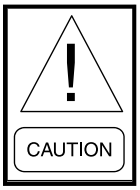
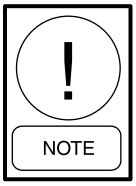
YORK BY JOHNSON CONTROLS	Form No.: 102.20-NOM1 (LS04)	109
	Supersedes: 102.20-NOM1 (LS04) 208	
LITERATURE SUPPLEMENT	File with: 102.20-NOM1 (105)	
Subject: Indirect Fired Gas Heat Start Up - Eclipse Gas Burner Start Up 10:1 - 25:1 Turndown & Powerflame Gas Burner Start Up 3:1 - 10:1 Turndown		

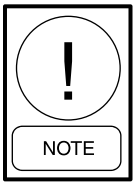
For your safety and satisfaction, this product requires check, test and start-up adjustment by a qualified HVAC technician. Do not use for temporary heat prior to start-up.



Review burner control literature, including wiring, piping, cut sheets and drawings before attempting to start this unit.



All factory test start up burner specifications are located on a laminated "Factory Specification Sheet" located on the inside of the control panel door".



Your gas burner has been carefully inspected and tested at the factory; however, different conditions at the jobsite, including controls that have been added at time of installation, require careful testing and final adjustment for satisfactory operation. The Burner Test Report / Factory Specification Sheet in each unit shows the general data recorded during the operation and safety tests at the factory. This data should be used as a general guide; with final data recorded on the start-up form. Do not exceed 550°F flue temperature at the ID fan inlet. Do not exceed 200°F supply air temperature.

INTRODUCTION

This guideline describes the basic steps a technician would take in starting an Indirect Fired gas heat system on a YORK Solution Air Handler for the first time.

Each gas burner has been test run and inspected at the factory. Adjustments to component settings are typically not required. However, measurements of system parameters should be taken and compared to the measurements recorded on the "Burner Test Report" to ensure safe and reliable operation. The "Burner Test Report" is laminated to the inside of the burner control door.

IDENTIFY THE UNIT TYPE

Two types of Indirect Fired gas burners are used on YORK Solution Air Handlers: The Powerflame series and the Eclipse series. The Powerflame series offers a turndown (modulating ratio) of 3:1 or 10:1. The Powerflame is easily identifiable by the motorized gas valve with external linkage connecting the air dampers on the burner air inlet.

The Eclipse series uses an air/gas ratio regulator with no external linkage, and has a turndown range of 10:1 to 25:1 (sometimes greater). A visible external plastic tube is used to transmit gas pressure from the burner to the regulator. No external linkage is used.

Both burners utilize a combustion air blower. YORK Solution Air Handlers also use an exhaust blower, called an induced draft (ID) blower. This exhaust blower keeps the combustion chamber at a slight negative pressure. Verification of this negative pressure and other system parameters is part of a proper start up procedure.

PRELIMINARY COORDINATION

Contact contractor/customer who requested start-up.

- Verify air handler has had proper start-up.
- Ensure air handler and system is capable of design airflow for gas heat start-up.
- Ensure reliable power is available.
- Verify gas lines are purged of air to equipment valve.
- Verify controls are complete.
- Verify flue (stack) is correctly installed if parts were shipped loose *(see Fig's 3-21 and 3-22)*.

TOOLS RECOMMENDED

- **Electrical Multimeter w/ Amprobe**
- **Heating Unit Installation and Operation Instruction**. - One is provided with every heating unit for technical information and troubleshooting.
- **Magnehelic Gauge 0" To .25" WC, Dwyer Series 2000 or Model 1227 Dual Range Manometer.** - For checking pressure over fire (draft).
- **Control Signal Generator, 0 to 20 mA (Altek-234 or 334A)** - For 2 to 10 VDC signal add 500 ohms in series with signal generator.
- **Magnehelic Gauge 0" to 15" WC and 0 to 3 lbs. (Dwyer series-2000) or Monometer (Dwyer- 1227) Duel Range Monometer**. - For checking supply gas pressure and manifold gas pressure or pilot gas pressure.
- **Honeywell - S7800A Test Module** - For use on (Honeywell-7800) Series Relay Module. (Available through Airside Parts - 800-545-7814, Ext.12).
- **Flue Gas Analyzer (CO_2 and O_2)**
- **Stack Thermometer (0°F - 1000°F approx.)**

AIR HANDLER PRE START CHECKS

- Verify air handler has had proper start up and airflow is at design maximum for heating cycle *(refer to air balance report)*.
- Set bypass damper if provided in air handler.
- Airflow proving switch for main supply fan installed and operational.
- Check with Control Technician: two-minute post-purge programmed in air handler controller. Upon call for air handler unit stop, burner cycles off then air handler fan cycles off two minutes later.

BURNER PRE START CHECKS

1. Open fuse disconnects before working on burner *(see Fig. 3-13)*.

FIG. 3-13 – OPEN FUSE DISCONNECTS

2. Check all wire terminations for tightness.
3. Check that the incoming voltage(s) are correct. Compare measured voltages to burner motor and ID motor nameplates and the "Burner Test Report". Reset fuse disconnects.
4. Check for correct rotation of 3 phase burner motor and ID motor.
5. Verify that contractor has purged new gas lines of air up to manual valve on gas train.
6. Valves which have been closed for shipping must be opened accordingly. Check that all manual valves operate without leaks.

7. The flue (stack) damper is located at the discharge of the ID blower and closed for shipping. Release the locking mechanism and set the damper to match the position indicated by the scribed markings. Lock in place *(see Fig. 3-14)*.

