Bulletin AFX-1
January 2015
Supersedes AFX-1
Dated April 2014

AEROFLO

AFX SERIES
GAS FIRING

A TOTAL AIR CIRCULATION HEATING SYSTEM

INDIRECT FIRED SPACE HEATER FOR LARGE OPEN AREA INDUSTRIAL AND COMMERCIAL BUILDINGS

FEATURING

- High Air Delivery For Uniform Temperature
- Minimum Fan Horsepower
- Reduced Energy Consumption
- Low Noise Level
- Summer Ventilation Capability
- Low Installation Cost
- Easy to Service

MODELS AVAILABLE FROM:
25,000 to 150,000 SCFM
850 to 4,500 MBH OUTPUTS

IDEAL FOR TODAY'S INSULATED STRUCTURES

AFX SERIES AEROFLO HEATER

WHAT IS THE AEROFLO HEATER?

The Aeroflo heater is a rugged floor-mounted Industrial grade space heater that achieves uniform building temperature, moisture control and maximum heating efficiency using the principle of low velocity constant air circulation to heat large air volumes to lower temperatures.

WHERE SHOULD THE AEROFLO HEATER BE USED?

The Aeroflo heater has proven to be the correct way to heat industrial or commercial buildings with large open spaces. The total air circulation system provides uniform temperature throughout the space. Unit heaters, conventional space heaters, and infrared heaters function as spot or area heaters. These various units cannot offer the flexible building occupancy or the total space comfort of the Aeroflo heater. It is ideal for new or renovated facilities such as large warehouses, manufacturing plants, garages, aircraft hangars and service centers.

HOW DOES THE AEROFLO HEATER FUNCTION?

Continuously circulating the building's air volume several times each hour, the Aeroflo heater develops a gentle air rotation pattern, without requiring a duct system, as illustrated in Figure 1. Cooler air at the floor level is drawn through a screened intake in the base of the Aeroflo heater. Specially designed twin fans direct the air upward across the heat exchanger, thereby heating the air. The heated air is then discharged at low velocity from the top section of the unit through a screened hood. The air circulation continually sweeps warmer ceiling air down to the floor level, thereby minimizing stratification. This results in minimum temperature differentials (often 2° or less) throughout the space, assuring a uniform comfort level. As an added benefit, the problems of condensation on equipment and materials are considerably reduced.

For buildings requiring winter ventilation, the Aeroflo heater can be fitted with outside air intake sections to provide a source of heated fresh air. The Aeroflo heater can also furnish, quietly and with low power consumption, as much as one-half of a typical building's summer ventilation requirements.

WHERE SHOULD THE AEROFLO HEATER BE LOCATED?

The Aeroflo heater should be installed near high infiltration or "cold spot" areas; by doorways or along cold walls. Low pressure, created by the fans pulling air from the floor along with the returning high volume air mass, draws infiltrated or cold air back to the return air section of the unit.

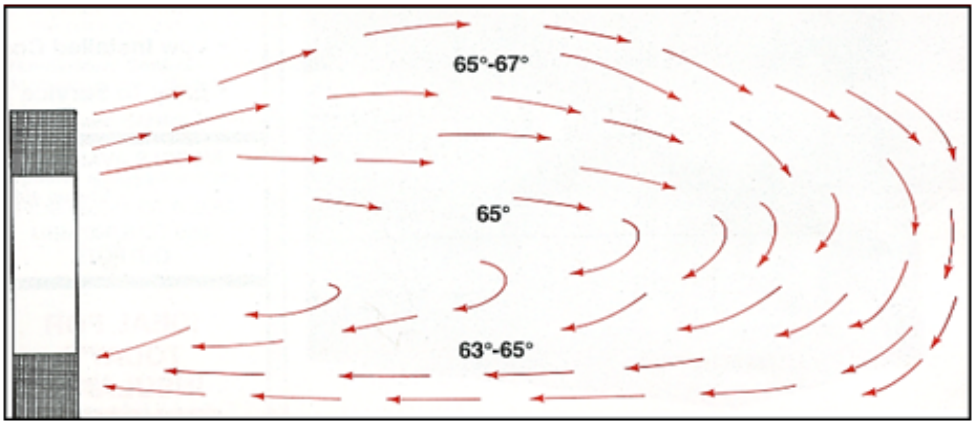
HOW DOES THE AEROFLO HEATER SAVE ENERGY?

