



# GENUINE CAMBRIDGE®

## “Nothing Else Like It”

### 10 reasons why there is nothing else like a Genuine Cambridge® Heater

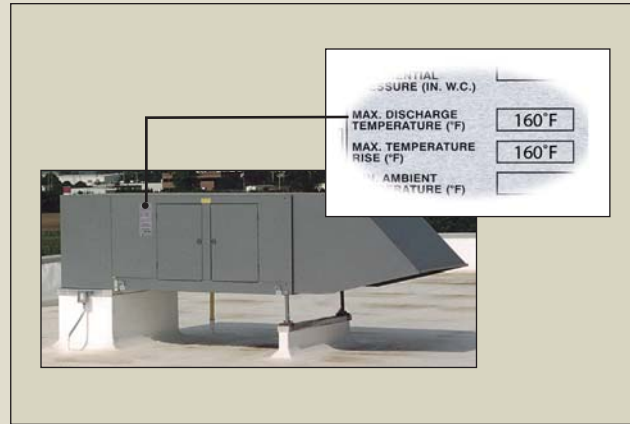
#### 1. Experience

Cambridge was the first to pioneer the concept of using direct gas-fired heaters for industrial space

#### **WARNING** DO NOT ATTEMPT TO SUBSTITUTE

any other heater for a Genuine Cambridge Blow-Thru® Space Heater. The technologies are different. Ability to heat the building will be jeopardized and energy costs will increase.

heating applications over 45 years ago. In recent years, Cambridge has heated thousands of buildings and over one billion square feet.



#### 2. Patented Cambridge Burners

Unlike our competition, Cambridge designs and manufactures its own patented high efficiency burners. You can't get the high performance of a Cambridge Burner unless you have a Cambridge Heater.



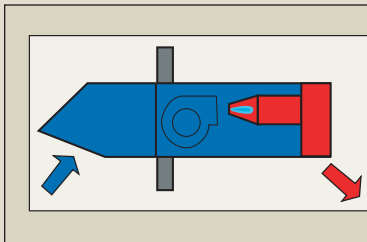
Patented Cambridge Burner

#### 3. Blow-Thru® Space Heater

The patented Cambridge Burner, combined with Blow-Thru® technology outperforms every other direct gas-fired heater on the market. This means a higher BTU/CFM ratio and lower operating costs.

#### 4. 160°F Certified Heater

Despite misleading claims by our competitors, Cambridge is still the only manufacturer certified to ANSI Standard Z83.4/CSA 3.7 with a heater that will take 0°F inlet air and heat it through a 160°F temperature rise to achieve a max discharge temperature of 160°F. The max 160°F rating for both temperature rise and outlet temperature is crucial for space heating applications. It translates into a smaller, more energy efficient heater that uses a lower horsepower motor and most important of all, will heat a building using less outside air.



#### Blow-Thru® Cambridge Space Heater

- Burner is downstream of blower
- Components in the cold air stream
- Highest BTU/CFM Ratio
- More energy efficient



### 5. Save Energy and Reduce Carbon Footprint

High temperature rise, Blow-Thru® Space Heaters are 40% to 70% more energy efficient than all other types of indirect and direct gas-fired systems used to heat/ventilate large commercial and industrial facilities. Saving energy means a corresponding reduction in CO<sub>2</sub> emissions to reduce your building's carbon footprint. Cambridge heaters are recommended for LEED/Green buildings.

Other Industrial Heating Systems	Energy Savings with Blow-Thru® Space Heaters
<b>Indirect Gas-Fired Systems</b>	
Boilers	40% to 70%
Infrared (Radiant)	15% to 40%
Unit Heaters	30% to 50%
Air Turnover Systems	25% to 70%
<b>Direct Gas-Fired Systems</b>	
Make-Up Air (MUA)	20% to 50%
Recirculation (pressurization)	20% to 50%

### 6. Indoor Air Quality (IAQ)

Cambridge® heaters use 100% fresh air to improve IAQ. There are no IAQ problems from reheating and partial incineration of indoor air as with gas-fired equipment certified to ANSI Standard Z83.18 for recirculating type heaters.

