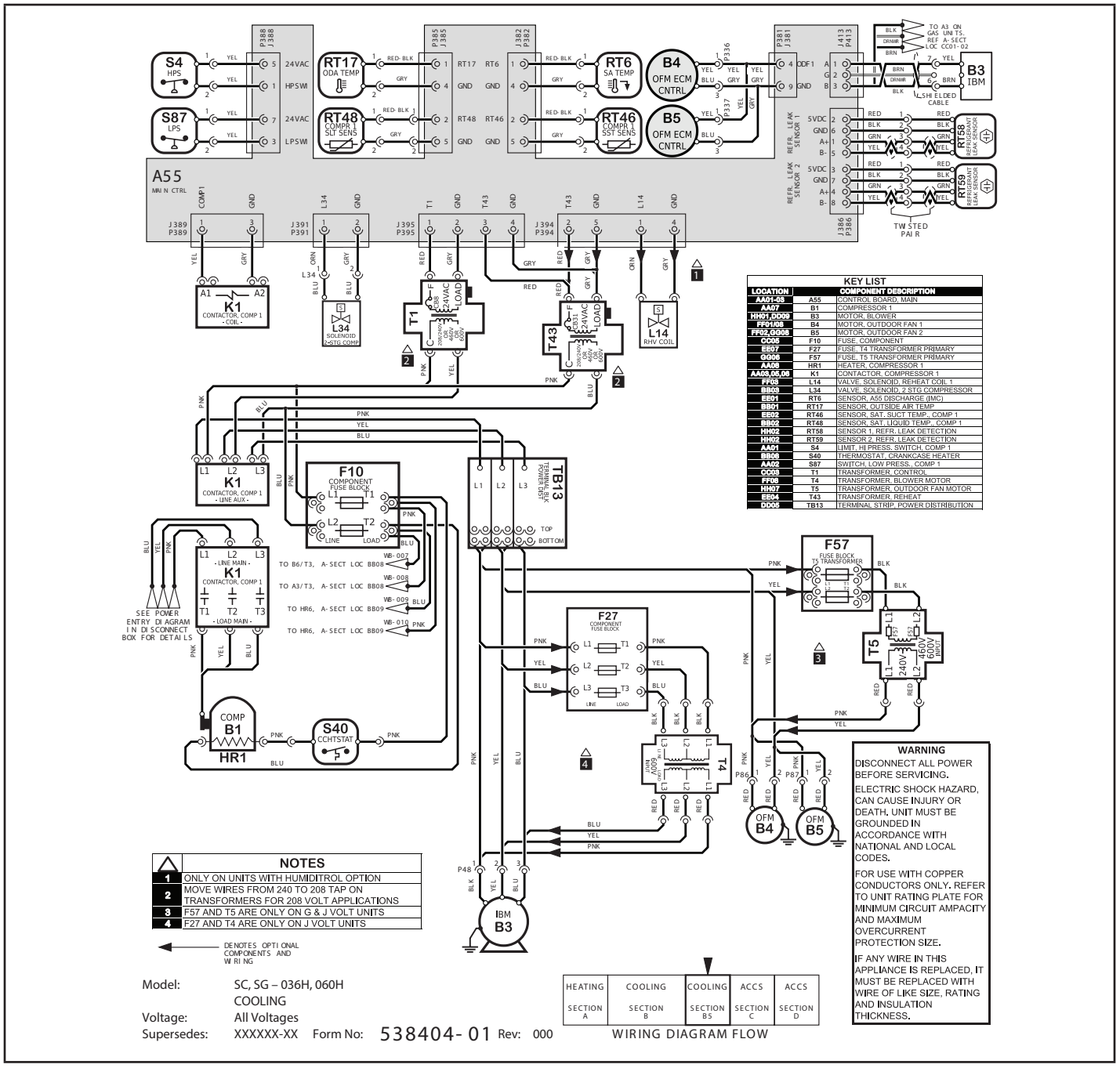
7 - S11 n.o. contact close below 62ºF. A55 energizes outdoor fan motors B4 and B5 on low speed. Second-Stage Cooling

8 - A55 receives a Y2 and G cooling demand and energizes blower B3 in high speed.

