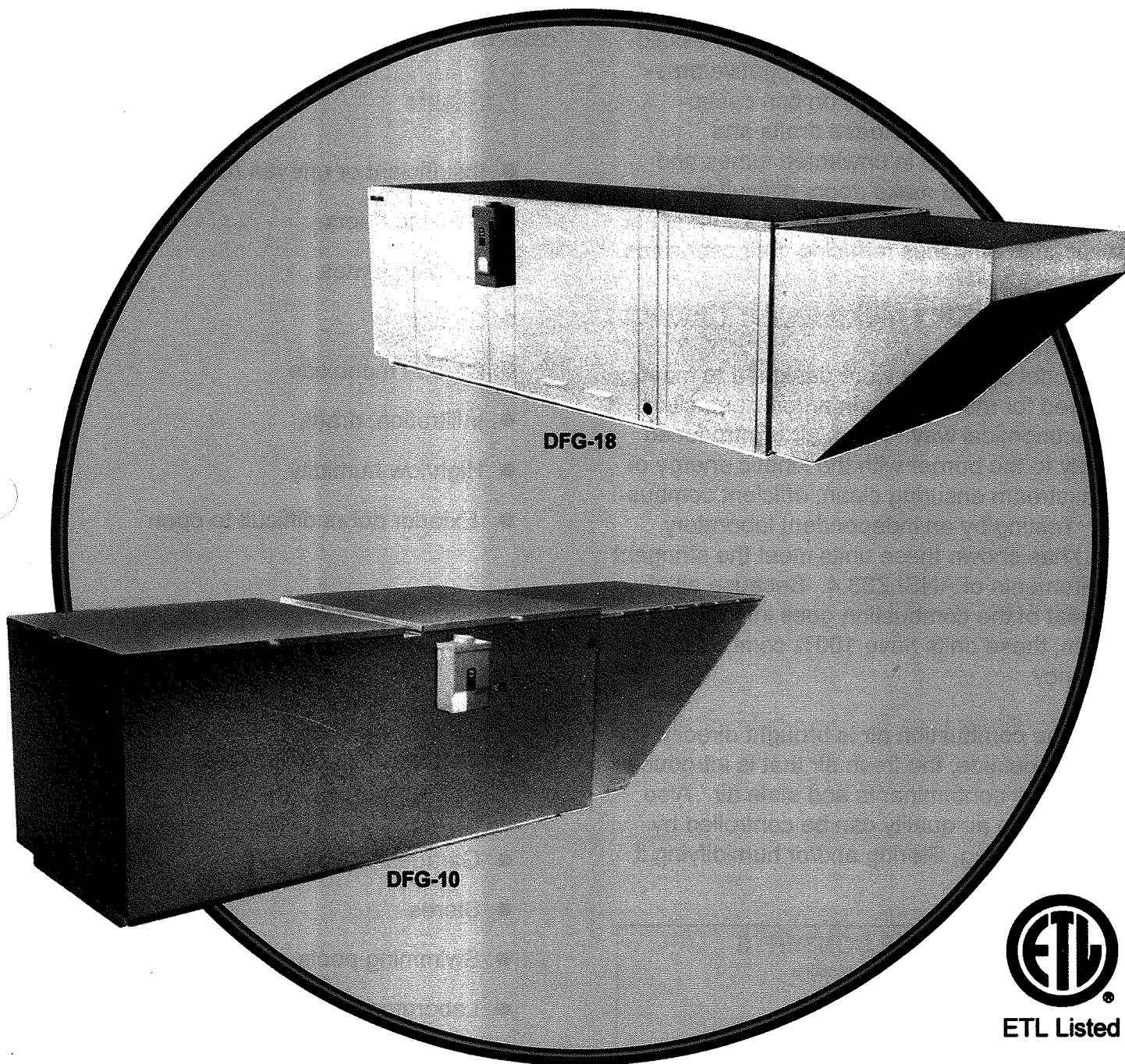


DIRECT FIRED GAS MAKE-UP AIR HEATERS

MODEL DFG



ETL Listed

**AIR DELIVERIES FROM 1,000 TO 15,000 SCFM
HEAT INPUT FROM 34,000 TO 1,650,000 BTU**

KEES, INCORPORATED • 400 S. INDUSTRIAL DRIVE • P.O. BOX L
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MODEL DFG DIRECT FIRED GAS MAKE-UP AIR HEATERS

The Need for Make-up Air

Kitchen ventilation and industrial processes require the exhausting of air contaminants, undesirable odors and excessive heat. Oftentimes more air is exhausted from a building than is supplied causing a negative pressure condition. This condition can cause backdrafts in flues, increase drafts and crosscurrents, draw in unwanted fumes and contaminants and make doors difficult to open. It can also increase the static pressure against the exhaust fans thus reducing their capacities.

Direct Fired Gas Make-up Air Heaters

The Model DFG units were designed to meet the need for make-up air in an efficient, clean and economical way. Fresh air is introduced directly to the burner with the kinetic energy of the airstream ensuring clean, efficient combustion. Testing by an independent laboratory (ETL) has shown these units meet the stringent requirements of ANSI Z83.4. Because all of the heat of the combustion goes into the airstream, these units have 100% combustion efficiency.

Since the combustion air is brought directly from the outside, the fresh air that is introduced can reduce contaminants and stale air. Also, the make-up air quality can be controlled by heating, cooling, filtering and/or humidifying it through the unit.

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Pg. 3	Construction Features
Pg. 4	Optional Components
Pg. 5	Temperature Control Systems
Pgs. 6,7	Model DFG Control Systems
Pg. 8	Gas Manifold Diagrams
Pg. 9	Direct Fired Gas Burner And Wiring Diagram
Pg. 10	Model DFG With V-Bank Filters
Pg. 11	Model DFG With Flat Filter Bank
Pg. 12	Roof Curb Dimensional Data
Pg. 13	Discharge Arrangements And Selection Guide
Pgs. 14,15	Performance Tables
Pg. 16	Typical Specifications

Typical Applications

The make-up air supplied by Model DFG units can resolve numerous problems related to air handling and can fit into a wide variety of applications.

Problems

- Insufficient or uneven heat
- Cooking odors
- Welding fumes
- Smoke
- Carbon monoxide
- Infiltration, drafts
- High/low humidity
- Exterior doors difficult to open

Applications

- Kitchens
- Factories
- Warehouses
- Garages
- Stores
- Swimming pools
- Laboratories
- Auditoriums
- Outside doors
- Lobbies

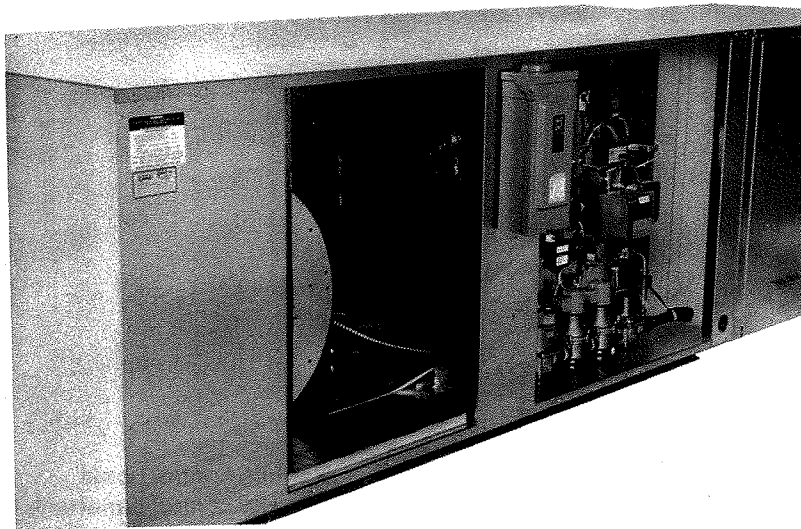
Standard Construction

Housing

- G90 galvanized steel housing
- weatherproof construction
- curb cap or channel base
- 1" insulation to prevent condensation and provide a thermal and acoustic barrier
- large access panels for easy servicing
- 1" aluminum mesh filters in a V-bank arrangement (flat filter arrangement is optional)
- intake weatherhood with birdscreen

Blower Compartment

- forward curved, double width, double inlet blower
- precision machined steel shaft
- blower wheels statically and dynamically balanced
- adjustable V-belt drives up to 10 HP
- pulleys and belt selected for not less than 165% of driven horsepower
- fan and motor mounted on vibration isolators
- self-aligning, pre-lubricated bearings
- ODP motor with adjustable motor mount



Control Compartment

- controls mounted in weatherproof enclosure and wired to a numbered terminal strip
- wired in compliance with NEC
- all wiring color coded
- all components are UL recognized
- electronic flame safety control
- flame rod safety flame detection system
- main gas safety shutoff valve
- high temperature limit switch
- air flow proving switch
- Maxitrol electronic modulating gas valve with temperature controller
- main & pilot gas pressure regulators
- electric spark intermittent pilot
- automatic pilot valve
- main & pilot hand shutoff valves
- ignition transformer
- motor starter with overload protection
- control circuit fuses

Burner Compartment

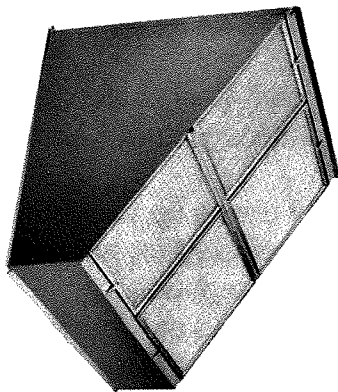
- direct fired gas burner (natural gas or propane)
- modulating with up to 30 to 1 turndown ratio
- required air velocity maintained by an adjustable profile plate
- burner assembly and gas manifold prepiped and factory test fired
- gas supplied at relatively low pressure
- observation port to view pilot and main flame

The Model DFG units can meet various needs and come with a complete line of optional accessories. These options can be found in the following pages. Do not hesitate to contact your local representative to inquire about special applications.