For several reasons, heating larger air volumes to lower temperatures in the Aeroflo heater reduces fuel consumption in comparison to conventional space heaters which raise smaller air volumes to higher temperatures:

- Burner operation is reduced because the high volume air circulation minimizes air stratification, thereby returning warmer air to the heater.
- The large air volume circulation also utilizes heat recovered from internal and solar gains normally found at the upper building levels.
- Transmission heat losses are reduced because of lower indoor-outdoor temperature differentials at the upper building levels.

Aeroflo heaters offer several additional energy-saving features. Tandem propeller fans are used in place of conventional centrifugal blowers to reduce motor horsepower, thereby lowering operating power costs. Fuel consumption can be further reduced by operating the heater with night set-back and weekend clock and temperature control. As an added economy measure, heat recovered from complimentary equipment can be ducted into the Aeroflo discharge section. Or, preheat stream or water coils can be fitted to the heater as components of a heat recovery system.

Figure 1



Aeroflo Total Air Circulation Concept

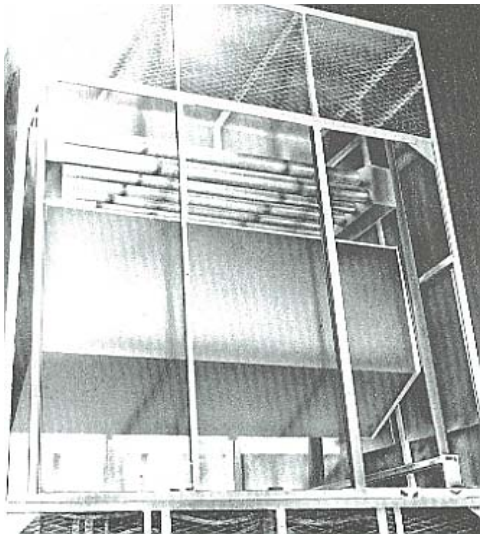
AFX AEROFLO FEATURES

LONG LIFE COMBUSTION CHAMBER

The floating heavy gauge, stainless steel combustion chamber is designed to withstand contraction and expansion cycles to ensure long, trouble-free operation. The original Counterflo combustion chamber was introduced over forty years ago. This time-tested reliability and proven performance assures the extended life of the Aeroflo chamber.

FOUR PASS HEAT EXCHANGERS

In the AFX Series Aeroflo heater design, the combustion products flow internal four times across the path of the air to be heated. The first two passes are within the primary heat exchanger, a stainless steel combustion chamber where the flame and hot gases release 75% of their total heat through contact with the entire chamber surface. The third and fourth passes are made in the secondary heat exchanger through two staggered economizer tube sections. The net result is a compact and highly efficient heat exchanger unit.

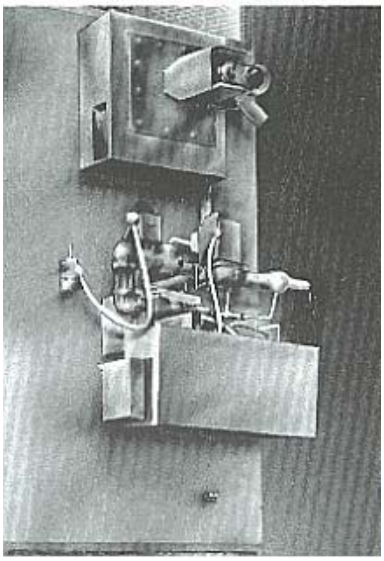


AIR COOLED RADIATION SHIELD

An internal, air cooled radiation shield is provided to ensure minimum radiation and transmission losses, less than 2%, and cool cabinet surfaces.