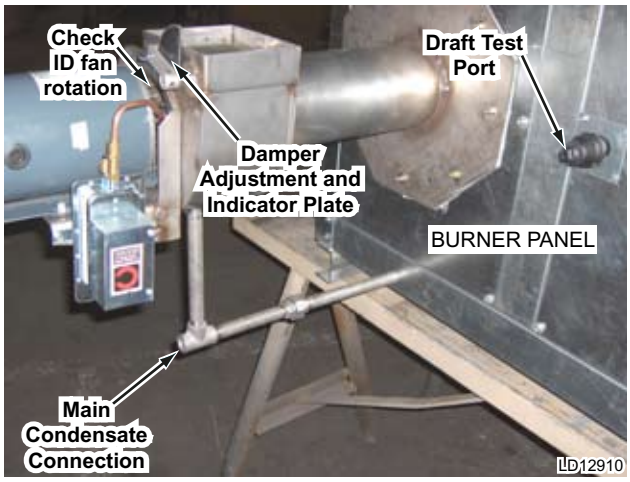


FIG. 3-14 – SET ID FAN DAMPER

8. Inspect condensate drain trap to see that it is large enough, as described in this guideline *(see Fig. 3-20)*.

9. Measure the gas supply pressure coming into the gas train *(see Fig. 3-15)*. Gas pressure can be greater than shown on the "Burner Test Report", but it must be between the min/max values listed in Table 3-2.

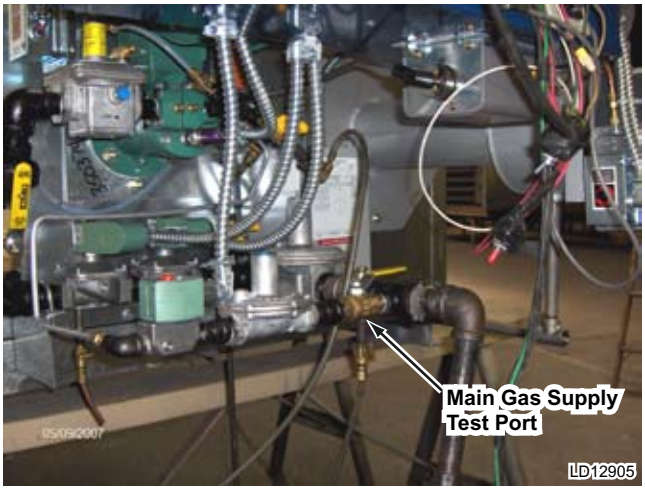


FIG. 3-15 – CHECK MAIN GAS SUPPLY PRESSURE

10. Visually check that the high temperature safety limit is set for a 200-230°F range. The limit switch is typically mounted behind the burner control panel.

11. Connect a 0-15" gas pressure gauge or other suitable instrument to the gas manifold port. The gas pressure will be measured when running (*refer to step 4 of Burner Start-up Procedure)*.

NOTE

On Powerflame burners this test port is downstream of the main regulator, typically on a standard tee fitting in the main gas line.

NOTE

On Eclipse burners, this test port is located on the backside of the burner, just below the spark igniter. A small valve is provided at this test port.

12. Connect a manometer or other suitable device to the Heat Exchanger Draft Port located on the side of the unit near the burner. The expected draft should read slightly negative – about -.03" WC. The draft port is typically made of ¾" steel pipe and may be plugged. Remove plug and add a small stop valve and a nipple for a rubber tube *(see Fig. 3-14 & 3-16)*.

13. Install the Honeywell S7800 Test Module (display), if available.

14. Connect signal generator (0-20mA) to terminals in place of modulation control signal (for 2-10 VDC signal add a 500 Ω resistor in series). *See Fig. 3-23*.

15. Visually check that the flue (stack) is secure and connected properly. Typical connections are shown at the end of this guideline *(see Fig.'s 3-21 & 3-22)*.

16. Burner panel off/on switch should be "off".

    System is now ready for start up.

BURNER START-UP PROCEDURE

NOTE

Prior to starting burner, technician must verify incoming gas pressure. A minimum pressure is listed on the "Burner Test Report". The maximum pressure is listed in Table 3-2.

1. Open manual gas valves on gas supply and pilot line.
2. Initiate a call for heat or use jumper to create call for heat *(see Fig. 3-23 for typical wiring diagram).*

3. Turn burner panel off-on switch to on.

NOTE

Once there is a call for heat, a 30 second pre-purge period is initiated to remove any gases from the heat exchanger. The burner will then go through a second purge before ignition.

4. The burner will automatically go to Low Fire at start up. After proof of Low Fire, the burner will modulate up to High Fire. This may take 15 seconds for a Powerflame burner and 90 to 180 seconds for the Eclipse burner. After the burner operates at High Fire use the manometer connected to the Heat Exchanger Draft Port *(see Fig. 3-16)*, observe the reading. A negative pressure of about -.03" WC is expected for draft overfire. Readings may differ slightly from those shown on the "Burner Test Report".

NOTE

For valid readings, before making any adjustments, allow the burner to fire at least 20 minutes to allow the heat exchanger to come up to operating temperature.

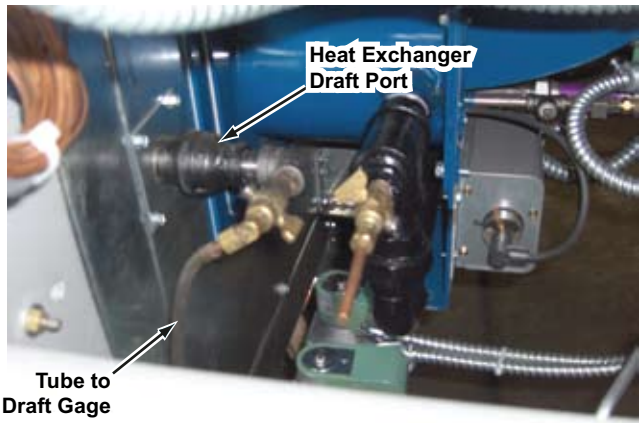


FIG. 3-16 – DRAFT OVER FIRE TEST PORT

5. Observe the gas manifold pressure and compare to data on the "Burner Test Report" under both High Fire and Low Fire conditions.