**HEATER IS FACTORY ASSEMBLED,
WIRED AND FLAME TESTED.**

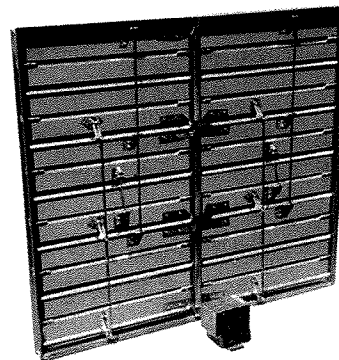
Optional Components

**INTAKE WEATHERHOOD
WITH FLAT FILTERS**

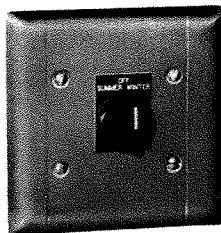


NOTE: This option replaces the V-bank filter section and intake weatherhood which are standard components.

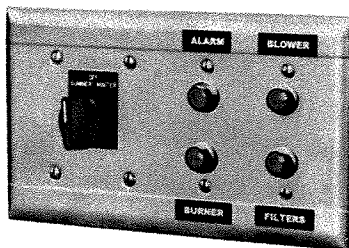
**MOTORIZED
DAMPER**



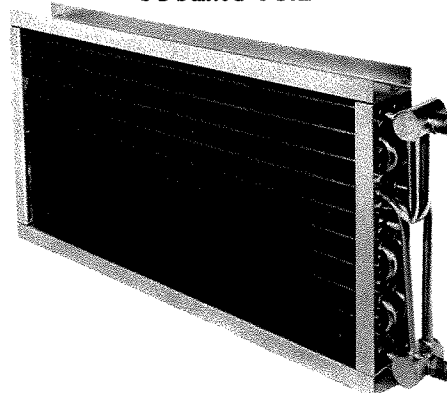
**REMOTE CONTROL
PANEL**



**REMOTE CONTROL PANEL
WITH OPERATING LIGHTS**



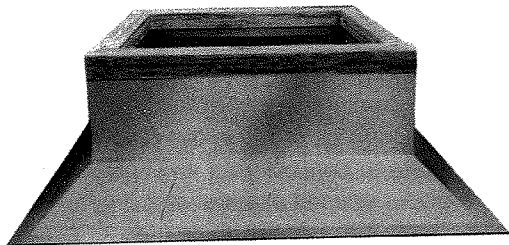
COOLING COIL



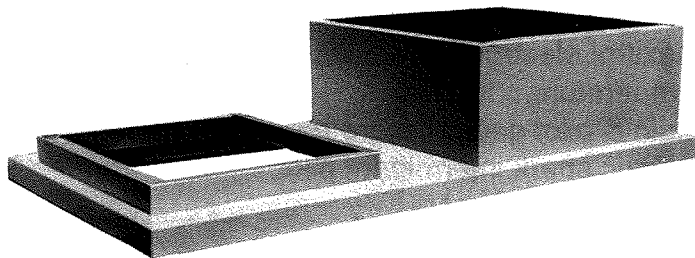
Optional Components

- | | |
|--|--|
| 1. Discharge arrangements (see page 13) | 13. Remote control panel |
| 2. Intake weatherhood with filters and birdscreen | 14. Remote control panel with indicator lights |
| 3. Roof curbs | 15. 115V duplex service receptacle |
| 4. Modular curb adaptors | 16. Control system diagnostic indicator |
| 5. Motorized intake or discharge damper | 17. Painted housing |
| 6. Special filters (high efficiency, 2" thick, etc.) | 18. Cooling coil section |
| 7. Totally enclosed or high efficiency motors | 19. Evaporative cooling section |
| 8. Room override thermostat | 20. High and/or low gas pressure switches |
| 9. Mild weather thermostat (intake air thermostat) | 21. High pressure regulator |
| 10. Low temperature limit switch (freezestat) | 22. Spring isolators under blower and motor |
| 11. Clogged filter switch & indicator light | 23. Hanging or floor isolators for entire unit |
| 12. Additional motor starter(s) for exhaust fan(s) | |

STANDARD ROOF CURB



MODULAR CURB ADAPTOR



CONTACT FACTORY FOR AVAILABILITY OF ANY OPTION NOT LISTED ABOVE.

Temperature Control Systems

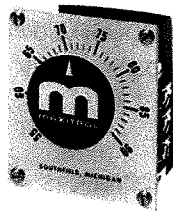
Maxitrol Series 14 - Make-up Air Applications (Standard System)

The Maxitrol Series 14 temperature control system is comprised of four components which work together to maintain a constant discharge air temperature. The discharge temperature sensor determines the discharge air temperature. If it is below the set point of the remote temperature selector then a signal is sent to the amplifier. This signal is used to modulate the gas valve to high fire. As the temperature approaches the setpoint the valve closes in small increments until the setpoint is reached. The valve remains in this position until the outside air temperature changes. The system works in reverse upon a temperature increase.

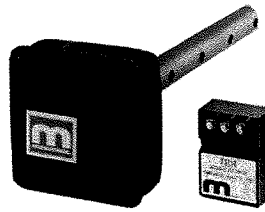
An optional room override thermostat provides the ability to "override" the discharge temperature sensor and raise the discharge air temperature when more heat is needed to maintain the room temperature.



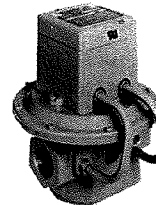
AMPLIFIER



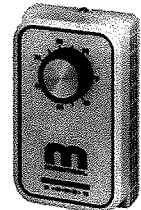
REMOTE TEMP.
SELECTOR



DISCHARGE TEMP.
SENSOR



VALVES

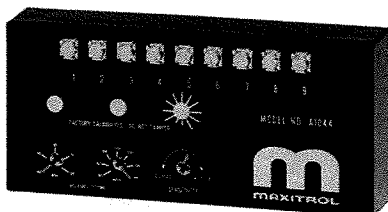


OVERRIDE STAT
(OPTIONAL)

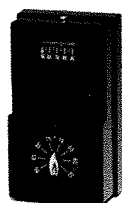
Maxitrol Series 44 - Space Heating Applications (Optional System)

The Maxitrol Series 44 temperature control system allows for modulated space temperature control. The system functions similarly to the Series 14. A modulating space thermostat called the Selectrastat contains the temperature sensing element that controls the space temperature. The discharge temperature sensor contains an averaging sensor and two thermistors to limit minimum and maximum temperatures. These limits are set on the amplifier. Together these components can not only control the heating of the space but also the cooling if the outside air is cooler than the space being controlled.

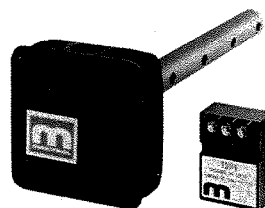
By using the space temperature selector and sensor in place of the Selectrastat it is possible to set the desired temperature in a remote location away from unauthorized personnel.



AMPLIFIER



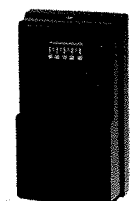
SELECTRASTAT



DISCHARGE TEMP.
SENSOR



SPACE TEMP.
SELECTOR



SPACE TEMP.
SENSOR

Model DFG Control Systems

- ① **Supply Fan Motor Starter** - (Standard) This is used to control the flow of power to the supply fan motor while providing overload protection. Item ② is the optional exhaust fan motor starter.
- ③ **Control Transformer** - (Standard) It is required to step down the voltage on units where the supply voltage cannot provide 115V single phase power for the control circuit.
- ④ **Control Fuses** - (Standard) They protect the control circuit from over-current problems.
- ⑤ **High Temperature Limit Switch** - (Standard) This is a safety limit that protects the system against overheating. Reduced air flow (e.g. clogged inlet) may cause the temperature to rise above the preset level. This limit will then shut down the system. It must be manually reset to start-up the system again.
- ⑥ **Mild Weather Thermostat** - (Optional) This thermostat senses the outside air temperature. On "mild" days when the outside air is comfortable and doesn't need any heating but is below the discharge air temperature setting (e.g. 65° F outside air with discharge setting at 72° F), the thermostat will override the call for heat.
- ⑦ **Low Temperature Limit Switch** - (Optional) This component is also known as a freeze stat. It prevents the introduction of cold outside air into the space. A bypass timer is included to allow cold start-ups.
- ⑧ **Flame Failure Relay** - (Optional) This device shuts down the entire system in the event of a flame failure as sensed by the flame relay module.
- ⑨ **Wiring Duct** - (Standard) This houses the main wiring race and the terminal blocks.
- ⑩ **Amplifier** - (Standard) This electronic amplifier converts the signal sent by the discharge air sensor (not shown, located in the blower discharge). The DC signal is then sent to the modulating control valve.
- ⑪ **Low Voltage Transformer** - (Standard) It supplies 24V power to the low voltage circuit.
- ⑫ **Burner Control Module** - (Standard) This device processes all of the inputs related to the burner. These inputs are then translated into sequential outputs (ignition, pilot lighting, main burner lighting). It also controls safety shutdowns in the event of flame failure or unsafe start-ups.
- ⑬ **Remote Temperature Selector** - (Standard) This remote control allows the user to choose the most convenient and/or secure location for setting the discharge temperature. It can be placed in the control compartment of the unit or remotely in the location being heated.
- ⑭ **Air Flow Switch** - (Standard) Another part of the safety controls, this switch senses the pressure differential to prove air flow. When it has been proven the switch allows the firing sequence to initiate.
- ⑮ **Ignition Transformer** - (Standard) Upon receiving an input from the flame relay module this device provides the ignition spark for the pilot.