### 7. Lower Installation Costs

Smaller, lightweight, pre-piped and pre-wired Cambridge heaters are available with five mounting options, including the popular "thru-wall" design for easier installation.

### 8. Reliability

With Cambridge you know it will ship on time and it will always work. Cambridge® heaters require little maintenance and are built to last. All units include the rugged stainless steel Cambridge Burner with a 5-year warranty. The complete heater has a 2-year warranty.

**Industry's Best  
Warranty Package**

**Heater - 2 years  
Burner - 5 years**

### 9. Best Customer Support

Cambridge has factory-trained sales/service representatives throughout North America who provide: heating and ventilating system design assistance, building heat loads, operating cost analysis, factory start-up and field service support. Surveys show that Cambridge provides the best overall customer support.

### 10. We Have the Proof

Saying it and doing it are two different things. We back up our claims with documented proof, including computer modeling and a growing list of over 300 onsite building studies and customer testimonials. See sample comparison study below.

## Sample Comparison Study - 2 Identical Warehouses

### Cambridge Space Heaters

#### Warehouse #1

- 1,291,950 ft<sup>2</sup> x 36' high
- R-19 Roof / R-10 Walls
- 27,806 MBH / 132,340 CFM / 95 HP



**Results: Cambridge system used over 47% less total energy on a cost per ft<sup>2</sup> basis**

If Warehouse #2 had installed a high efficiency **Cambridge system** they could have saved

### Other Gas Fired Heating System

#### Warehouse #2

- 1,296,950 ft<sup>2</sup> x 36' high
- R-19 Roof / R-10 Walls
- 30,315 MBH / 210,000 CFM / 150 HP



Gas Cost	Electric Cost	Annual Savings
\$ .75 / therm	\$ .08/kwh	\$ 142,000
1.00 / therm	.10/kwh	168,000
1.25 / therm	.12/kwh	233,000



# Genuine Cambridge® Heaters

**Direct Gas-Fired**

**Space Heating**

## **BLOW-THRU® SPACE HEATER**

- 200 to 3400 MBH
- Up to 14,400 CFM
- Natural Gas, LP Gas or Propane Air Burners

## **MOST ENERGY EFFICIENT WAY TO HEAT:**

- Warehouses
- Distribution Centers
- Manufacturing Plants
- Indoor Sports Facilities
- Boat Storage Buildings
- Auto Dealership Service Bays
- Aircraft Hangars/Service Areas

## **GENUINE CAMBRIDGE® “Nothing Else Like It”**

- Building Studies document 40% to 70% energy savings
- Blow-Thru® Space Heating Technology
- Improves indoor air quality with fresh air
- 160°F temperature rise at 0°F
- 160°F discharge temperature at 0°F
- Patented gas burner manufactured by Cambridge and only available in a Genuine Cambridge® heater
- 100% combustion efficiency (no flue or heat exchanger losses)
- 92% thermal efficiency (equivalent AFUE rating)
- High quality construction designed to outperform and outlast the competition
- Exclusive 5 year burner warranty
- Industry leader with 40+ years direct gas-fired experience and over 1 billion square feet heated in recent years
- Recommended for green, high performance, LEED buildings



## **S-Series**



[www.cambridge-eng.com](http://www.cambridge-eng.com)

Cambridge Engineering, Inc.  
760 Long Road Crossing Dr.  
Chesterfield, MO 63005  
800.899.1989 • Fax 636.530.6133

# Genuine Cambridge® Heaters

## Blow Thru® S-Series Heater



### **WARNING** DO NOT ATTEMPT TO SUBSTITUTE

any other heater for a Genuine Cambridge Blow-Thru® Space Heater. The technologies are different. Ability to heat the building will be jeopardized and energy costs will increase.