6. Check the flue (stack) combustion temperature at the ID Blower Housing Test Port. Make sure the test probe is inserted half way into the ID Inlet Tube (*see Fig. 3-17).* Compare results to the "Burner Test Report".

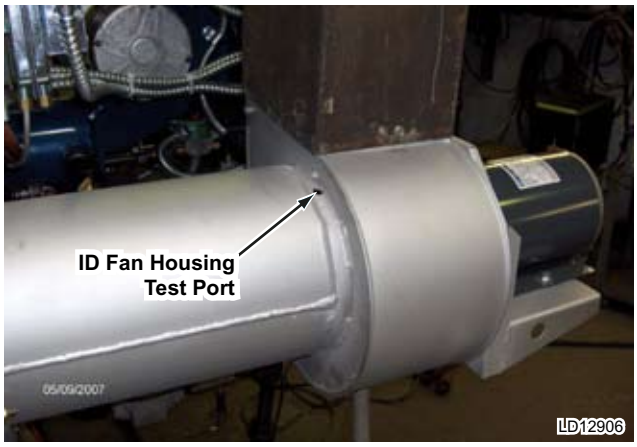


FIG. 3-17 – FLUE (STACK) COMBUSTION TEMPERATURE AND EFFICIENCY TEST PORT

NOTE

Ignition transformer is intermittent. Pilot continues to burn after ignition transformer is de-energized.

7. Using the signal generator, cycle the burner to check capacity modulation. Observe valve/damper actuator operation.

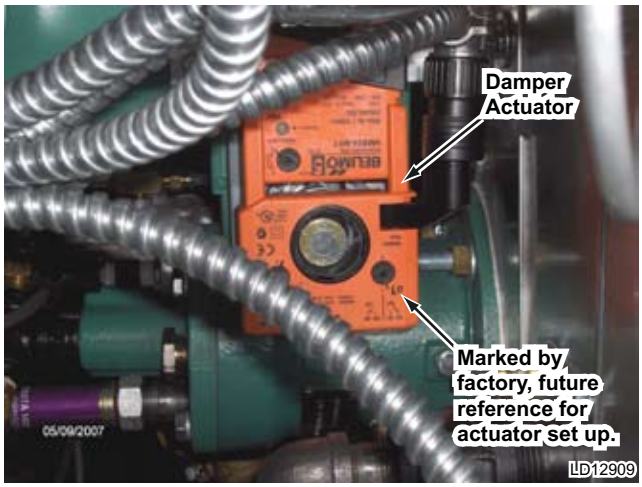


FIG. 3-18 – DAMPER ACTUATOR

8. Using the standard operating controls, cycle the burner several times to assure proper sequencing of start-up, firing, and capacity modulation, plus operation of all safety and monitoring controls.

9. Test 180°F. high temp. safety by running burner with airflow off or diverted. Burner will shut down at 180°F. Turn air handler on as quickly as possible to remove heat from the heat exchanger.

10. Burner efficiency testing should be done last. The burner should be running at High Fire rate for 30 minutes before efficiency testing is done.

11. Efficiency at High Fire is pre-determined, but may be checked by flue gas analysis at the entrance to the ID Blower Housing Test Port. At High Fire CO_2 should be between 8-1/2 and 10 %; 0_2 should be between 7-1/2 and 4%. With these ranges, efficiency is 80% plus or minus 2% *(see Fig. 3-17).*

12. Contact contractor, facilities manager or customer to inform successful start-up has been completed.

CAUTION

In the unlikely event that adjustment is required; it is done at High Fire and must* NOT *retard Low Fire light-off.

NOTE

Do not change set up of factory preset air inlet dampers on Power Flame burner.

NOTE

Any questions should be directed to your local Service office or Johnson Controls Product Tech Support, before contacting the burner manufacturer.