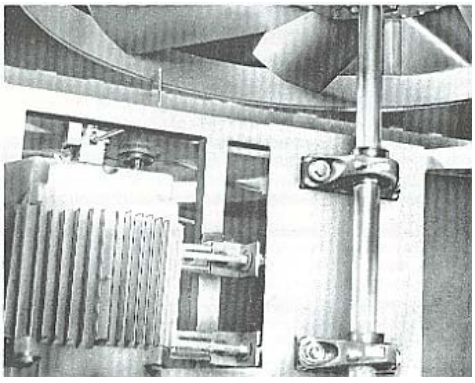
INDUSTRIAL QUALITY CONSTRUCTION

Integral tubular steel structural members provide maximum cabinet rigidity. Reinforced steel surfaces are cleaned and painted with heat and corrosion resistant industrial enamel.



FLUE GAS EXHAUSTER

The combustion gas exhaust system includes a heavy-duty exhaust fan, three phase motor, V-belt drives and heat slinger to yield low ambient temperature motor operating conditions.



PROPELLER FANS

Heavy-duty, turbine-bladed propeller fans provide high air flow at low velocity for minimum fan horsepower and quiet operation. All fans are tested in accordance with AMCA standards and driven by V-belts safely enclosed within the air intake section.

COMPLETE FIELD SERVICE CAPABILITIES

Hastings HVAC is the only commercial and industrial heating and ventilating equipment manufacturer with a company staffed in-house technical and parts organization. This insures that Hastings' products are properly built, properly installed and properly serviced.

Standard Equipment

CABINET
Indoor floor-mounted model.
Reinforced aluminized steel surfaces cleaned and painted with heat and corrosion resistant industrial enamel. Unit includes four side return air screens and integral steel structural members for maximum cabinet rigidity.
Low velocity discharge plenum with three sides screened and deflector.

FAN ASSEMBLY
Fans – Heavy-duty, 10 gauge, turbine-bladed propeller fans tested in accordance with AMCA standards. Two fans per unit (AFX-240 through AFX-284), three fans per unit (AFX-360).
Shaft – Cold-rolled steel, machined journals with first critical speed limited to at least 25% above maximum operating speed.
Bearings – Self-aligning, pre-lubricated pillow block, thrust bearings, extended grease lines.

MOTORS
Premium efficient three phase, open dripproof type on adjustable mount. Two motors per unit (AFX-248 through AFX-284), three motors per unit (AFX-360).

DRIVES
Variable pitch sheaves with V-belts safely enclosed within the air intake section.

HEAT EXCHANGER
Primary exchanger, all-welded 14 gauge #430, stainless steel, designed for two passes and transfer of 75% of total heat release. Two staggered sections of stainless steel secondary tubes insure maximum combustion efficiency.

FLUE GAS EXCHANGER
Combustion gas exhaust system includes a heavy-duty exhaust fan, three phase motor, V-belt drive.

CONTROLS
Safety Control - Electronic sequencing burner safety relay with main and pilot flame sensing. Flame rod on gas.
Prepurge Timer - Provides four full internal air changes prior to ignition.
Fan/Limit Switch - Provides for continuous fan operation and for burner shutdown.
Draft Switch - Insures operation of exhauster prior to ignition and burner shutdown on loss of draft.
Combustion Air Switch - Prevents burner operation in the absence of proper combustion air flow.
Burner Switch - Manually de-energizes burner circuit.
Blower Starter - Magnetic, three-phase, across-the-line.
NEMA 1 Control Box - with a fused dead front disconnect which manually de-energizes blowers and control circuit.
Thermostat - Maintains desired space temperature utilizing two stage return air thermostat.