### **FAST START-UP AND EASY MAINTENANCE**

- Installation flexibility with rooftop, thru-wall, under roof, pad mount and indoor or outdoor vertical mounting options
- Compact, lightweight, pre-piped and pre-wired to make installation and start-up easier
- Blow-Thru® design eliminates the time required during start-up for adjustment of a burner profile damper necessary with draw-thru heaters
- Multiple easy-access doors for quick start-up and maintenance
- Service and gas valve leak test switches are provided for easy installation and service
- Every heater is tested as a fully-assembled unit to minimize initial start-up problems

### **RELIABILITY**

- Blow-Thru® design puts burner downstream of blower so motor and other critical components are located in cool air stream for extended service life
- Low voltage hot surface igniter with Cambridge Low Fire Start (Patent Pending) provides the most dependable gas ignition system for direct gas-fired heaters
- Stainless steel burner & flame rod reduce maintenance and extend service life
- High quality polyester powder paint coating is a standard feature
- Closed cell, non-water absorbing insulation in the base of each unit eliminates condensation problems associated with less expensive fiberglass insulation
- The industry's best warranty package includes 2 years on the heater and 5 years on the patented Cambridge burner

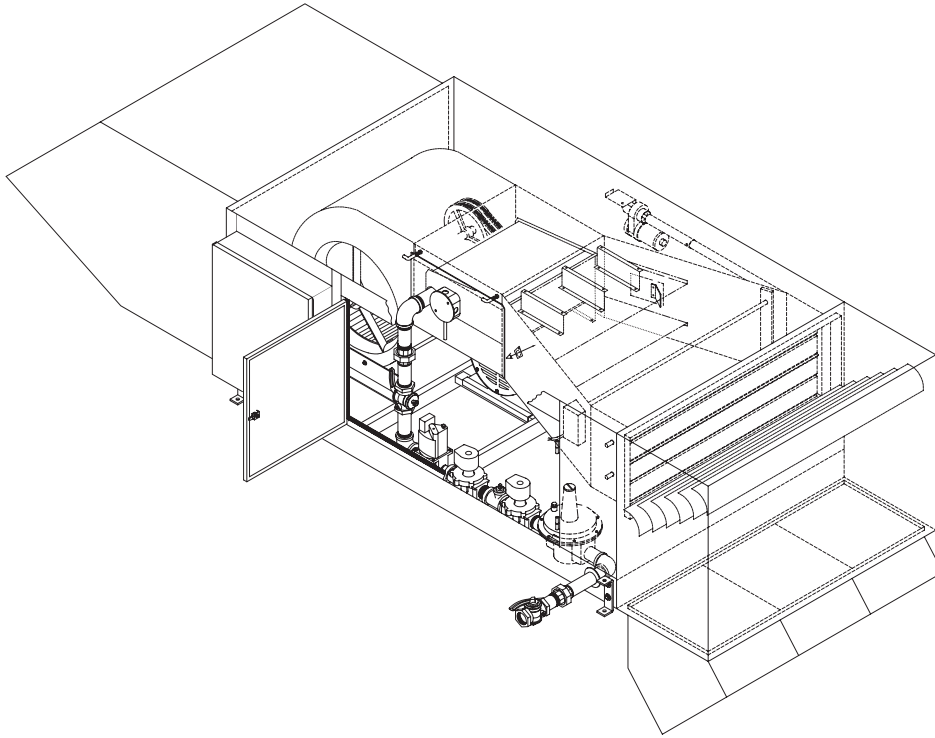
### **PERFORMANCE**

- More heat, less energy and better indoor air quality
- High performance, Blow-Thru® technology provides more BTUs per CFM than draw-thru make-up air heaters. Less outside air and less energy are required for space heating
- Certified for both 160°F temperature rise and 160°F discharge temperature at 0°F outdoor
- Intermittent operation matches heat and air loads to reduce energy usage
- 100% fresh outside air is used to improve indoor air quality, help solve negative air pressure problems and eliminate cold drafts from open dock doors
- High 10-to-1 induction mixing ratio minimizes stratification and provides even temperatures throughout the building