FIG. 3-19 – CONDENSATE DRAIN

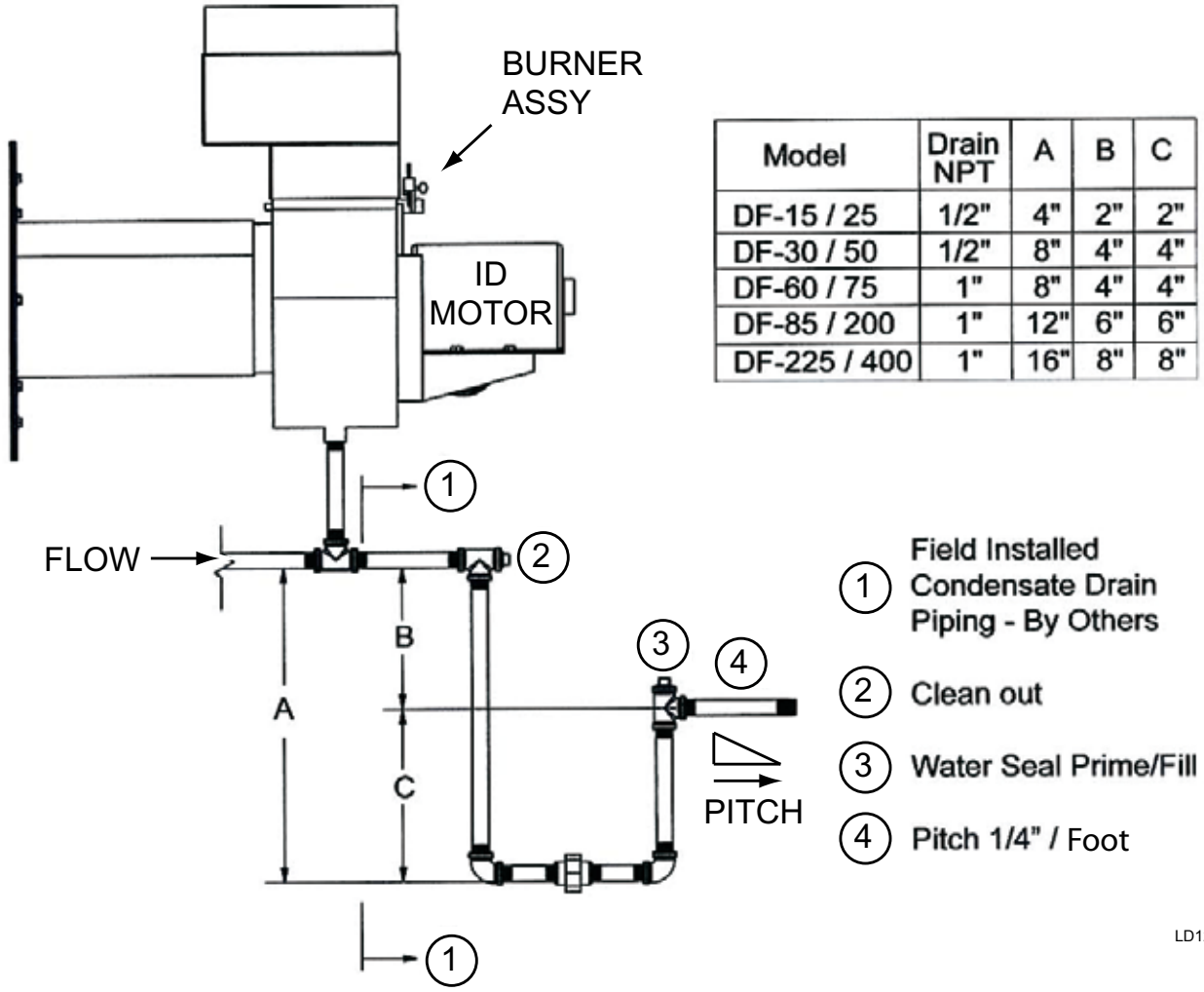
CONDENSATE DRAIN ARRANGEMENT

The YORK Solution Indirect Fired gas heat exchanger has the potential to create highly acidic condensation, particularly during extended operation at low capacity or low firing rate conditions. To insure proper drainage the following guidelines should be followed *(See Fig. 3-20).*

CAUTION

When constructing the condensate trap for the heat exchanger drainage system, make sure the trap is tall enough to handle the Total Static Pressure of the ID Blower at Low Fire times 2.

Example: TSP is 6" at Low Fire - construct trap 12" tall (See Table in Fig. 3-20).



Model	Drain NPT	A	B	C
DF-15 / 25	1/2"	4"	2"	2"
DF-30 / 50	1/2"	8"	4"	4"
DF-60 / 75	1"	8"	4"	4"
DF-85 / 200	1"	12"	6"	6"
DF-225 / 400	1"	16"	8"	8"

FIG. 3-20 – GAS FURNACE CONDENSATE DRAIN TRAP

CAUTION

Failure to follow these guidelines may cause excessive condensation build up resulting in water damage to the facility and/or a cracked heat exchanger.

1. Observe local jurisdiction codes for gravity condensate drainage requirements.

2. Be sure the air handler is installed at an elevation that enables proper condensate drainage and trapping dimensions as provided in Fig. 3-20. Minimum trap dimensions MUST be accommodated.

3. Condensate drain line size must be the full line size of the heat exchanger drain connection.

4. Drain lines, fittings and supports should conform to local codes and be suitable for the application.

5. Condensate drain and trap discharge should be pitched away from the equipment at a slope of 1/4" per linear foot or as local code dictates.

6. For outdoor or unconditioned space installations local climate may dictate the need to heat trace and/or insulate the exposed drain lines and trap. Frozen drain lines and/or trap will cause build up of condensate inside the heat exchanger resulting in leakage and damage to the air handler and possibly to the facility.

7. Provide unions in drain lines to allow removal of trap for periodic cleaning of drain lines as well as the trap. When the burner is operated at low capacity for extended periods, more condensate is generated and with it deposits of solids in the condensate drainage system.

8. Provide the ability to prime the trap. During initial and seasonal start up, trap inspection and priming is required. Condensate in the trap will evaporate during long periods of non-use.

GAS HEAT SEGMENT MODEL NUMBER NOMENCLATURE

B REV LEVEL	100 DF SIZE/ CAPACITY MBH		U CODE COMPLIANCE		3 BURNER TDR		L UNIT HAND YORK DESIGNATION		G ID FAN HOUSING		G UNIT VOLTAGE		A CONTROL VOLTAGE (T'STAT VOLTAGE)		A BURNER MOD CONTROL	
A	15	150	A	ANSI	3	3:1	L	Left	G	Galvanized	A	120/1/60	A	24	A	2-10 vdc
B	20	200	U	UL	10	10:1	R	Right	S	Stainless	B	200 or 208/3/60	B	120	B	4-20 mA
C	25	250	F	FM	25	25:1					C	277/1/60			C	0-135 Ohms
	30	300	R	IRI							D	230 or 240/3/60				
	35	350									E	380/3/60				
	40	400									F	440/3/50				
	45	450									G	460/3/60				
	50	500									H	380 or 415/3/50				
	60	600									J	575/3/60				
	75	750									K	220/3/50				
	85	850														
	100	1000														
	125	1250														
	150	1500														
	175	1750														
	200	2000														
	225	2250														
	250	2500														
	275	2750														
	300	3000														
	325	3250														
	350	3500														
	375	3750														
	400	4000														

GAS { GAS LP = 2,500 BTU/ CU FT.
NATURAL = 1,000 BTU/ CU FT.
Output is approx. 80% of input BTU's

TABLE 3-2 – NATURAL GAS PRESSURE REQUIREMENTS (INCHES WC)