BURNER
Standard burner is Hi/Lo/Off.
Gas (G) – Power type, with pilot spark ignition and main burner pilot ignition for use with natural, manufactured, mixed, liquefied petroleum gas or liquefied gas/air mixture. Included in the manifold are main gas electric shut-off valve with linkage to combustion air damper, main and pilot gas pressure regulators for maximum inlet pressure of 1 PSI, pilot gas-air mixer and pilot solenoid valve. Minimum standard entering pressure is 4 ozs.
Intake/Discharge Screens - Flattened and expanded metal screens.

FACTORY TESTED
Factory piped, wired and flame tested.

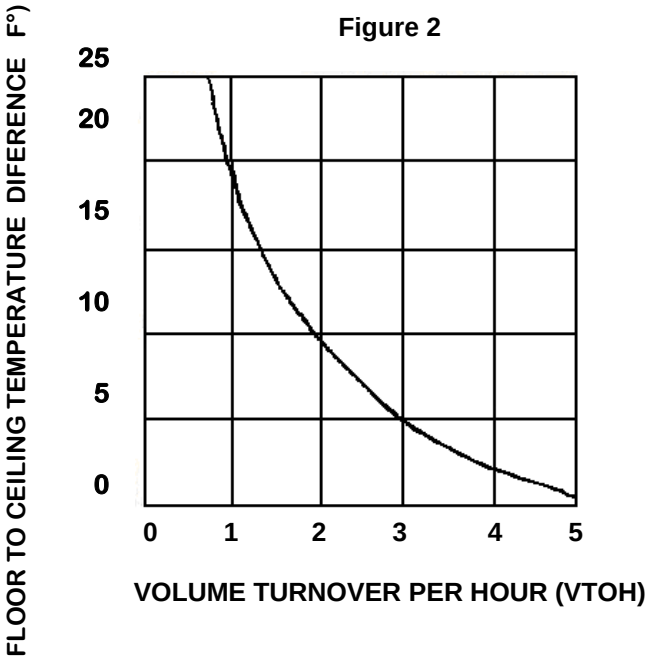
Options and Accessories

Discharge Plenum Extension - For installations where additional height is needed to avoid obstructions or for tall buildings to insure proper air circulation.
Fresh Air Intake - Motorized damper mounted in fan section for minimum outside air (10%).
FM or IRI Controls - Adds controls for these approvals.
High Gas Pressure Regulator - For inlet gas pressure from 1 to 75 PSIG.
Low Gas Pressure Controls - Reduces inlet gas pressure requirement by 3 inches w.c.
TEFC Motors - Fan, exhauster and burner motors.
Modulating Burner - 2:1 full modulating burners are available.
Circuit Breaker - in lieu of fused disconnect switch.
NEMA 12 Control Box
Summer-Winter Switch
Remote Station - with operating switch and indicating lights
Day-Night Operation.
Alarm Light or Audible Alarm.
Flat Bank Filter Section
Coils - Chilled water or direct expansion available on most sizes.
U.L. Labeled Control Panels
ETL Labeled Unit (Natural gas only**)**

HOW TO SELECT AN AFX AEROFLO

Step 1 Calculate the total space heat loss in MBH for the building to be heated including transmission ventilation and infiltration losses less any appreciable internal heat gains.

Figure 2



Step 2 Determine the net building volume (NBA) to be heated exclusive of stored materials, office cubicles, large machinery, etc.

Step 3 Select a desired air volume turnover per hour (VTOH). Experience indicates that 3 to 4 VTOH results in optimum operation of the AFX Aeroflo. For reference, Figure 2 presents an empirically developed relationship of floor to ceiling temperature difference as a function of volume turnover per hour for a typical structure. It should be noted that very high or low ceilings, or high localized internal heat gains could cause variations in the distribution shown.