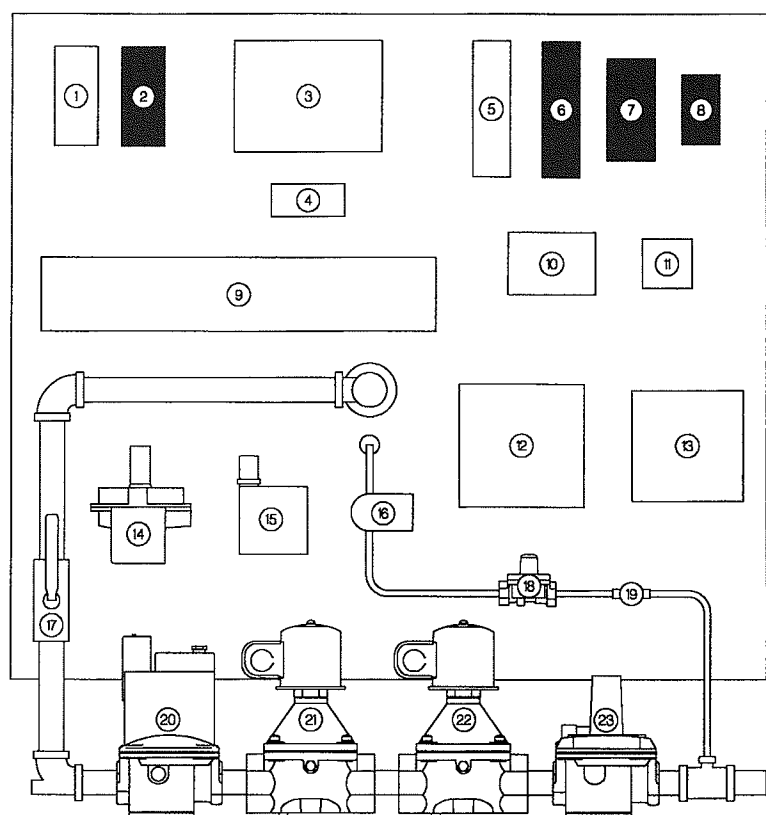
- ①⑥ ②① ②② **Solenoid Valves** - (Standard) These normally closed safety shut-off valves prevent gas flow to the pilot and main burner in case of a safety shutdown or when the unit is not operating.
- ①⑦ ①⑨ **Shut-Off Valves** - (Standard) These manual valves as well as the one sent loose for field installation provide the means to shut off gas flow for service and testing purposes.
- ①⑧ ②③ **Gas Pressure Regulators** - (Standard) These controls regulate the gas pressure to the pilot and main gas lines providing uniform gas flow.
- ②④ **Modulating Valve** - (Standard) This valve provides continuous flame adjustment. Working with the discharge air sensor, amplifier and remote temperature selector it responds quickly and evenly to changes in the outside air temperature. At minimum fire the valve is closed and gas flows through the bypass. As the signal from the amplifier increases the solenoid applies force to the plunger which in turn pushes down on the main diaphragm. When the force is sufficient to overcome the counterspring, the main valve opens and gas flows through the main valve as well as the bypass. The valve can continue to open further as the signal increases until it reaches high fire. An equilibrium point is quickly reached where the discharge air temperature setting is satisfied. From there the valve modulates depending on changes in the outside air temperature.

Main Disconnect Switch - (Standard) Not shown, attached on exterior of unit. This safety switch disconnects all ungrounded supply connectors. It can also disconnect related exhaust fan(s) provided they are within sight of the unit.

Remote Control Panel - (Optional) Not shown, ships loose. This panel consists of a "summer-off-winter" switch mounted in a 4 x 4 gang box. Alternately, two toggle switches can be mounted on a kitchen hood face to provide the same controls.

DFG CONTROL COMPARTMENT

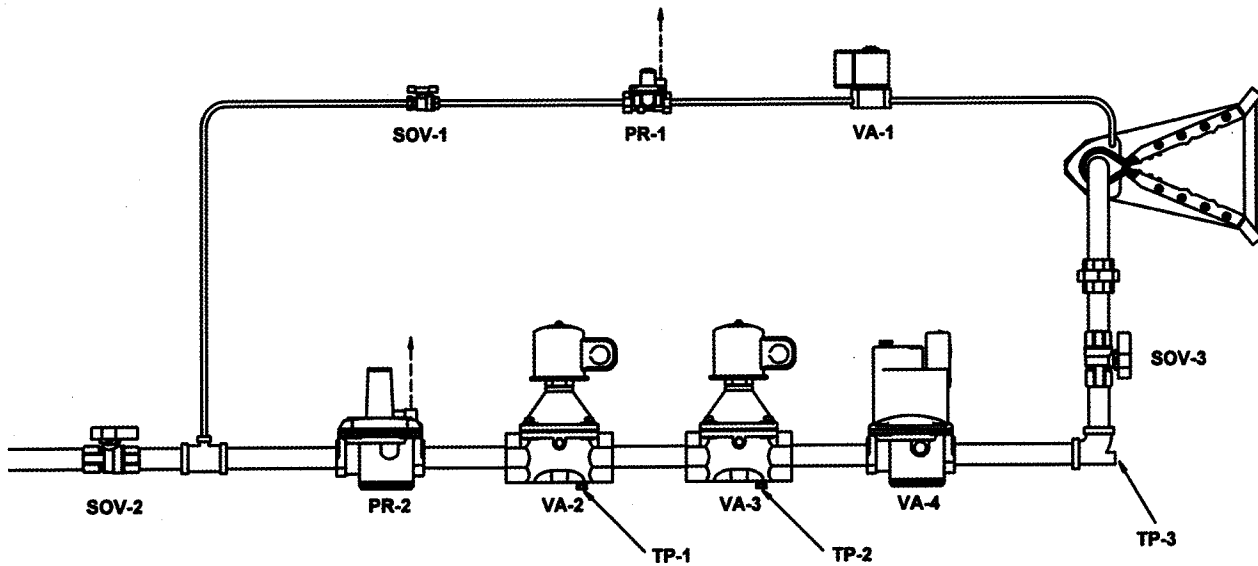
- ① SUPPLY FAN MOTOR STARTER
 - ② EXHAUST FAN MOTOR STARTER **
 - ③ CONTROL TRANSFORMER
 - ④ CONTROL FUSES
 - ⑤ HIGH TEMPERATURE LIMIT SWITCH
 - ⑥ MILD WEATHER THERMOSTAT **
 - ⑦ LOW TEMPERATURE LIMIT SWITCH **
 - ⑧ FLAME FAILURE RELAY **
 - ⑨ WIRING DUCT
 - ⑩ AMPLIFIER
 - ⑪ LOW VOLTAGE TRANSFORMER
 - ⑫ BURNER CONTROL MODULE
 - ⑬ REMOTE TEMPERATURE SELECTOR
(CAN BE MOUNTED REMOTELY)
 - ⑭ AIR FLOW SWITCH
 - ⑮ IGNITION TRANSFORMER
 - ⑯ PILOT SOLENOID VALVE
 - ⑰ MAIN SHUT-OFF VALVE
 - ⑱ PILOT PRESSURE REGULATOR
 - ⑲ PILOT SHUT-OFF VALVE
 - ⑳ MODULATING VALVE
 - ㉑ MAIN SOLENOID VALVE
 - ㉒ SECOND SOLENOID VALVE
 - ㉓ MAIN PRESSURE REGULATOR
- ** OPTIONAL COMPONENT - ALSO SHOWN AS SHADED ITEMS IN THE DRAWING



NOTE: MAIN DISCONNECT SWITCH NOT SHOWN
(STANDARD, BUT MAY BE PROVIDED BY OTHERS)

Standard Manifold

MEETS ETL / ANSI / FM / IRI REQUIREMENTS



FM and IRI are insurance providers that typically cover factories, schools and other commercial buildings. Often they have specific construction requirements for equipment in the building to ensure that it is safe. These requirements must be met before they will agree to insure.

Both FM and IRI have agreed to accept our standard ETL rated units without any modifications. If a specification calls for either FM or IRI approved construction then our standard unit meets that specification.