		MAXIMUM ALLOW INLET PRESSURE											
NOMENCLATURE		A03	U03	F03	R03	A10	U10	F10	R10	A25	U25	F25	R25
FEATURE	GASBTUS	GAS BURNER PIPING/GAS BURNER TD											
OPTION		ANSI 3	UL 3	FM 3	IRI 3	ANSI 10	UL 10	FM 10	IRI 10	ANSI 25	UL 25	FM 25	IRI 25
	FURNACE OUTPUT (X10K)	ANSI 3:1	UL 3:1	FM 3:1	IRI 3:1	ANSI 10:1	UL 10:1	FM 10:1	IRI 10:1	ANSI 25:1	UL 25:1	FM 25:1	IRI 25:1
	015	14.00	NA	NA	NA	27.00	NA	NA	NA	NA	NA	NA	NA
	020	14.00	NA	NA	NA	27.00	NA	NA	NA	NA	NA	NA	NA
	025	14.00	NA	NA	NA	27.00	NA	NA	NA	NA	NA	NA	NA
	030	14.00	NA	NA	NA	27.00	NA	NA	NA	NA	NA	NA	NA
	035	NA	14.00	NA	27.00	NA	27.00	NA	27.00	NA	NA	NA	NA
	040	NA	14.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	045	NA	14.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	050	NA	14.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	060	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	075	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	085	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	100	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	125	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	150	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	27.00
	175	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	55.00	NA	55.00
	200	NA	27.00	NA	27.00	NA	27.00	NA	27.00	NA	55.00	NA	55.00
	225	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	250	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	275	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	300	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	325	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	350	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	375	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00
	400	NA	NA	27.00	27.00	NA	NA	27.00	27.00	NA	NA	55.00	55.00

	MINIMUM INLET PRESSURE TO FIRE											
	A03	U03	F03	R03	A10	U10	F10	R10	A25	U25	F25	R25
	GASBURNER PIPING/ GAS BURNER TD											
	ANSI 3	UL 3	FM 3	IRI 3	ANSI 10	UL 10	FM 10	IRI 10	ANSI 25	UL 25	FM 25	IRI 25
FURNACE OUTPUT (X10K)	ANSI 3:1	UL 3:1	FM 3:1	IRI 3:1	ANSI 10:1	UL 10:1	FM 10:1	IRI 10:1	ANSI 25:1	UL 25:1	FM 25:1	IRI 25:1
015	4.00	NA	NA	NA	13.00	NA	NA	NA	NA	NA	NA	NA
020	4.00	NA	NA	NA	13.00	NA	NA	NA	NA	NA	NA	NA
025	4.00	NA	NA	NA	13.00	NA	NA	NA	NA	NA	NA	NA
030	4.00	NA	NA	NA	13.00	NA	NA	NA	NA	NA	NA	NA
035	NA	5.00	NA	4.00	NA	4.00	NA	4.00	NA	NA	NA	NA
040	NA	5.00	NA	5.00	NA	5.00	NA	5.00	NA	18.00	NA	18.00
045	NA	5.00	NA	5.00	NA	5.00	NA	5.00	NA	18.00	NA	18.00
050	NA	5.00	NA	5.00	NA	5.00	NA	5.00	NA	18.00	NA	18.00
060	NA	6.00	NA	6.00	NA	6.00	NA	6.00	NA	19.00	NA	19.00
075	NA	6.00	NA	7.00	NA	6.00	NA	7.00	NA	19.00	NA	19.00
085	NA	9.00	NA	8.00	NA	9.00	NA	8.00	NA	19.00	NA	19.00
100	NA	11.00	NA	9.00	NA	11.00	NA	9.00	NA	20.00	NA	20.00
125	NA	8.00	NA	7.00	NA	8.00	NA	7.00	NA	20.00	NA	20.00
150	NA	11.00	NA	9.00	NA	11.00	NA	9.00	NA	20.00	NA	20.00
175	NA	15.00	NA	12.00	NA	15.00	NA	12.00	NA	34.00	NA	34.00
200	NA	15.00	NA	12.00	NA	15.00	NA	12.00	NA	38.00	NA	38.00
225	NA	NA	8.00	11.00	NA	NA	8.00	11.00	NA	NA	34.00	34.00
250	NA	NA	8.00	11.00	NA	NA	8.00	11.00	NA	NA	35.00	35.00
275	NA	NA	11.00	10.00	NA	NA	11.00	10.00	NA	NA	39.00	39.00
300	NA	NA	11.00	11.00	NA	NA	11.00	11.00	NA	NA	40.00	40.00
325	NA	NA	8.00	9.00	NA	NA	8.00	9.00	NA	NA	41.00	41.00
350	NA	NA	8.00	9.00	NA	NA	8.00	9.00	NA	NA	48.00	48.00
375	NA	NA	8.00	10.00	NA	NA	8.00	10.00	NA	NA	49.00	49.00
400	NA	NA	9.00	10.00	NA	NA	9.00	10.00	NA	NA	48.00	48.00

Note: Gas pressure requirements at the inlet to the main manual shutoff cock of the gas train.