Step 4 Calculate required air flow in SCFM using the net building volume (NBV) from Step 2 and volume turnover per hour (VTOH) of Step 3 in the following formula:

$$SCFM = \frac{NBV \times VTCH}{60}$$

Step 5 Select the AFX Aeroflo

a. Use Selection Table to pick AFX model whose Maximum SCFM and Burner Output (MBH) meet both the SCFM requirement of Step 4 and space heat loss of Step 1.

b. Discharge air temperature from the AFX Aeroflo heater, that is the total of design space room temperature plus the temperature rise, is recommended to be approximately 100° F, not exceeding 120°F.

NOTE: Your local Hastings sales representative will be pleased to offer assistance in estimating heat losses, proper equipment location, of other AFX Aeroflo application information. Your representative can also furnish information on the AFC Series Aeroflo heaters equipped with steam, hot water or electric heating coils.

EXAMPLE OF AFX SELECTION

PROBLEM:

Heat warehouse.
Size of warehouse 20' wide x 360' long x 25' high.
Warehouse stock and office cubicles occupy 40% of total building volume.
Design space temperature: 65° F
Fuel: Natural Gas
Desired burner control: Hi/Lo/Off

SOLUTION:

Step 1 Calculate total space heat loss:
Total heat loss was calculated to be 2,074,000 Btuh or 2074 MBH

Step 2 Net building volume
NBV = 200 x 360 x 25 x (100% - 40%)
NBV = 1,080,000 Cu. Ft.

Step 4 Total air flow required

$$SCFM = \frac{NBV \times VTOH}{60}$$

$$SCFM = \frac{1{,}080{,}000 \times 3}{60} = 54{,}000$$

Step 5 Select AFX Aeroflo
From Selection Table -
a. Proceed under the "Maximum SCFM" column to determine which model to select for the required 54,000 SCFM. This air quantity falls in the AFX-260 range. Fans with 5 hp motors have a maximum of 52,000 SCFM so the selection is an AFX-260 with (2) 7-1/2 HP motors capable of a maximum of 58,000 SCFM. (The belts and drives will be set at the factory for the desired 54,000 SCFM.)
The next step is to check burner capacity in the SCFM and motor HP range selected. The total heat loss was calculated to be 2,074 MBH. The smallest burner in this category which satisfies the heating requirement is 1,500 MBH. The final selection is thus completed: (1) Model AFX-260-G2 with (2) 7-1/2 HP motors, a 2,250 MBH natural gas fired burner and Hi/Lo/Off burner control.

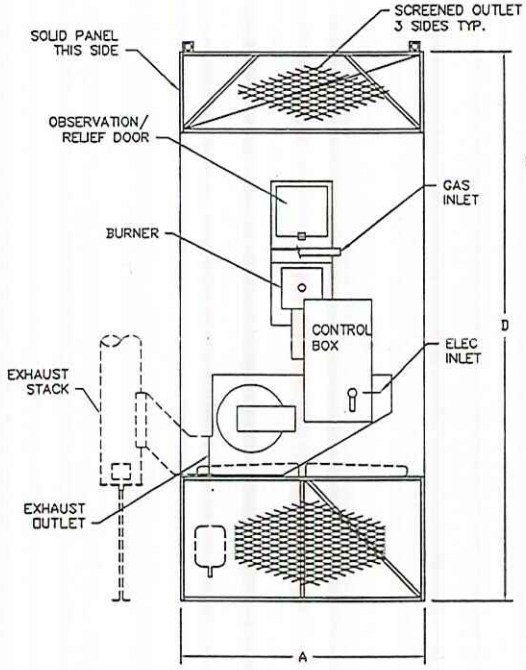
b. Check discharge air temperature.

$$\text{Temp. Rise} = \frac{\text{MBH Output} \times 1{,}000}{\text{SCFM} \times 1.08} \quad \text{or use Table}$$