ITEM

PR-1

PR-2

PS-3

PS-4

SOV-1

SOV-2

SOV-3

TP-1

TP-2

TP-3

VA-1

VA-2

VA-3

VA-4

DESCRIPTION

Pilot Gas Pressure Regulator

Main Gas Pressure Regulator

Low Gas Pressure Switch

High Gas Pressure Switch

Pilot Gas Manual Shut-off Valve

Main Gas Manual Shut-off Valve

Leak Test Manual Shut-off Valve

Plugged Test Port

Plugged Test Port

Plugged Test Port

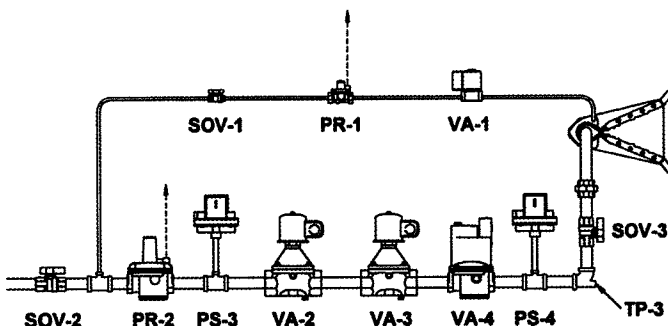
Pilot Solenoid Valve

Main Solenoid Valve

Second Solenoid Valve

Modulating Valve

STANDARD MANIFOLD WITH OPTIONAL COMPONENTS

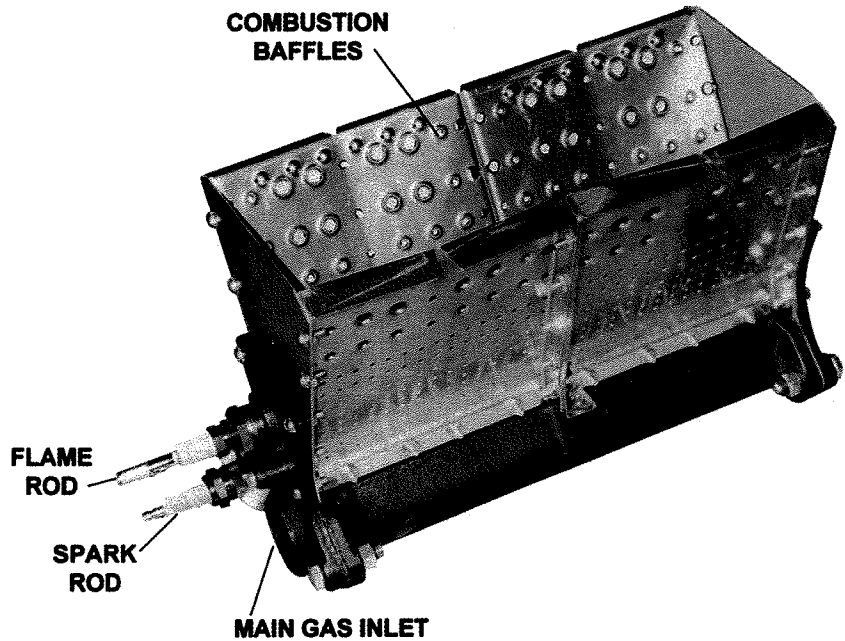


NOTES:

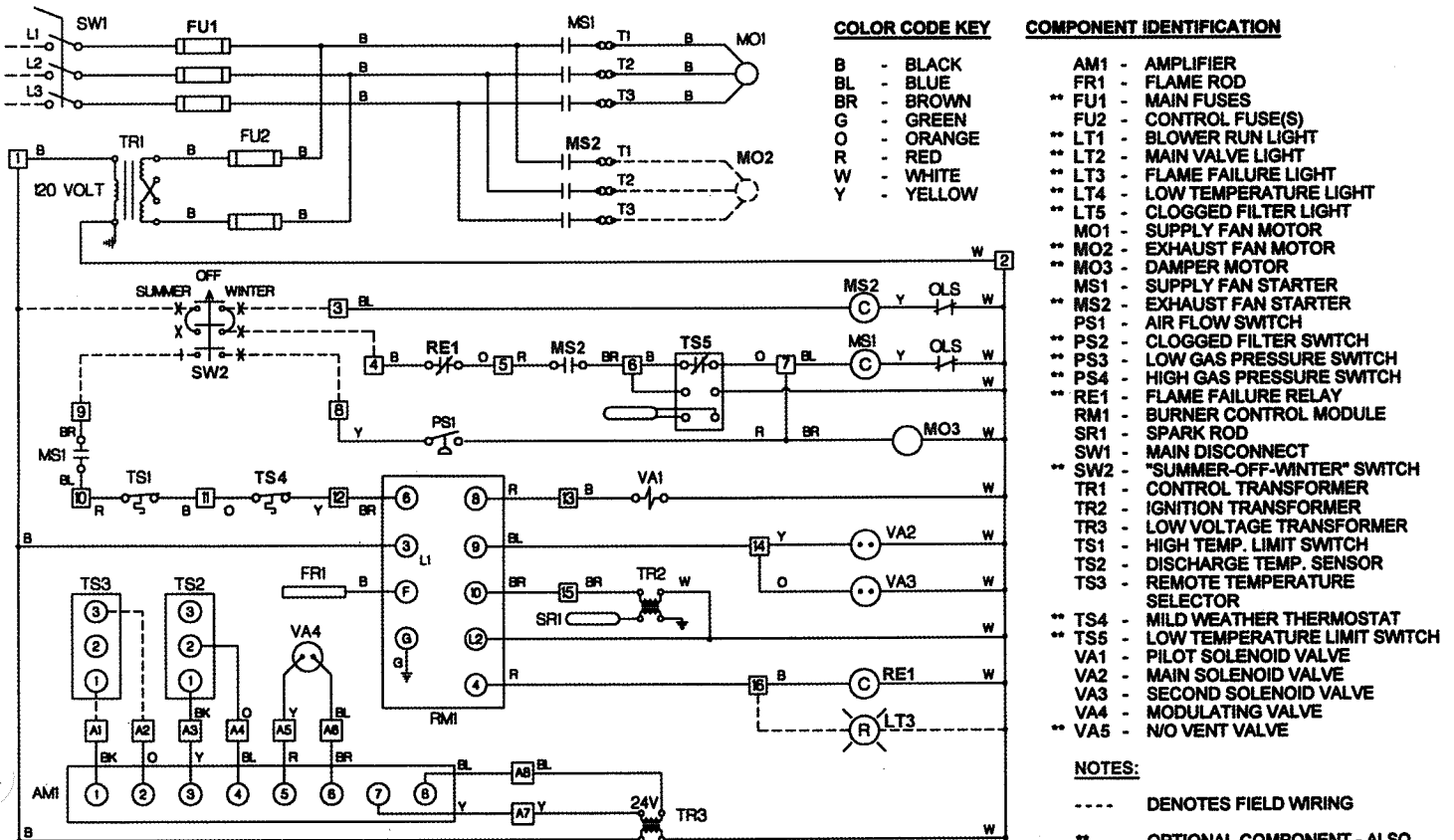
1. PR-2 and VA-4 are combined into a single component on units with input > 825 MBH.
2. PS-3 and PS-4 are available as optional components.
3. SOV-2 ships loose for field installation on the outside of the unit.
4. PR-1 and PR-2 vent to the inside of the control compartment. Any vents to the outside are provided by others.

Direct Fired Gas Burner

Direct fired gas burners utilize 100% outside air. The motion of this airstream across the burner provides the combustion air necessary to mix with the raw gas provided by the burner. Proper mixing at all firing rates is ensured by the design of the perforated combustion baffles. The required gas supply pressures are low; approximately 5" W.C. for natural gas and 2" W.C. for propane. Because the combustion takes place directly in the airstream 100% combustion efficiency is achieved. Testing by an independent laboratory (ETL) found insignificant levels of carbon monoxide in the products of combustion.