TABLE 3-2A – PIPE SIZE REQUIRED

	INLET SIZE (NPT)											
	A03	U03	F03	R03	A10	U10	F10	R10	A25	U25	F25	R25
	GAS BURNER PIPING/GAS BURNER TURN DOWN											
	ANSI 3	UL 3	FM 3	IRI 3	ANSI 10	UL 10	FM 10	IRI 10	ANSI 25	UL 25	FM 25	IRI 25
FURNACE OUTPUT (X10K)	ANSI 3:1	UL 3:1	FM 3:1	IRI 3:1	ANSI 10:1	UL 10:1	FM 10:1	IRI 10:1	ANSI 25:1	UL 25:1	FM 25:1	IRI 25:1
015	0.75	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA	NA
020	0.75	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA	NA
025	0.75	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA	NA
030	0.75	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA	NA
035	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	NA	NA	NA
040	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00
045	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00
050	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00
060	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.00
075	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.25	NA	1.25
085	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.25	NA	1.25
100	NA	1.00	NA	1.00	NA	1.00	NA	1.00	NA	1.25	NA	1.25
125	NA	1.25	NA	1.25	NA	1.25	NA	1.25	NA	1.50	NA	1.50
150	NA	1.25	NA	1.25	NA	1.25	NA	1.25	NA	1.50	NA	1.50
175	NA	1.25	NA	1.25	NA	1.25	NA	1.25	NA	1.50	NA	1.50
200	NA	1.50	NA	1.50	NA	1.50	NA	1.50	NA	1.50	NA	1.50
225	NA	NA	2.00	1.50	NA	NA	2.00	1.50	NA	NA	2.00	2.00
250	NA	NA	2.00	1.50	NA	NA	2.00	1.50	NA	NA	2.00	2.00
275	NA	NA	2.00	1.50	NA	NA	2.00	2.00	NA	NA	2.00	2.00
300	NA	NA	2.00	1.50	NA	NA	2.00	2.00	NA	NA	2.00	2.00
325	NA	NA	2.50	2.50	NA	NA	2.50	2.50	NA	NA	2.50	2.50
350	NA	NA	2.50	2.50	NA	NA	2.50	2.50	NA	NA	2.50	2.50
375	NA	NA	2.50	2.50	NA	NA	2.50	2.50	NA	NA	2.50	2.50
400	NA	NA	2.50	2.50	NA	NA	2.50	2.50	NA	NA	2.50	2.50