[www.cambridge-eng.com](http://www.cambridge-eng.com)

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# Cambridge® S-Series Direct Gas-Fired Blow-Thru® Space Heaters

400 to 3,400 MBH Capacities  
Complete Heater Packages & Options



760 Long Road Crossing Dr., Chesterfield MO 63005  
(636) 532-2233 • (800) 899-1989 • Fax (636) 530-6133  
[www.cambridge-eng.com](http://www.cambridge-eng.com)



# Genuine Cambridge® ... Nothing Else Like It!

Being the best at saving energy, reducing operating costs and improving indoor air quality has made Cambridge Engineering the preferred choice for heating warehouses, manufacturing plants, automobile service areas, aircraft hangars, indoor recreational facilities and other large commercial/industrial buildings. Other manufacturers now describe their heaters as being “Just Like Cambridge®.” Don’t believe it! Only Cambridge offers Blow-Thru® Space Heating Technology that outperforms every other direct gas-fired heater on the market.

## Application

- **Flexible Application** - Cambridge® S-Series Heaters can be used as a perimeter heating system or rotating air system; and as an air-neutralization or air-pressurization system. When properly applied, Cambridge Blow-Thru® Space Heaters will heat the least amount of fresh air required to address the facility’s air infiltration, make-up air and space heating needs.
- **High Induction Ratio** – The high velocity discharge air induces large volumes of room air into the discharge stream, at a ratio exceeding 10:1. This process mixes the high temperature discharge air with room air, providing large volumes of fresh, warm air flowing throughout the building, thus eliminating higher ceiling temperature and uncomfortable drafts.

## Certification

- **Tested and Certified by CSA International** - Cambridge was the first manufacturer certified to the more stringent requirements of ANSI Standard Z83.4/CSA3.7 for non-recirculating air heaters. S-Series Heaters are approved for use in both the U.S. and Canada.
- **ASHRAE 90.1 Compliant** - Properly configured energy efficient Cambridge® Heaters comply with the latest requirements of ASHRAE Standard 90.1. This is a requirement for LEED Certified Green Buildings and a growing number of local, state and federal (DOE) building codes.
- **Safe** – Non-recirculating Cambridge® Heaters have less than 5.0 ppm carbon monoxide and 0.5 ppm nitrogen dioxide at all firing rates. S-Series Heaters use 100% fresh outside air to improve indoor air quality.
- **Max Performance** - Despite misleading claims by our competitors, only Cambridge has a certified heater that will take 0°F inlet air and heat it through a 160°F temperature rise to achieve a max discharge temperature of 160°F. This higher temperature rating is crucial for space heating applications where the cost of energy matters.

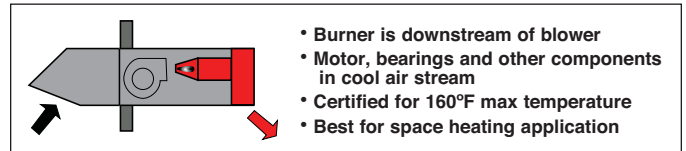
## Patented Cambridge Burner

Cambridge designs and manufactures its own patented high efficiency, stainless steel burners. You can’t get the high performance and extended life of a Cambridge burner unless you have a Cambridge® Heater.

## Blow-Thru® Space Heater Design

The S-Series Heater uses Blow-Thru® Space Heating Technology, where the patented Cambridge burner is located downstream of the blower. This translates into a smaller, more energy efficient design for space heating applications compared to a conventional draw-thru make-up air heater. Cambridge® S-Series Heaters use a lower horsepower motor and, most important of all, use less outside air to heat a building. This is because of its higher btu/cfm ratio and unique certified 160°F maximum rating for both discharge temperature and temperature rise from 0°F.

### Cambridge Blow-Thru® Heater



## Save Energy

High temperature rise, Blow-Thru® Space Heaters are 40% to 70% more energy efficient than all other types of indirect and direct gas-fired systems used to heat/ventilate large commercial and industrial buildings. This has been documented by computer energy modeling and a growing list of over 300 on-site building studies.