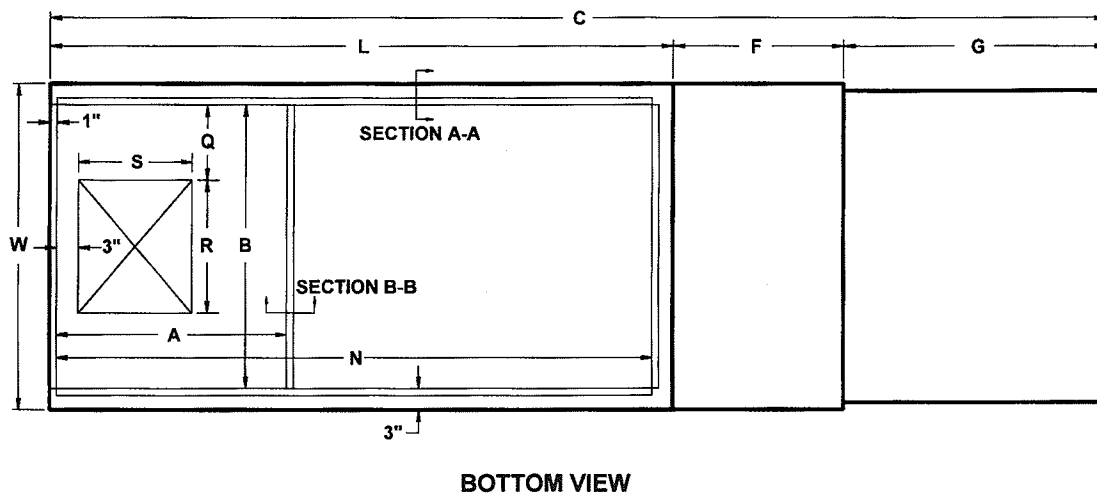
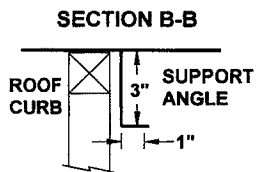
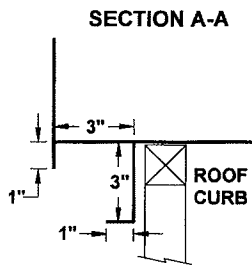
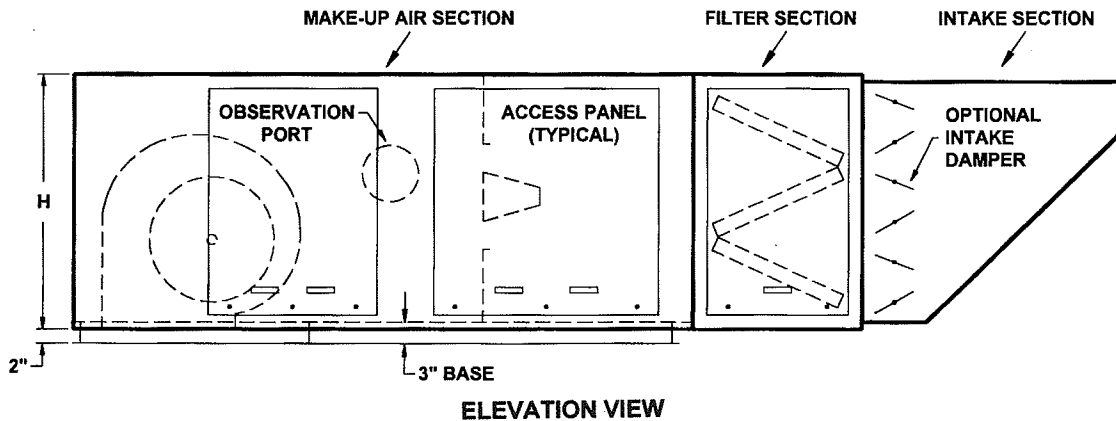


Model DFG Wiring Diagram



NOT ALL OPTIONAL COMPONENTS SHOWN ON THIS DRAWING

Model DFG With V-Bank Filters

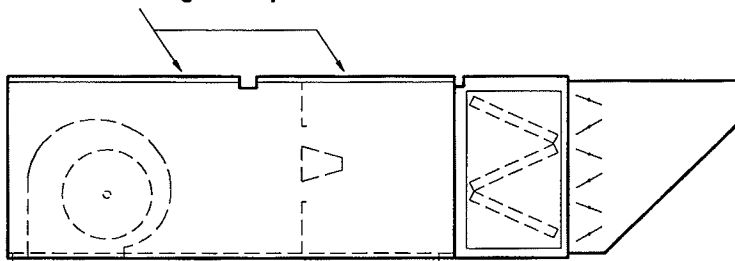


NOTE: Horizontal down discharge is shown. Side discharge and vertical unit configurations are also available.
Support angle in Section B-B is deleted on units with a full perimeter curb.

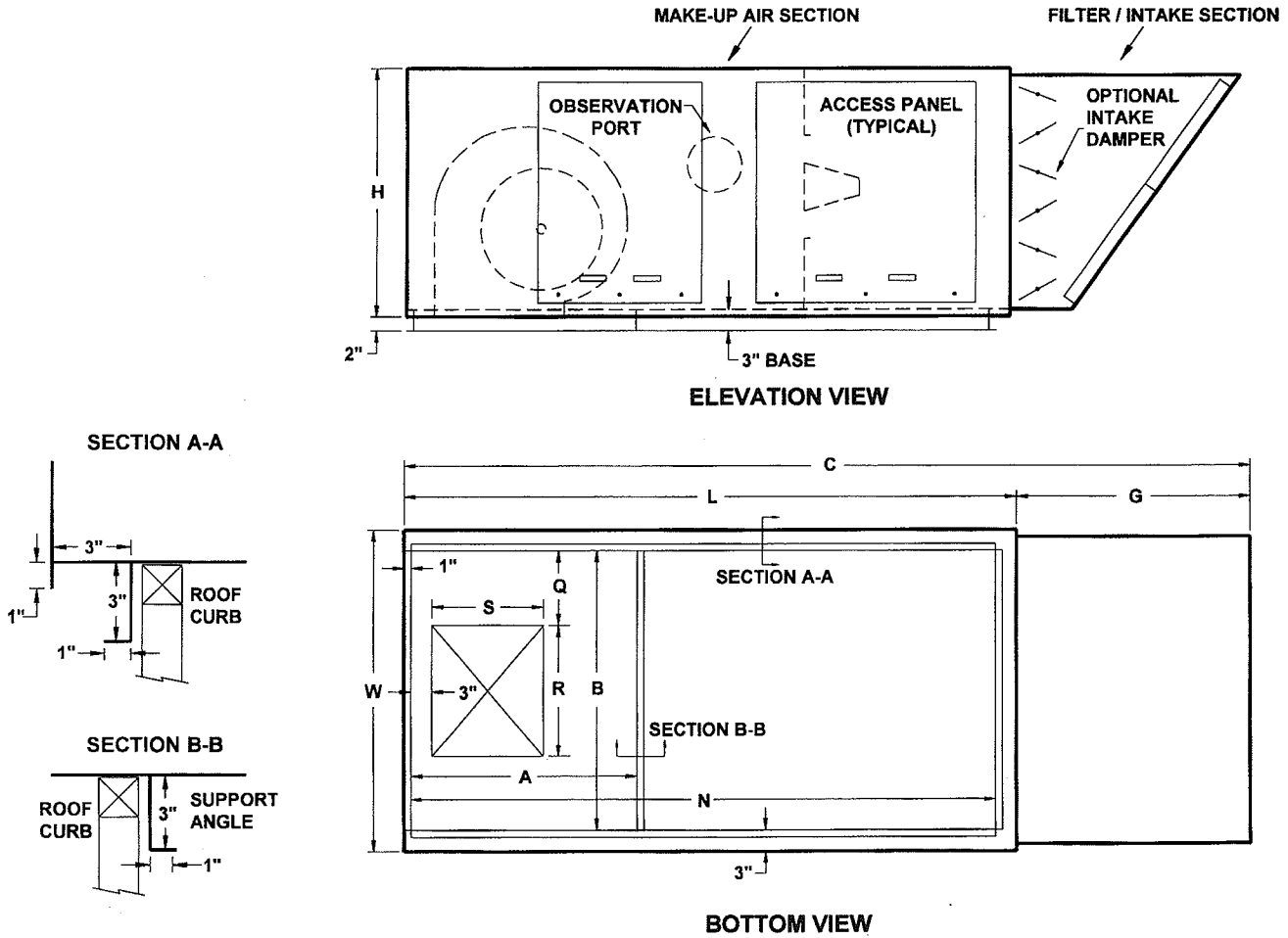
MODEL	MAXIMUM C.F.M.	H	W	L	A	B	C	D	E	F	G	J	K	M	N	O	P	Q	R	S	T	U	Y	V-BANK FILTERS
DFG-10	3,600	32	34	78	28	28	143			24	41	42	36		74			6.88	13.25	11.50				(6) 20 x 16
DFG-12	4,800	32	34	78	28	28	143			24	41	42	36		74			5.63	15.75	13.50				(6) 20 x 16
DFG-15	7,200	37	46	88	28	40	149			24	37	52	48		84			6.62	18.75	16.00				(3) 25 x 20 (3) 20 x 20
DFG-18	10,200	37	46	88	28	40	149			24	37	52	48		84			8.50	22.00	19.00				(3) 25 x 20 (3) 20 x 20
DFG-20	15,000	47	52	94	31	46	165			24	47	55	54		90			7.62	22.75	24.75				(10) 25 x 20

Dimensions D, E, O, P, T, U & Y vary depending on the exhaust fan selected. Dimension M is the curb height. See page 12.

NOTE: On DFG-10/12 units, access to the fan and controls is through the top of the units.



Model DFG With Flat Filter Bank

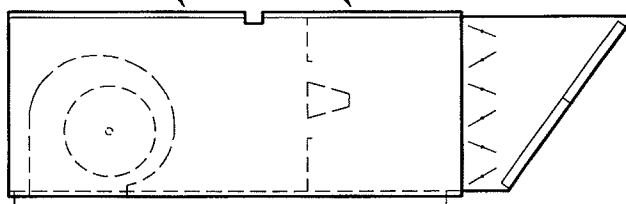


Horizontal down discharge is shown. Side discharge and vertical unit configurations are also available. Support angle in Section B-B is deleted on units with a full perimeter curb.