9 - A55 energizes compressor solenoid L34, switching compressor to high speed.

10 - A55 energizes outdoor fan motors B4 and B5 on high speed.

SGH036 / 060 GAS HEAT



KEY LIST		
LOCATION		COMPONENT DESCRIPTION
AA01-05	A55	CONTROL BOARD, MAIN
AA07	B1	COMPRESSOR 1
HH01,DD09	B3	MOTOR, BLOWER
FF01/08	B4	MOTOR, OUTDOOR FAN 1
FF02,GG08	B5	MOTOR, OUTDOOR FAN 2
GG09	F10	FUSE, COMPONENT
EE07	F27	FUSE, T4 TRANSFORMER PRIMARY
GG06	F57	FUSE, T5 TRANSFORMER PRIMARY
AA08	HR1	HEATER, COMPRESSOR 1
AA05,05,09	K1	CONTACTOR, COMPRESSOR 1
FF09	L14	VALVE, SOLENOID, REHEAT COIL 1
BB03	L34	VALVE, SOLENOID, 2 STG COMPRESSOR
EE04	RT6	SENSOR, A55 DISCHARGE (IMC)
BB01	RT17	SENSOR, OUTSIDE AIR TEMP
BB02	RT46	SENSOR, SAT, SUCT TEMP., COMP 1
BB02	RT48	SENSOR, SAT, LIQUID TEMP., COMP 1
HH02	RT58	SENSOR 1, REFR. LEAK DETECTION
HH02	RT59	SENSOR 2, REFR. LEAK DETECTION
AA01	S4	LIMIT, HI PRESS. SWITCH, COMP 1
BB08	S40	THERMOSTAT, CRANKCASE HEATER
AA02	S87	SWITCH, LOW PRESS., COMP 1
GG09	T1	TRANSFORMER, CONTROL
FF09	T4	TRANSFORMER, BLOWER MOTOR
HH07	T5	TRANSFORMER, OUTDOOR FAN MOTOR
EE04	T43	TRANSFORMER, REHEAT
GG05	TB13	TERMINAL STRIP, POWER DISTRIBUTION

NOTES	
1	ONLY ON UNITS WITH HUMIDITROL OPTION
2	MOVE WIRES FROM 240 TO 208 TAP ON TRANSFORMERS FOR 208 VOLT APPLICATIONS
3	F57 AND T5 ARE ONLY ON G & J VOLT UNITS
4	F27 AND T4 ARE ONLY ON J VOLT UNITS

DENOTES OPTIONAL COMPONENTS AND WIRING

WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.

IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS.

Model: SC, SG – 036H, 060H
COOLING
Voltage: All Voltages
Supersedes: XXXXXX-XX Form No: 538404-01 Rev: 000

HEATING SECTION A	COOLING SECTION B	COOLING SECTION B5	ACCS SECTION C	ACCS SECTION D

WIRING DIAGRAM FLOW

Heat Call

1 - Heating demand initiates at W1 in the thermostat.

2 - 24VAC is routed through TB34 to the Unit Controller A55. After A55 proves N.C. primary limit S10, the combustion air blower relay K13 is energized.

3 - N.O. K13-1 contacts close allowing line voltage to energize combustion air blower B6.