Other Industrial Heating Systems	Energy Savings with Cambridge® Space Heaters*
Boilers	40% to 70%
Unit Heaters	30% to 50%
Air Turnover Systems	25% to 70%
Infrared (Radiant)	15% to 40%
Make-Up Air (MUA)	20% to 50%
Recirculation (80/20 - pressurization)	20% to 50%

\* Some building studies show more energy savings than listed above

## Reduce Carbon Footprint

Saving energy means a corresponding reduction in CO<sub>2</sub> emissions to reduce your building’s carbon footprint. Cambridge heaters are recommended for LEED/Green projects.

## Lower Installation Costs

Smaller, lightweight, pre-piped and pre-wired S-Series Heaters are available with five mounting options including the popular thru-wall design for easier installation. Every heater is tested as a fully assembled unit to minimize initial start-up problems.

## Reliability

Genuine Cambridge® Heaters require little maintenance and are built to last. The Blow-Thru® design means the motor and other critical components are located in the cool air stream for extended life. The industry’s best warranty package includes 2 years on the heater and 5 years on the patented Cambridge burner.

## Genuine Cambridge® Specifications

### S-Series Blow-Thru® Space Heater

**General:** The high efficiency, S-Series Direct Gas-Fired Heater shall be manufactured, assembled and factory tested to assure proper alignment of assemblies and performance of controls and other components. Each heater must be design certified by CSA, International to be in compliance with ANSI Standard Z83.4 • CSA 3.7 for Non-Recirculating Direct Gas-Fired Industrial Air Heaters and be labeled ASHRAE 90.1 compliant. **Each heater shall be capable of achieving a 160°F temperature rise with a discharge temperature of 160°F at 0°F outdoor temperature in accordance with the terms of the certification.** The standard heater mounting package, including all specified components, shall be  thru wall  roof top  under roof  outdoor vertical  indoor vertical.

**Construction:** Each **Blow-Thru®** space heater shall be constructed with the **burner section located at the blower discharge**, isolating the blower motor, drive and control components from operationally detrimental high temperatures. The construction of each heater shall be built around a structurally reinforced, unitized housing and base made of G90 galvanized steel and shall be painted with a gray polyester powder paint finish. **Indoor mounted heaters** are to have a fully insulated cabinet with 1" thick, 1/2 lb. density NFPA 90A thermal and acoustical insulation (mechanically fastened). The base of indoor heaters shall be fully, internally insulated with 1/2" thick, non-water absorbing, closed cell insulation. **Outdoor mounted heaters** shall have watertight access panels to the blower, motor and drive, and gas train. The control enclosure shall be directly accessible from the exterior of the heater and shall be watertight with a full length, continuous stainless steel hinge and full perimeter gasket seal.

**Blower:** The blower shall be constructed with a discharge transition duct which is approximately 2 1/2 wheel diameters in length to provide maximum regain of static pressure and uniform discharge air temperature. The blower shall be a double width double inlet (DWDI), forward-curved centrifugal fan with a painted housing. The fan wheel shall be statically and dynamically balanced. [The fan bearings on Series S400, S800, S950, S1200 (with 3 HP motors) heaters shall have permanently lubricated self-aligning sealed ball bearings, resiliently mounted for sound and vibration attenuation.] [The fan bearings on Series S1200 (with 5 HP motors), S1600, S1850, S2200, and S3200 heaters shall have self-aligning, sealed ball bearings with grease fittings.] Fan bearings are to be located out of the heated air stream. Fan speed shall be at least 25% below the first critical speed for the shaft. The shaft shall be coated with a rust inhibitor. Bearing slingers shall be provided to minimize airborne moisture access to the fan bearings.