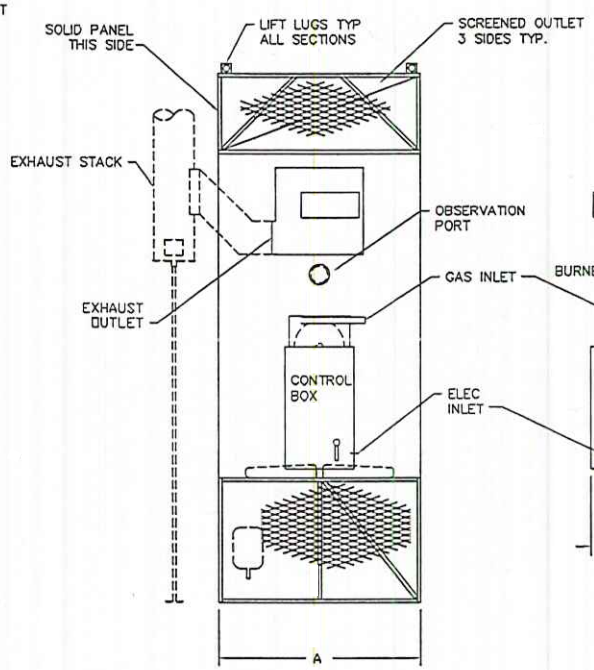
$$\text{Temp. Rise} = \frac{2{,}250 \times 1{,}000}{54{,}000 \times 1.08} = 38.6°$$

Discharge Air Temp. = 65° (design) + 32.2° = 103.6°

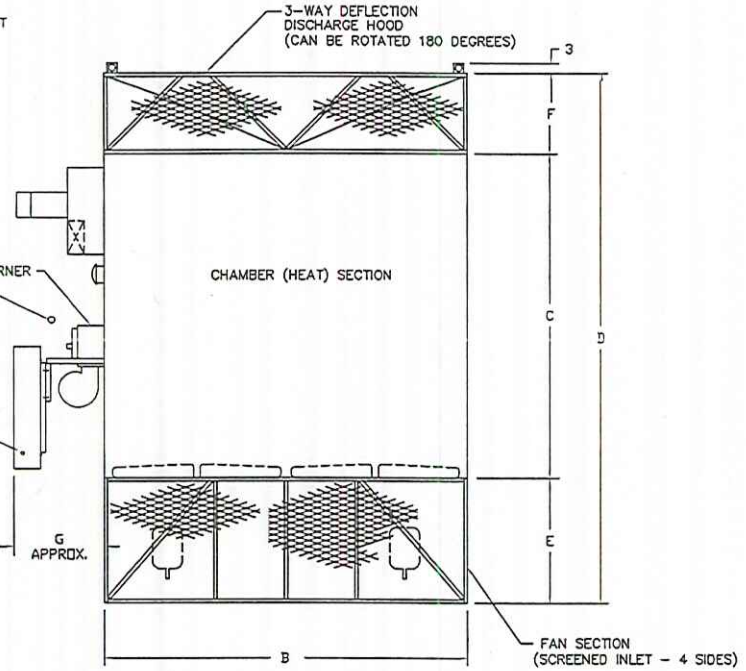
Note: Cost considerations may warrant an alternate selection of a Model AFX-260 with (2) 5 HP motors and an air delivery of 52,000 SCFM, thus yielding 300 VTOH. As shown in Figure 2, there is only a small increase in the floor to ceiling temperature difference for a typical building when reducing the volume turnover per hour from 3 to 2.89.



FRONT ELEVATION
AFX 260–360



FRONT ELEVATION
AFX 248–254



SIDE ELEVATION
ALL MODELS

MODEL DESIGNATION

AFX – XXX – X – X

Size:
X – Number of fans
XX – Diameter of fans

Fuel:
G – Gas

Controls:
2 – Hi/Lo/Off
2:1 – Full Modulation with 2:1 turndown

	AFX MODEL					
	248	254	260	272	284	360 (40A)
A	60	72	72	96	96	90
B	108	120	145	182	212	210
C	96	96	102	102	102	102
D	157	157	163	163	163	258
E	37	37	37	37	37	96
F	24	24	24	24	24	60
G	25	25	28	29	29	29

Dimensions in inches

NOTE: All standard models are designed to ship in two pieces; (a) heating section and (b) fan section with discharge plenum stacked on top. AFX-248 single order units will ship LTL; all other models and quantities must ship via dedicated trailer.