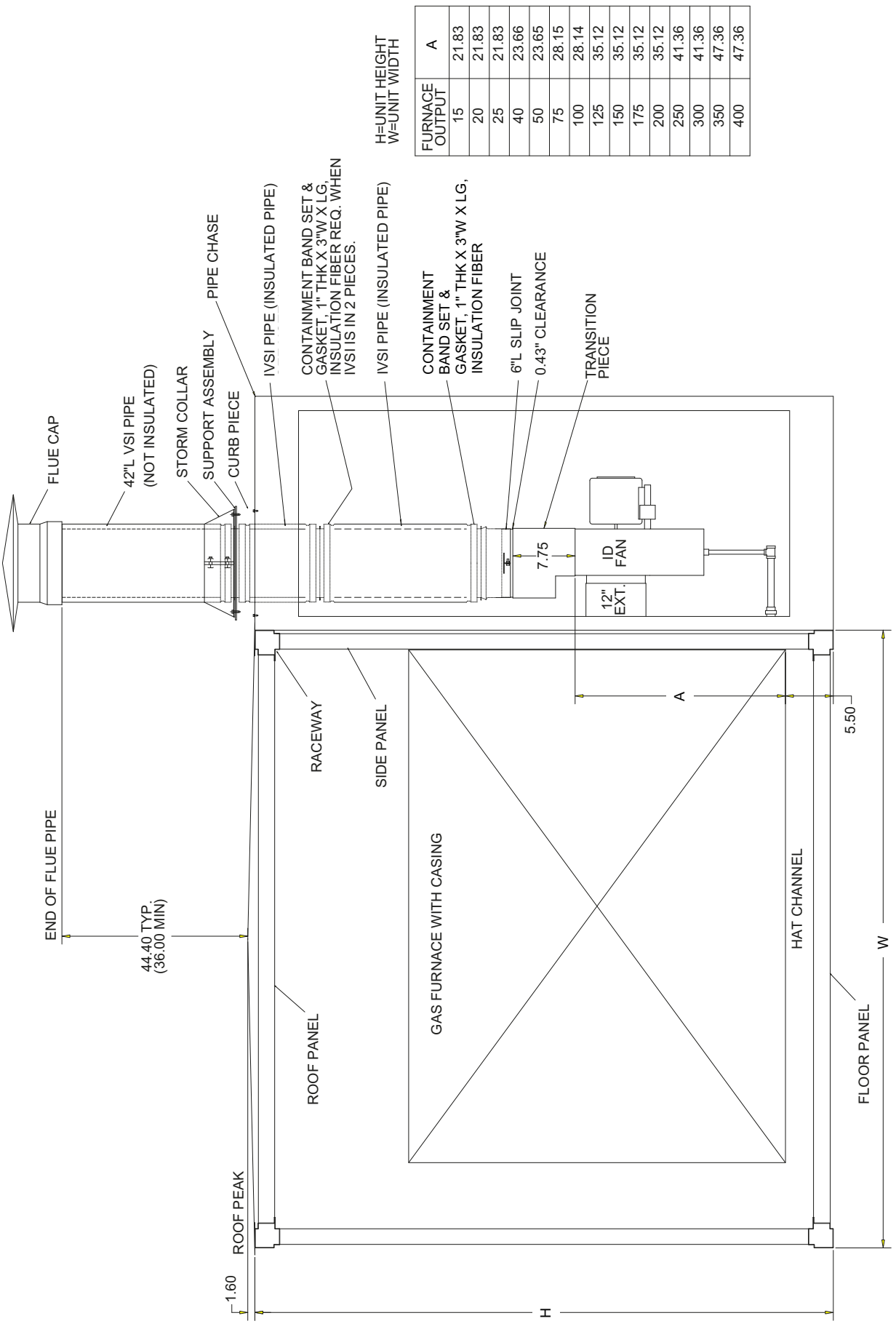


FIG. 3-21 – GAS FURNACE FUEL VENTING SYSTEM

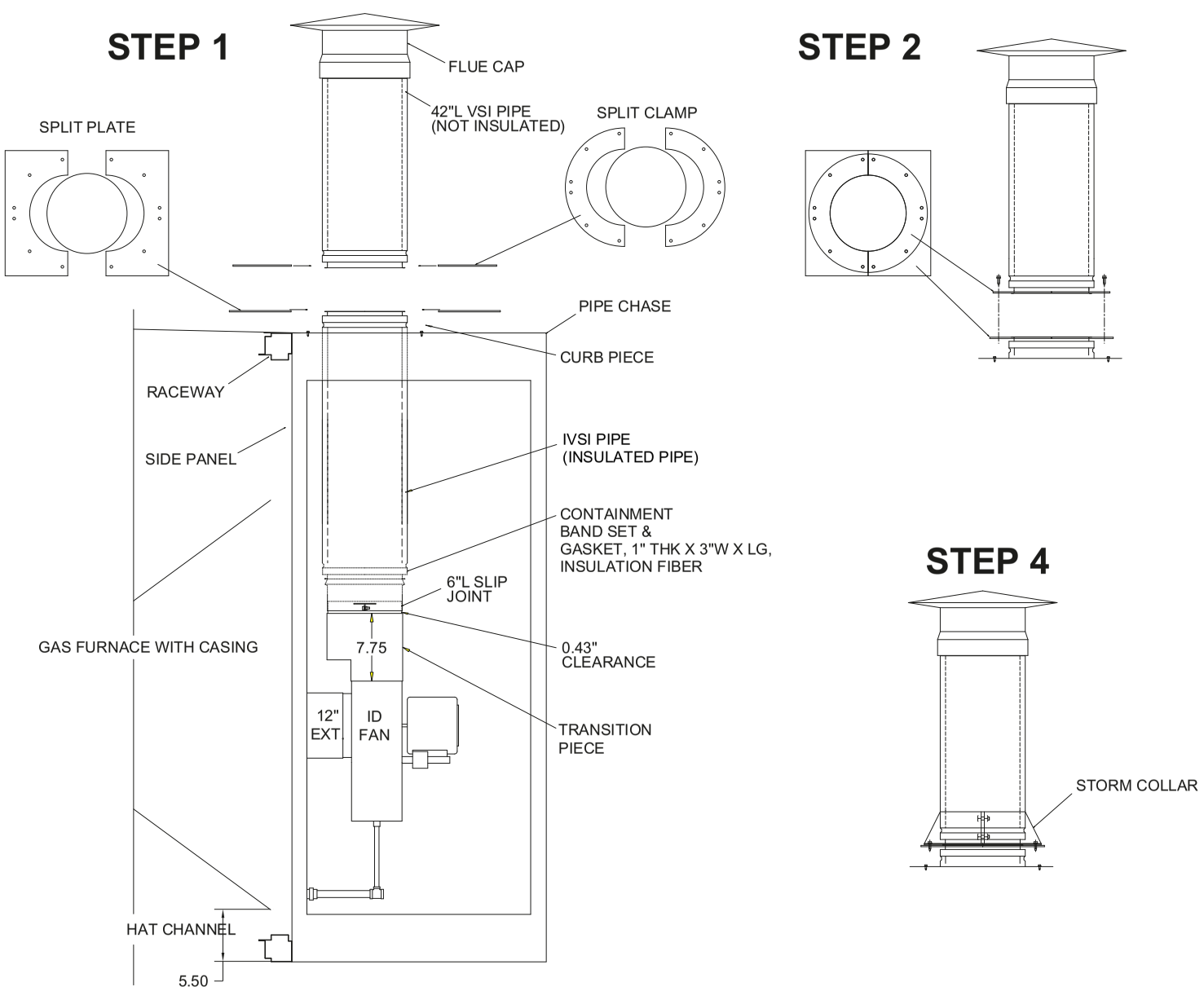
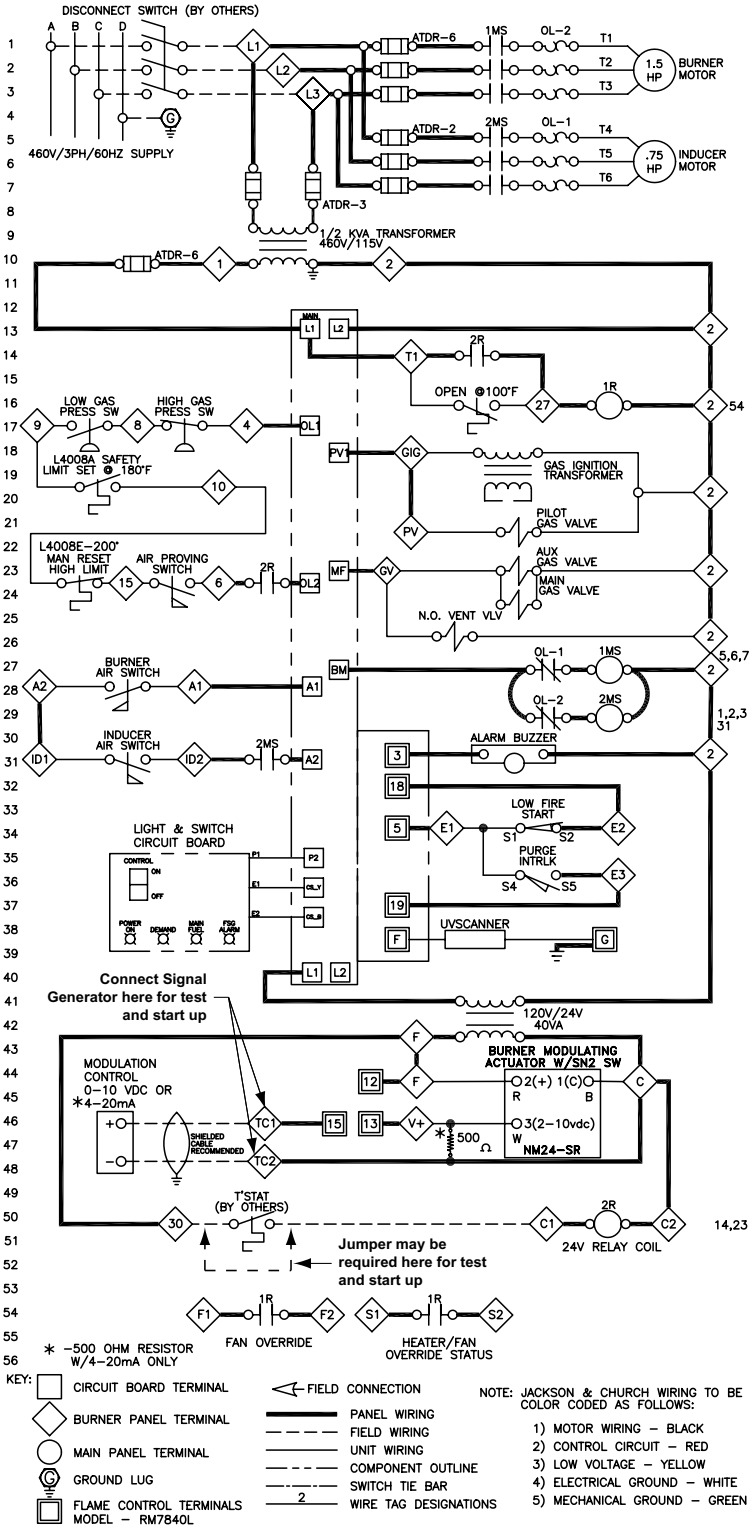