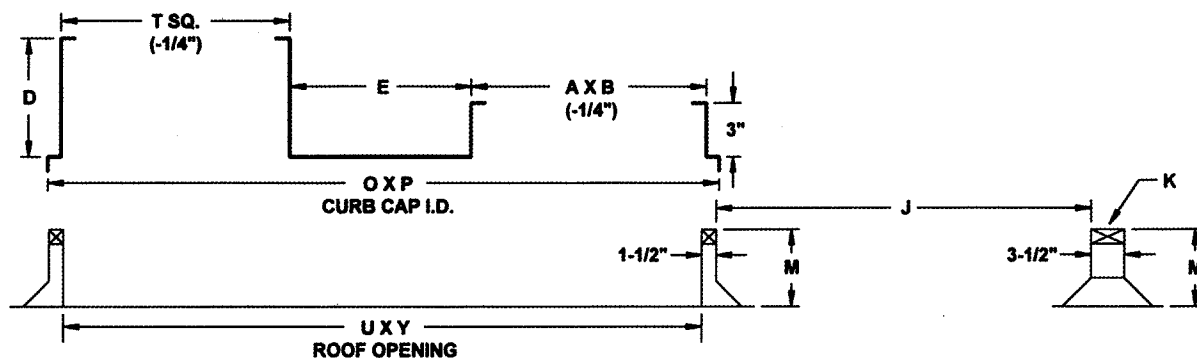
MODEL	MAXIMUM C.F.M.	H	W	L	A	B	C	D	E	F	G	J	K	M	N	O	P	Q	R	S	T	U	Y	FLAT FILTERS IN INT. HOOD
DFG-10	3,100	32	34	78	28	28	120			N/A	42	42	36		74			6.88	13.25	11.50				(4) 20 x 16
DFG-12	3,100	32	34	78	28	28	120			N/A	42	42	36		74			5.63	15.75	13.50				(4) 20 x 16
DFG-15	5,000	37	46	88	28	40	122			N/A	34	52	48		84			6.62	18.75	16.00				(2) 25 x 20 (2) 20 x 20
DFG-18	5,000	37	46	88	28	40	122			N/A	34	52	48		84			8.50	22.00	19.00				(2) 25 x 20 (2) 20 x 20
DFG-20	8,300	47	52	94	31	46	148			N/A	54	55	54		90			7.62	22.75	24.75				(6) 25 x 20

Dimensions D, E, O, P, T, U & Y vary depending on the exhaust fan selected. Dimension M is the curb height. See page 12.

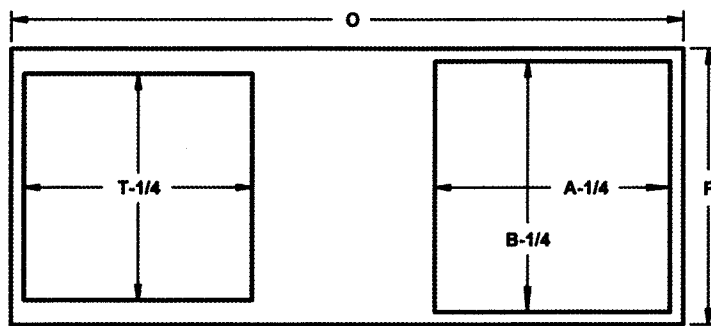
NOTE: On DFG-10/12 units, access to the fan and controls is through the top of the units.



Roof Curb Dimensional Data

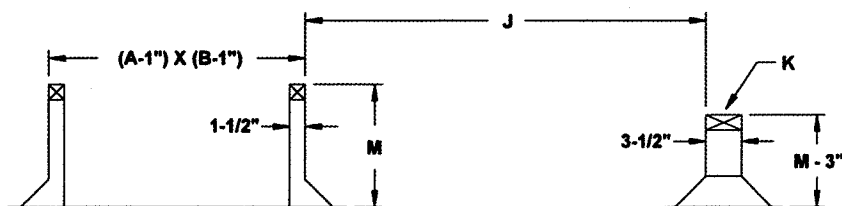


**SIDE VIEW OF MODULAR CURB CAP, ROOF CURB AND RAIL
(ARRANGEMENT A1)**



PLAN VIEW OF CURB CAP

- A - Length of curb
- B - Width of curb
- D - Varies; see below for minimum requirements to meet NFPA 96
- E - (Exhaust fan overhang + 3")
- J - Distance between roof curb and support rail (inside edges)
- K - Length of support rail
- M - Varies; 8" to 12" are typical
- N - Length of full perimeter curb
- O - (A + E + T + 3")
- P - Largest of (B + 3") or (T + 3")
- T - Exhaust fan base
- U - O minus 4"
- Y - P minus 4"



**SIDE VIEW OF ROOF CURB AND RAIL
(ARRANGEMENT A2)**

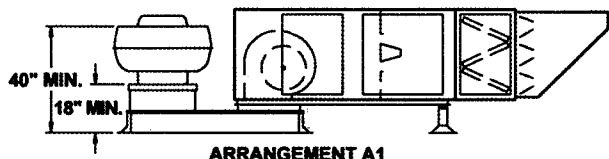
ARRANGEMENT A3

Use two support rails of height M and length K. Distance between the rails should be J + 15".

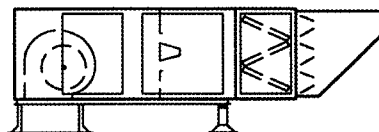
ARRANGEMENT A4

Full perimeter curb does not require a support rail. Size of curb is (N-1") X (B-1") X M.

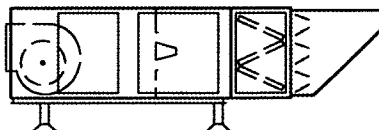
Curb Arrangements



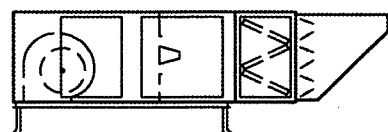
ARRANGEMENT A1



ARRANGEMENT A2



ARRANGEMENT A3

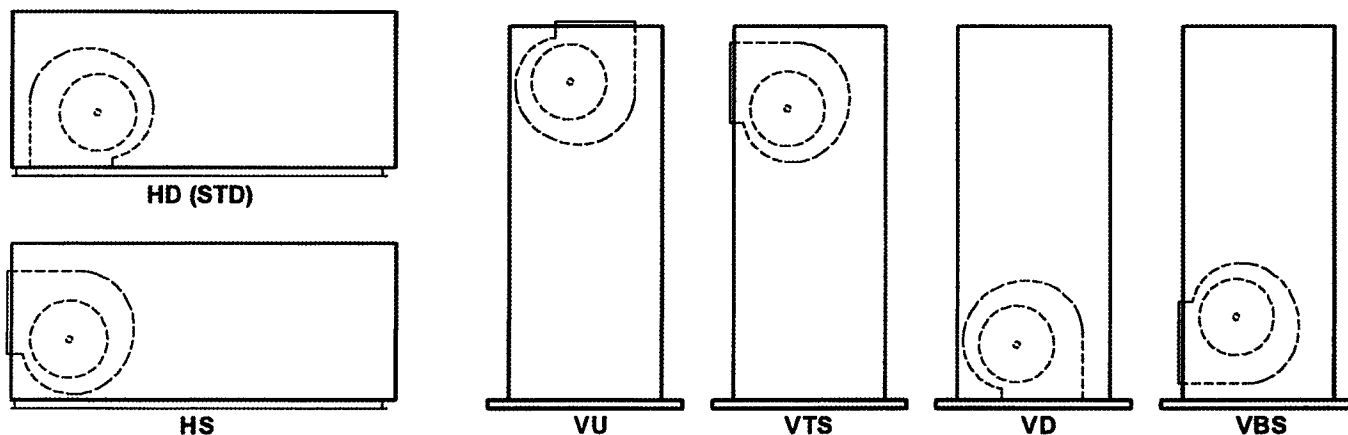


ARRANGEMENT A4



ARRANGEMENT A5

Discharge Arrangements



Approximate Shipping Weights								
MODEL	STANDARD UNIT	INTAKE DAMPER	MODULAR CURB CAP & CURB	12" CURB	SUPPORT RAIL	FULL PERIMETER CURB	DEDUCT INTAKE HOOD	DEDUCT FOR FLAT FILTERS IN INTAKE HOOD
DFG-10	705	45	125	60	25	100	(70)	(75)
DFG-12	735	45	140	60	25	100	(70)	(75)
DFG-15	995	55	160	70	35	120	(90)	(105)
DFG-18	1045	55	180	70	35	120	(90)	(105)
DFG-20	1295	70	210	75	40	130	(130)	(110)

NOTE: Curb and rail weights based on 12" height.

Selection Guide

- Determine the required amount of replacement air by computing the total amount of air being exhausted. Restaurants should be sized for 90% of the exhaust fan to minimize food odor transfer. Other applications should be sized 10% above the air being exhausted to provide for a slight pressurization.
- Determine the total **external static pressure** by adding the pressure drops through all of the accessories.

NOTE: Burner pressure drop is included in the fan performance tables.

- A. Ductwork " W.C.
- B. Kitchen Hood (if applicable) " W.C.
- C. Intake Hood with Birdscreen13" W.C.
- D. V-bank Filter Section25" W.C.
- E. Flat Filters in Intake Section12" W.C.
- F. Motorized Damper06" W.C.

- Select unit size, brake horsepower and fan RPM from the tables. Keep in mind that the BHP figures in the table do not include drive losses. Add approximately 10% to BHP figures when sizing the motor HP to account for the drive losses.
NOTE: At higher elevations use the appropriate air density correction factor or consult factory for assistance.

- Determine the BTUH input rating using the following formula:

$$\text{BTUH} = \text{CFM} \times \Delta T \times 1.08$$

This formula includes a 1.08 constant for the heat content of air.

Performance Tables

DFG-10

10.62 IN. DWDI WHEEL DIAMETER

OUTLET AREA = 1.02 FT.