SELECTION TABLE

Model	Maximum SCFM	3 Phase Motors		Burner Output	Temp. Rise	Fuel Consumption	Burner Motor HP	3 Phase Exhauster Motor HP	Stack Diameter Size (In.)	Approx. Shipping Wt. (lbs.)
		HP	NO	(MBH)	(°F)	Gas (1)CFH	Gas			
AFX-248 (42")	25,000	3	2	850	31.5	1063	1/6	1/2	10	4000
				1,100	37.0	1250	1/6	3/4	10	
				1,250	46.3	1563	1/6	3/4	12	
	27,000	3	2	850	29.1	1063	1/6	1/2	10	
		5	2	1,000	34.3	1250	1/6	3/4	10	
				1,250	42.9	1563	1/6	3/4	12	
	32,000	5	2	850	24.6	1063	1/6	1/2	10	
				1,000	28.9	1250	1/6	3/4	10	
				1,250	36.2	1563	1/6	3/4	12	
				1,500	43.4	1875	1/6	3/4	12	
	37,000	5	2	1,000	25.0	1250	1/6	3/4	10	
				1,250	31.3	1563	1/6	3/4	12	
				1,500	37.5	1875	1/6	3/4	12	
				1,750	43.8	2188	1/6	3/4	12	
	44,000	7 1/2	2	1,250	26.3	1563	1/6	3/4	12	
				1,500	31.6	1875	1/6	3/4	12	
				1,750	36.8	2188	1/6	3/4	12	
				2,000	42.1	2500	1/6	3/4	12	
AFX-254 (48")	41,000	5	2	1,000	22.6	1250	1/6	3/4	10	5800
				1,250	28.2	1563	1/6	3/4	12	
				1,750	39.5	2188	1/6	3/4	12	
	50,000	7 1/2	2	1,250	23.1	1563	1/6	3/4	12	
				1,750	32.4	2188	1/6	3/4	12	
	57,000	7 1/2	2	1,250	20.3	1563	1/6	3/4	12	
		10	2	1,750	28.4	2188	1/6	3/4	12	
				2,000	32.5	2500	1/6	3/4	12	
AFX-260 (54")	52,000	7 1/2	2	1,250	22.3	1563	1/6	3/4	12	6100
				1,750	31.2	2188	1/6	3/4	12	
	58,000	7 1/2	2	1,500	23.9	1875	1/6	3/4	12	
				1,750	27.9	2188	1/6	3/4	12	
				2,250	35.9	2813	1/6	1	12	
	65,000	10	2	1,500	21.4	1875	1/6	3/4	12	
				1,750	24.9	2188	1/6	3/4	12	
				2,250	32.1	2813	1/6	1	12	
				2,500	35.6	3125	1/6	1	12	
AFX-272 (72")	70,000	10	2	1,750	231	2188	1/6	3/4	12	6500
				2,250	29.8	2813	1/6	1	12	
				2,750	36.4	3438	1/2	1	16	
	80,000	10	2	1,750	20.2	2188	1/6	3/4	12	
				2,500	28.9	3125	1/6	1	12	
				3,000	34.7	3750	1/2	1	16	
	85,000	10	2	2,000	21.8	2500	1/6	3/4	12	
				2,250	24.5	2813	1/6	1	12	
				3,000	32.7	3750	1/2	1	16	
	100,000	15	2	2,250	20.8	2813	1/6	1	12	
				2,750	25.5	3438	1/2	1	16	
				3,250	30.1	4063	1/2	1	16	
AFX-284 (72")	85,000	10	2	2,250	24.5	2813	1/6	1	12	7000
				2,500	27.2	3125	1/6	1	12	
				2,750	30.0	3438	1/2	1	16	
	95,000	15	2	2.500	24.4	3125	1/6	1	12	
				2,750	26.8	3438	1/2	1	16	
				3,000	29.2	3750	1/2	1	16	
	105,000	15	2	2,750	24.2	3438	1/2	1	16	
				3,250	28.7	4063	1/2	1	16	
				3,500	30.9	4375	3/4	2	18	
	115,000	15	2	3,250	26.2	4063	1/2	1	16	
				3,500	28.2	4375	3/4	2	18	
AFX-360 (60")	120,000	10	3	4,500	34.7	5625	3/4	2	18	10,000
	135,000	15	3	4,500	30.9	5625	3/4	2	18	
	150,000	15	3	4,500	27.8	5625	3/4	2	18	