FIG. 3-22 – GAS FURNACE FUEL VENTING SYSTEM

LD13305

FOR REFERENCE ONLY



LD13315

FIG. 3-23 – TYPICAL WIRING DIAGRAM

TABLE 3-3 – BURNER TEMPERATURE RISE

CFM	TEMPERATURE RISE (°F)				INTERNAL PRESSURE DROP " WC
	DF-15	DF-20	DF-25		
1,500	91	--	--		0.17
2,000	68	91	--		0.29
2,500	55	73	91		0.46
3,000	46	61	76		0.65
3,500	40	52	65		0.89
4,000	35	46	57		1.17
4,500	31	41	51		1.47
5,248	26	35	44		2
	DF-30	DF-35	DF-40		
3,000	95	--	--		0.22
3,500	82	91	--		0.31
4,000	71	79	95		0.41
4,500	63	70	85		0.54
5,000	57	63	76		0.66
5,500	52	57	69		0.84
6,000	47	53	63		1
6,500	43	47	58		1.2
7,000	40	46	54		1.45
8,440	32.9	38.4	43.9		2
	DF-45	DF-50			
4,500	88	--			0.39
5,000	80	90			0.47
5,500	72	82			0.55
6,000	66	75			0.65
6,500	61	69			0.75
7,000	57	64			0.86
7,500	53	60			0.98
8,000	50	56			1.1
8,500	47	53			1.23
9,000	46	50			1.38
10,725	38.8	43.2			2

CFM	TEMPERATURE RISE (°F)				INTERNAL PRESSURE DROP " WC
	DF-60	DF-75			
6,000	91	--			0.44
6,500	84	--			0.52
7,000	78	--			0.6
7,500	73	91			0.68
8,000	68	85			0.78
9,000	61	76			0.98
10,000	55	68			1.2
11,000	50	62			1.4
12,000	46	57			1.7
12,900	43	53.8			2
	DF-85	DF-100			
8,500	91	--			0.47
9,000	86	--			0.52
9,500	81	--			0.58
10,000	77	91			0.64
10,500	74	87			0.7
11,000	70	83			0.76
12,000	64	76			0.9
13,000	59	70			1.05
14,000	55	65			1.25
15,000	51	61			1.4
16,000	49	57			1.6
17,000	46	54			1.75
17,825	44	52			2

TABLE 3-3 - BURNER TEMPERATURE RISE (CONT)

CFM	TEMPERATURE RISE (°F)				INTERNAL PRESSURE DROP " WC
	DF-125	DF-150			
13,000	89	--			0.48
14,000	83	--			0.56
15,000	77	93			0.65
16,000	72	87			0.73
17,000	68	82			0.82
18,000	64	77			0.92
19,000	61	73			1.03
20,000	58	69			1.13
21,000	55	66			1.25
22,000	52	63			1.35
23,000	50	60			1.5
24,000	48	58			1.3
25,000	46	55			1.75
26,315	43.6	52			2
	DF-175	DF-200			
17,000	95	--			0.45
18,000	90	--			0.52
19,000	85	--			0.57
20,000	81	93			0.63
21,000	77	88			0.7
22,000	74	85			0.76
23,000	71	81			0.82
24,000	68	78			0.9
26,000	62	71			1.05
28,000	58	66			1.25
30,000	54	62			1.4
32,000	51	58			1.6
34,000	48	54			1.8
35,635	45.5	52			2

CFM	TEMPERATURE RISE (°F)				INTERNAL PRESSURE DROP " WC
	DF-225	DF-250	DF-275	DF-300	
24,000	87	--	--	--	0.337
27,000	77	86	92.5	--	0.427
30,000	69	77	83.3	90.8	0.527
33,000	63	70	75.8	82.5	0.637
36,000	58	64	69.5	75.7	0.758
39,000	53	59	64	70	0.89
42,000	50	55	59.5	65	1.035
45,000	46	51	55.6	60.6	1.185
48,000	43	48	52.1	55.8	1.35
51,000	41	45	50	53.5	1.525
54,000	39	43	47	50.5	1.71
58,475	35	39.5	43.5	47.5	2
	DF-325	DF-350	DF-375	DF-400	
31,565	95	--	--	--	0.4
35,290	85	92	--	--	0.5
41,755	72	78	83	89	0.7
47,345	64	68	73	78	0.9
52,340	57	62	66	71	1.1
54,665	55	59	64	68	1.2
59,045	51	55	59	63	1.4
63,125	48	51	55	59	1.6
66,950	45	48	52	55	1.8
70,573	42.6	45.9	49.2	52.4	2

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