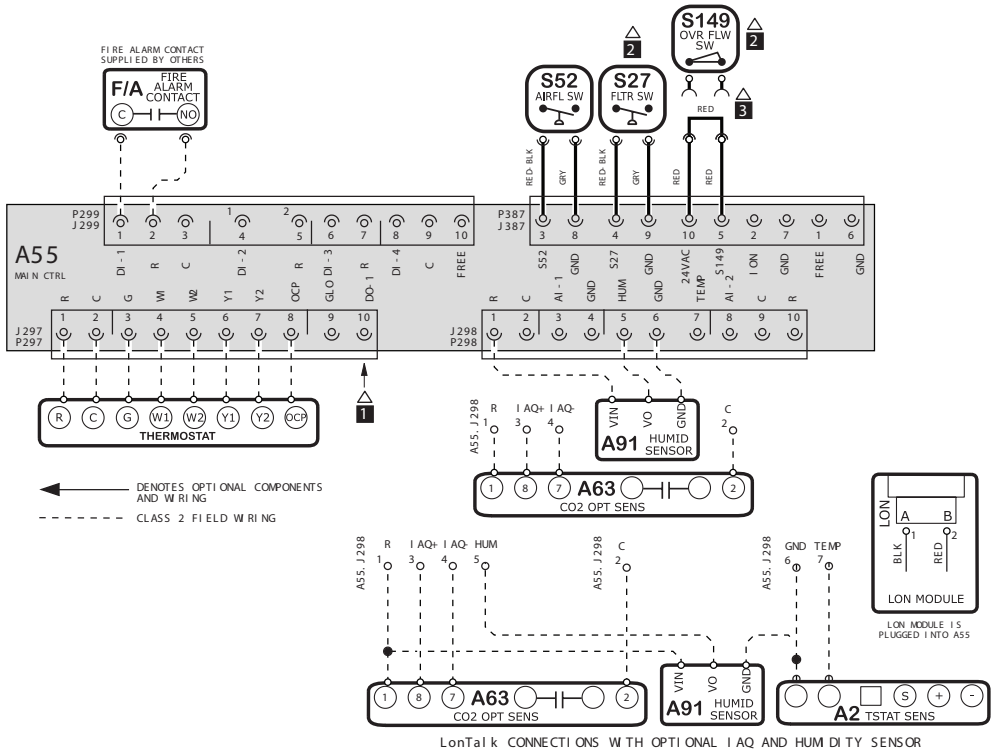
4 - After the combustion air blower B6 has reached full speed, the combustion air proving switch S18 contacts close. The A55 routes 24VAC through N.C. burner flame rollout switch S47 and the closed contacts of combustion air proving switch S18 to energize the ignition module A3.

5 - After a 30 second delay A3 energizes the ignitor and gas valve GV1.

End of Heat Call

6 - Ignition A3 is de-energized by control module A55 in turn de-energizing GV1. Combustion air blower relay K13 is also de-energized.