TIP SPEED (FPM) = 2.49 x RPM

CFM	OV	.25 SP		.50 SP		.75 SP		1.00 SP		1.25 SP		1.50 SP		1.75 SP		2.00 SP	
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
1000	980	962	0.23	1101	0.29												
1200	1176	995	0.31	1117	0.38	1235	0.45	1348	0.52								
1400	1373	849	0.30	1152	0.49	1258	0.56	1360	0.64	1460	0.72	1557	0.81				
1600	1569	862	0.37	980	0.46	1295	0.71	1388	0.79	1479	0.88	1568	0.97	1656	1.07	1741	1.16
1800	1765	877	0.44	992	0.54	1096	0.65	1430	0.98	1514	1.07	1595	1.17	1676	1.27	1755	1.37
2000	1961	893	0.53	1007	0.64	1109	0.75	1202	0.87	1290	0.99	1374	1.11	1454	1.23	1782	1.62
2200	2157	914	0.63	1022	0.75	1123	0.87	1215	1.00	1301	1.12	1382	1.25	1460	1.38	1535	1.52
2400	2353	941	0.75	1040	0.87	1138	1.01	1229	1.14	1314	1.28	1394	1.41	1469	1.55	1542	1.69
2600	2549	976	0.89	1062	1.01	1155	1.15	1244	1.30	1328	1.44	1407	1.59	1482	1.74	1553	1.89
2800	2745	1018	1.06	1091	1.18	1175	1.32	1261	1.47	1343	1.63	1422	1.78	1495	1.94	1566	2.10
3000	2941	1065	1.26	1127	1.37	1200	1.51	1280	1.66	1360	1.83	1437	2.00	1510	2.16		
3200	3137	1115	1.49	1168	1.60	1231	1.72	1303	1.88	1378	2.05						
3400	3333	1168	1.75	1214	1.85	1269	1.98	1331	2.12								
3600	3529	1223	2.05	1263	2.15												

NOTE: The shaded areas indicate 9" blower performance in DFG-10 housing. To obtain corrected outlet velocities use the given OV values and multiply by 1.59.

DFG-12

12.62 IN. DWDI WHEEL DIAMETER

OUTLET AREA = 1.44 FT.

TIP SPEED (FPM) = 3.31 x RPM

CFM	OV	.25 SP		.50 SP		.75 SP		1.00 SP		1.25 SP		1.50 SP		1.75 SP		2.00 SP	
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
1800	1250	722	0.39														
2000	1389	728	0.44	833	0.57												
2200	1528	737	0.51	837	0.64	930	0.77										
2400	1667	748	0.59	845	0.72	935	0.86	1019	1.01								
2600	1806	761	0.67	854	0.82	941	0.97	1023	1.12	1101	1.28						
2800	1944	776	0.77	865	0.92	949	1.08	1029	1.24	1105	1.41	1177	1.58				
3000	2083	793	0.88	878	1.04	960	1.20	1037	1.37	1111	1.54	1181	1.72	1249	1.91		
3200	2222	812	1.00	893	1.16	972	1.34	1047	1.51	1118	1.69	1187	1.88	1253	2.07	1317	2.27
3400	2361	834	1.14	910	1.31	985	1.48	1058	1.67	1128	1.86	1195	2.05	1259	2.25	1322	2.45
3600	2500	857	1.29	929	1.46	1001	1.65	1071	1.84	1138	2.03	1204	2.23	1267	2.44	1328	2.65
3800	2639	882	1.46	949	1.63	1017	1.82	1085	2.02	1151	2.23	1214	2.43	1276	2.65	1336	2.86
4000	2778	909	1.65	971	1.82	1036	2.02	1101	2.22	1164	2.43	1226	2.65	1286	2.87	1345	3.09
4200	2917	937	1.86	995	2.03	1056	2.23	1118	2.44	1179	2.66	1239	2.88	1298	3.11		
4400	3056	966	2.09	1020	2.26	1078	2.46	1136	2.67	1195	2.90						
4600	3194	996	2.34	1047	2.52	1101	2.71	1157	2.93								
4800	3333	1027	2.61	1074	2.79	1125	2.99										

DFG-15

15.00 IN. DWDI WHEEL DIAMETER

OUTLET AREA = 2.01 FT.

TIP SPEED (FPM) = 3.93 x RPM

CFM	OV	.25 SP		.50 SP		.75 SP		1.00 SP		1.25 SP		1.50 SP		1.75 SP		2.00 SP	
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
2600	1294	610	0.56	701	0.72												
2800	1393	613	0.61	702	0.79												
3000	1493	617	0.68	704	0.85	784	1.05										
3200	1592	623	0.74	707	0.93	785	1.13	858	1.33								
3400	1692	629	0.82	711	1.01	788	1.21	859	1.43	927	1.65						
3600	1791	636	0.90	716	1.10	791	1.31	861	1.53	928	1.76	991	2.00				
3800	1891	644	0.99	722	1.20	795	1.41	864	1.64	929	1.87	991	2.12	1051	2.37		
4000	1990	652	1.09	729	1.30	800	1.52	867	1.76	932	2.00	993	2.25	1052	2.51		
4200	2090	661	1.19	736	1.41	806	1.64	872	1.88	935	2.13	995	2.39	1053	2.65	1108	2.92
4400	2189	671	1.30	744	1.53	812	1.77	877	2.01	939	2.27	998	2.53	1055	2.80	1109	3.08
4600	2289	681	1.42	753	1.66	819	1.90	883	2.16	943	2.42	1001	2.69	1057	2.96	1111	3.25
4800	2388	691	1.55	762	1.79	827	2.05	889	2.31	949	2.58	1006	2.85	1061	3.14	1114	3.43
5000	2488	702	1.68	771	1.94	835	2.20	896	2.47	955	2.74	1011	3.03	1065	3.32	1117	3.62
5200	2587	713	1.83	781	2.09	844	2.36	904	2.64	961	2.92	1016	3.21	1069	3.51	1121	3.81
5400	2687	725	1.98	791	2.26	853	2.54	912	2.82	968	3.11	1022	3.41	1074	3.71	1125	4.02
5600	2786	737	2.14	801	2.43	862	2.72	920	3.01	976	3.31	1029	3.61	1080	3.92	1130	4.24
5800	2886	749	2.32	812	2.61	872	2.91	929	3.21	983	3.52	1036	3.83	1086	4.15	1136	4.47
6000	2985	762	2.50	824	2.81	882	3.11	938	3.43	992	3.74	1043	4.06	1093	4.39	1142	4.72
6200	3085	775	2.70	835	3.01	893	3.33	948	3.65	1001	3.97	1051	4.30	1100	4.63	1148	4.97
6400	3184	789	2.91	847	3.23	904	3.55	958	3.88	1010	4.21	1060	4.55	1108	4.89		
6600	3284	802	3.13	859	3.45	915	3.79	968	4.13	1019	4.47	1068	4.81	1116	5.16		
6800	3383	817	3.36	872	3.69	926	4.04	978	4.39	1029	4.74	1077	5.09				
7000	3483	831	3.60	885	3.95	938	4.30	989	4.66	1039	5.01						
7200	3582	846	3.86	899	4.21	951	4.57	1001	4.94								

1. PERFORMANCE SHOWN IS FOR DFG WITH OUTLET DUCT, INCLUDING LOSSES ACROSS THE BURNER.
2. PERFORMANCE DOES NOT INCLUDE LOSSES FOR OPTIONAL ACCESSORIES. SEE PAGE 13.
3. BHP DOES NOT INCLUDE DRIVE LOSSES. ADD APPROXIMATELY 10% TO ACCOUNT FOR THESE LOSSES.
4. AT HIGHER ELEVATIONS USE APPROPRIATE AIR DENSITY CORRECTION FACTOR OR CONSULT FACTORY FOR ASSISTANCE.

Performance Tables

DFG-18

18.12 IN. DWDI WHEEL DIAMETER

OUTLET AREA = 2.87 FT.