(1) 1,000 BTU/Cu. Ft.

AFX SERIES AEROFLO HEATER
Engineers Specifications

Furnish and install the following Hastings gas heating equipment.

Item No.	Model No.	SCFM	Motor HP/ Volts/Phase	Burner Output (MBH)	Fuel Consumption (Gas-CFH)	(Gas) Pressure

The heater shall consist of the following basic assemblies:

1. **Fan Section –** Fan section shall have heavy-duty, turbine-bladed, propeller fans. All fans will be tested in accordance with AMCA standards and driven by a V-belt arrangement consisting of a three-phase, open, dripproof type motor on an adjustable mount. Intake to be low velocity type.
2. **Cabinet Section –** The portion of the casing enclosing the heat exchanger shall be backed with a carbon steel radiation shield. Air must travel up both sides of the radiation shield to ensure that radiation and transmission loss is less than 2%. Discharge plenum shall be of the low velocity type. All extensions shall be prefabricated, painted to match basic cabinet, and easily bolted into place. Surfaces are to be cleaned and painted with heat and corrosion resistant industrial enamel.
3. **Heater Section –**
   A. The primary heat exchanger shall be of all-welded #430 stainless steel construction with a minimum of 16 gauge material and shall have no refractory lining. The chamber shall be designed for a minimum of two-pass flame travel within the exchanger and approximately 75% of the total heat transfer shall be within the primary area.
   B. The secondary heat exchanger shall consist of a minimum of two staggered sections of stainless steel tubes. The stainless steel tubes welded, into collection boxes at each end. A removable plate shall be provided to enable access to all tubes for cleaning purposes. Heat exchangers of less than four-pass arrangement will not meet the requirements of the energy efficiency standards of this specification.
   C. The burner shall be (Hi/Lo/Off) (Modulating) type for burning natural gas or propane gas. **(Insert burner description shown on page 4 of this bulletin.)**
   D. The combustion exhaust gas system shall include a heavy-duty exhaust fan, three phase motor, belt, or direct drive and adjustable pitch sheave. The complete assembly will be positioned at the collection box where the combustion gases leave the heater. This exhaust fan shall provide for suitable pre-purging of the heat exchanger section. Exhauster RPM to remain at 2000 or below.
   E. The flame observation port will be located on the burner side of the heater.
   F. A NEMA-1 control box with dead front disconnect shall be located on the burner side of the heater. Controls shall include motor starters, fused disconnect switch, control and ignition transformer, a primary burner control that incorporates the electronic principle of flame control and a timer for purging the heat exchanger before every start-up.
4. **Temperature Control –** Electronic temperature control system shall consist of an (unmounted) (mounted) (Hi/Lo/Off) (modulating) room thermostat.
5. **Testing and Service –** Heater(s) shall be piped, wired and flame tested before leaving factory. Optional start-up service and instructions to owner's personnel shall be furnished by unit manufacturer's field service engineer.
6. **Options and Accessories –** The following items are to be furnished **(Insert desired items from page 4 of this bulletin.)**

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