THERMOSTAT

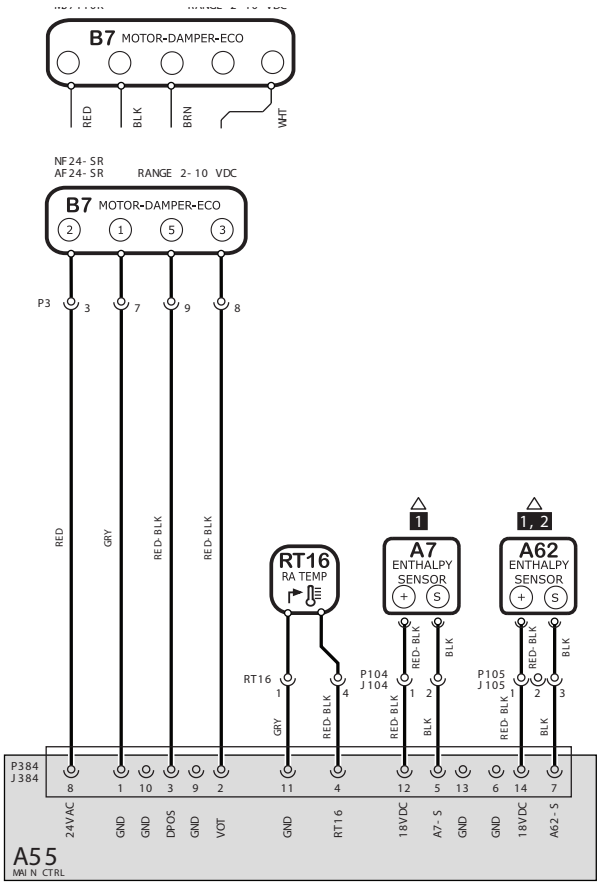


KEY LIST		
LOCATION	**COMPONENT DESCRIPTION**	
FF05	A2	SENSOR, ELECTRONIC THERMOSTAT
AA03	A55	CONTROL BOARD, MAIN
DD04/05	A63	SENSOR, CO2 (IAQ)
DD04/05	A91	SENSOR, HUMIDITY
AA01	F/A	FIRE ALARM CONTACT
DD01	S27	SWITCH, FILTER
DD01	S52	SWITCH, AIRFLOW
EE01	S149	SWITCH, OVERFLOW ONE

△	NOTES
1	P297-10 (SR) IS SERVICE RELAY OUTPUT (24VAC) IF USED CONNECT TO AN INDICATOR LIGHT
2	CORE CONTROLLER SETTINGS MUST BE MODIFIED WHEN S27, S149 ARE INSTALLED
3	REMOVE JUMPER TO INSTALL S149

Model: SC, SG Series RTU
Thermostat and LonTalk
Voltage: All Voltages
Supersedes: N/A Form No: 538391-01 Rev: 0

ECONOMIZER



△	NOTES
1	A7 AND A62 NOT USED FOR SENSIBLE TEMPERATURE CONTROL
2	FOR UNIT DIFFERENTIAL ENTHALPY CONTROL, ADD A62 RETURN AIR ENTHALPY SENSOR

KEY LIST		
LOCATION	**COMPONENT DESCRIPTION**	
CC05	A7	SENSOR, SOLID STATE ENTHALPY
AA06	A55	CONTROL BOARD, MAIN
DD05	A62	SENSOR, ENTHALPY INDOOR
BB02	B7	MOTOR, DAMPER ECONOMIZER
CC05	RT16	SENSOR, RETURN AIR TEMP

Model: LC,LG,LH,LD,SC,SG Series
Economizer & Motorized OAD
Voltage: All Voltages
Supersedes: N/A Form No: 538072-01 Rev: 2

HTG SEC A	CLG SEC B	CLG SEC B3	ACCS SEC C	ACCS SEC D

WIRING DIAGRAM FLOW

OPERATION:

1 - The main control module A55 along with outdoor enthalpy sensor A7 and indoor enthalpy sensor A62 (if differential enthalpy is used) communicates to the economizer control module A56 when to power the damper motor B7.

2 - The economizer control module A56 supplies B7 with 0 - 10 VDC to control the positioning of economizer.

3 - The damper actuator provides 2 to 10 VDC position feedback.

VIII-Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available befor the task is commenced.

Steps to ensure this are:

- Become familiar with the equipment and its operation,
- Isolate the system electrically,
- Ensure that before attempting the procedure that mechanical handling equipment is available, if required, for handling refrigerant cylinders, and that all personal protective equipment is available and being used correctly while the recovery process is supervised at all times by a competent person and that the recovery equipment and cylinders conform to the appropriate standards.

Additionally, pump down refrigerant system, if possible, and if a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system. Make sure that cylinders are situated on the scales before recovery takes place. Start the recovery machine and operate in accordance with instructions. Do not overfill cylinders (no more than 80 % volume liquid charge). Do not exceed the maximum working pressure of the cylinder, even temporarily. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.

Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area).

Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work. If a leak is suspected, all naked flames shall be removed/extinguished. If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- Safely remove refrigerant following local and national regulations,
- Evacuate the circuit,
- Purge the circuit with inert gas,
- Evacuate,
- Purge with inert gas,
- Open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems. Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.