TIP SPEED (FPM) = 4.75 x RPM

CFM	OV	.25 SP		.50 SP		.75 SP		1.00 SP		1.25 SP		1.50 SP		1.75 SP		2.00 SP	
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
3600	1254	557	0.83														
3800	1324	560	0.89														
4000	1394	564	0.96	640	1.21												
4200	1463	568	1.02	644	1.29	712	1.57										
4400	1533	573	1.10	647	1.38	715	1.66										
4600	1603	578	1.18	651	1.46	718	1.76	780	2.06								
4800	1672	583	1.26	655	1.55	721	1.86	783	2.17								
5000	1742	589	1.34	660	1.65	725	1.97	786	2.29	843	2.62						
5200	1812	594	1.44	665	1.75	729	2.08	789	2.41	846	2.75	899	3.10				
5400	1882	600	1.53	670	1.86	733	2.19	793	2.53	849	2.88	902	3.24				
5600	1951	607	1.64	675	1.97	738	2.31	797	2.66	852	3.02	905	3.39	955	3.76		
5800	2021	613	1.74	680	2.08	743	2.44	801	2.80	856	3.17	908	3.55	957	3.93	1005	4.32
6000	2091	620	1.86	686	2.21	748	2.57	805	2.94	860	3.32	911	3.71	960	4.10	1008	4.50
6200	2160	627	1.98	692	2.34	753	2.71	810	3.09	864	3.48	915	3.87	964	4.27	1011	4.68
6400	2230	635	2.11	698	2.47	758	2.85	815	3.24	868	3.64	919	4.04	967	4.45	1014	4.87
6600	2300	643	2.24	705	2.61	764	3.00	820	3.40	872	3.81	923	4.22	971	4.64	1017	5.07
6800	2369	651	2.38	712	2.76	770	3.16	825	3.56	877	3.98	927	4.41	975	4.84	1020	5.27
7000	2439	659	2.53	719	2.92	776	3.32	830	3.74	882	4.16	931	4.60	979	5.04	1024	5.48
7200	2509	668	2.69	726	3.08	782	3.49	836	3.92	887	4.35	936	4.79	983	5.24	1028	5.70
7400	2578	676	2.86	733	3.25	789	3.67	842	4.10	892	4.55	941	5.00	987	5.46	1032	5.92
7600	2648	686	3.03	741	3.43	796	3.86	848	4.30	898	4.75	946	5.21	992	5.68	1036	6.15
7800	2718	695	3.22	749	3.62	803	4.05	854	4.50	904	4.96	951	5.43	997	5.91	1041	6.39
8000	2787	705	3.41	757	3.82	810	4.25	861	4.71	910	5.18	957	5.66	1002	6.14	1045	6.64
8200	2857	715	3.62	766	4.02	817	4.46	867	4.93	916	5.40	962	5.89	1007	6.39	1050	6.89
8400	2927	725	3.83	775	4.24	825	4.68	874	5.15	922	5.64	968	6.14	1012	6.64	1055	7.15
8600	2997	735	4.05	784	4.46	833	4.91	881	5.39	928	5.88	974	6.39	1018	6.90	1060	7.42
8800	3066	746	4.29	793	4.70	841	5.15	888	5.64	935	6.14	980	6.65	1023	7.17		
9000	3136	756	4.53	802	4.95	849	5.40	896	5.89	942	6.40	986	6.92	1029	7.45		
9200	3206	767	4.79	812	5.20	858	5.66	904	6.16	949	6.67	993	7.20				
9400	3275	779	5.06	822	5.47	866	5.94	911	6.43	956	6.95	999	7.48				
9600	3345	790	5.33	832	5.75	875	6.22	919	6.72	963	7.24						
9800	3415	801	5.62	842	6.04	885	6.51	928	7.01								
10000	3484	813	5.93	852	6.35	894	6.82	936	7.32								
10200	3554	825	6.24	863	6.66	904	7.13										

DFG-20

20.00 IN. DWDI WHEEL DIAMETER

OUTLET AREA = 3.91 FT.

TIP SPEED (FPM) = 5.24 x RPM

CFM	OV	.25 SP		.50 SP		.75 SP		1.00 SP		1.25 SP		1.50 SP		1.75 SP		2.00 SP	
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
5000	1289	467	1.22	533	1.57												
5400	1392	472	1.36	536	1.72												
5800	1495	478	1.51	539	1.89	597	2.29	652	2.72								
6200	1598	485	1.68	544	2.07	600	2.49	654	2.93								
6600	1701	493	1.87	550	2.27	604	2.70	656	3.15	706	3.63						
7000	1804	502	2.07	557	2.49	609	2.93	660	3.40	708	3.89	754	4.39				
7400	1907	512	2.30	565	2.73	616	3.19	664	3.67	711	4.16	756	4.68	800	5.22		
7800	2010	522	2.54	573	2.99	623	3.46	670	3.95	715	4.47	759	5.00	802	5.55	843	6.12
8200	2113	532	2.80	582	3.27	630	3.76	676	4.27	720	4.79	763	5.33	805	5.90	845	6.48
8600	2216	543	3.09	592	3.58	639	4.08	683	4.60	726	5.14	768	5.70	808	6.27	848	6.86
9000	2320	554	3.39	602	3.90	648	4.43	691	4.96	733	5.51	773	6.08	813	6.67	851	7.27
9400	2423	565	3.72	613	4.25	657	4.79	699	5.34	740	5.91	779	6.49	818	7.10	856	7.71
9800	2526	577	4.07	624	4.63	667	5.18	708	5.75	748	6.34	786	6.93	824	7.55	861	8.18
10200	2629	590	4.44	635	5.03	677	5.60	717	6.17	757	6.79	793	7.39	830	8.03	867	8.68
10600	2732	604	4.83	646	5.44	687	6.03	727	6.62	766	7.26	801	7.87	837	8.54	873	9.21
11000	2835	617	5.05	658	5.89	696	6.48	737	7.10	775	7.79	809	8.40	845	9.08	880	9.77
11400	2938	625	5.42	670	6.35	711	7.02	747	7.65	785	8.34	818	8.96	853	9.65	888	10.36
11800	3041	633	5.81	682	6.88	722	7.55	758	8.22	795	8.92	828	9.55	862	10.24		
12200	3144	642	6.23	680	6.83	734	8.13	769	8.81	805	9.51	839	10.18				
12600	3247	651	6.66	688	7.28	743	8.66	780	9.42	815	10.11						
13000	3351	660	7.12	697	7.75	735	8.45	792	10.05								
13400	3454	669	7.60	706	8.25	743	8.96										
13800	3557	679	8.11	715	8.78	751	9.50	REFER TO PRICE SHEET FOR COST ADJUSTMENT.									
14200	3660	689	8.64	724	9.33	760	10.07										
14600	3763	699	9.20	733	9.90												
15000	3866	709	9.79	742	10.51												

NOTE: The shaded areas indicate 20" HD blower performance. To obtain corrected outlet velocities use the given OV values and multiply by 0.92.

1. PERFORMANCE SHOWN IS FOR DFG WITH OUTLET DUCT, INCLUDING LOSSES ACROSS THE BURNER.
2. PERFORMANCE DOES NOT INCLUDE LOSSES FOR OPTIONAL ACCESSORIES. SEE PAGE 13.
3. BHP DOES NOT INCLUDE DRIVE LOSSES. ADD APPROXIMATELY 10% TO ACCOUNT FOR THESE LOSSES.
4. AT HIGHER ELEVATIONS USE APPROPRIATE AIR DENSITY CORRECTION FACTOR OR CONSULT FACTORY FOR ASSISTANCE.



Typical Model DFG Specifications

Provide KEES Model DFG _____ direct-fired make-up air unit(s) designed for (indoor) (outdoor) application. The unit shall be ETL approved and assembled, wired and fire tested prior to shipment, with a capacity of _____ SCFM at _____" ESP using a _____ HP _____ phase _____ cycle _____ volt motor. The fuel will be natural gas (propane) at an inlet pressure of _____" water column. The burner shall deliver _____ BTUH and be built in accordance with (standard) (FM) (FM/IRI) (IRI) requirements.

The housing shall be fabricated from heavy-gauged galvanized steel and have gasketed panels providing access to all components. An observation port shall be located to provide a view of the pilot and main flame.

The unit shall be supplied with a forward curved, double inlet, statically and dynamically balanced centrifugal fan assembly. The fan shaft shall be ground and polished steel designed for a maximum operating speed not to exceed 75% of its first critical speed. Bearings are heavy duty and prelubricated. V-belt drives are to be sized for 150% of driven horsepower. The entire fan and motor assembly shall be mounted on vibration isolators to prevent noise transmission.

The burner shall be a direct gas-fired burner suitable for complete combustion and having a turndown ratio of up to 30:1. Adjustable profile plates shall be installed to control the proper air velocity across the burner. The operation of the burner shall be coordinated through an electronic flame supervision system and shall provide a clean and odorless combustion. The burner assembly and gas manifold shall be completely prepiped and factory tested prior to shipment.

All piping and controls shall be enclosed within the galvanized housing of the make-up air unit. Wiring shall be complete and in accordance with NEC with all controls wired to a numbered terminal strip. A circuit diagram shall be located within the control enclosure with markings to match the color coded wiring. All electrical components shall bear the UL label. The control center shall include but not be limited to the following components; Maxitrol electronic modulating gas valve, two solenoid safety valves, electronic flame safety module, magnetic motor starter(s), high temperature safety limit, flame rod, electronic ignition pilot, main and pilot regulators, pilot solenoid valve, main and pilot manual gas shut-off valves, airflow switch, and control circuit fusing.

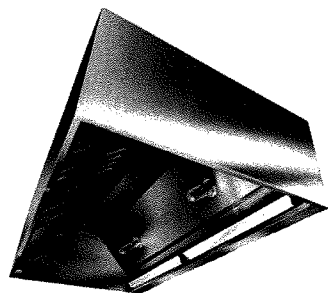
WARRANTY

KEES warrants all products to be free from defects in material and workmanship for a period of one year from the date of purchase. Any units which prove defective during the warranty period will be repaired or replaced at our option when returned to our factory, transportation prepaid. KEES will not be responsible for any installation or removal costs.

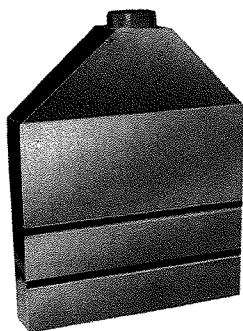
To maintain KEES' policy of continuous product improvement, we reserve the right to change prices, specifications, ratings or dimensions without notice or obligation.

Other KEES Products Available

KITCHEN EXHAUST HOODS



SLOTTED HOODS



OVERHEAD INDUSTRIAL HOODS