**Motor/Drive:** The motor shall be a \_\_\_\_ HP, ball bearing type, open drip-proof construction, designed for continuous duty at \_\_\_\_ volt \_\_\_\_ phase 60 Hz, and shall have a 1.15 service factor. The motor bearings shall be located out of the heated air stream. The motor mount is to be on an adjustable sliding base. The fan drive shall be a heavy duty V-belt drive designed for a 1.5 minimum service factor based on motor horsepower.

**Burner:** The direct gas-fired burner shall be suitable for  natural gas  propane air. Consult factory for  LP gas. The burner shall have stainless steel burner plates with non-clogging orifices. The burner shall produce less than 5 PPM (parts per million) carbon monoxide and 0.5 PPM nitrogen dioxide over its entire firing range. **The burner shall be warranted for five years.** The burner shall be furnished with a low voltage/hot surface ignition system and stainless steel flame rod.

**Gas Controls:** The temperature control system shall be EDL (Electronic Discharge Local) for all heaters. The EDL temperature control utilizes the Maxitrol Series 14 modulation controls. A gas valve leak test switch shall be provided to permit field verification of the gas tightness of the valve seats for heaters over 400,000 BTU/hr. A high gas pressure switch is required in applications where the gas supply pressure to the heater exceeds 14" WC.

**Controls:** The heater shall be furnished with factory mounted controls to include low temperature cutout, entering air thermostat, pre-purge timer, low fire start control (patent pending), service switches for blower and burner operation at the heater, non-fused disconnect switch, IEC motor starter with single phase overload protection, redundant gas valves, pressure regulator, electronic temperature controls and a low voltage, class 2 transformer for remote control wiring.

**WARNING - DO NOT ATTEMPT TO SUBSTITUTE** any direct gas-fired heater incapable of achieving 160°F temperature rise with a discharge temperature of 160°F at 0°F outdoor. The technologies are different. Ability to heat the building will be jeopardized and energy costs will increase.

## Factory Design Assistance

Take advantage of our 40+ years experience calculating heat loads and let us help design the most effective and energy efficient heating system for your building. Our proprietary Cal-Q-Heat® Program has become an industry standard for heat load calculations associated with warehouses, distribution centers, manufacturing plants, aircraft hangars, indoor recreational facilities, automobile service areas and other large commercial/industrial buildings.

### Fill out the Cal-Q-Heat® form

- Contact your local Cambridge Sales Representative to obtain a Cal-Q-Heat® input data form. It will include a list of the required building parameters and operating conditions needed to provide a heat loss calculation. The minimum information required is shown at the right.
- The Cal-Q-Heat® form can also be downloaded from our website, filled out and faxed or emailed to Cambridge or your local representative.
- Remember, the heat load and heater design are only as good as the accuracy of the information provided.

### Cambridge provides the following:

- Fast turnaround for heat loads and heater design information to meet your specific requirements.
- System design to include the number, size and location of Cambridge Blow-Thru® Space Heaters that will result in the most effective and energy efficient heating system for the building.
- Heater cut sheets in CAD format can be provided on request.

### CAUTION:

All information provided by Cambridge is based on the use of energy efficient, Genuine Cambridge® direct gas-fired space heating equipment capable of achieving 160°F temperature rise with a discharge temperature of 160°F at 0°F outdoor.

DO NOT ATTEMPT TO SUBSTITUTE any other type of indirect or direct gas-fired heating equipment. The technologies are different. The ability to heat a building will be jeopardized and energy costs will increase.

### CAL-Q-HEAT® INFORMATION

**Job Name:** \_\_\_\_\_

**Job Location:** \_\_\_\_\_

#### Design Temperatures

Indoor: \_\_\_\_\_ °F    Outdoor: \_\_\_\_\_ °F

#### Building Dimensions:

\_\_\_\_\_ ft. W x \_\_\_\_\_ ft. L x \_\_\_\_\_ ft. H

#### Insulation

Roof R-value: \_\_\_\_\_    Walls R-value: \_\_\_\_\_

#### Gas Supply

Natural Gas     Propane

#### Exhaust

\_\_\_\_\_ cfm

Intermittent

Continuous

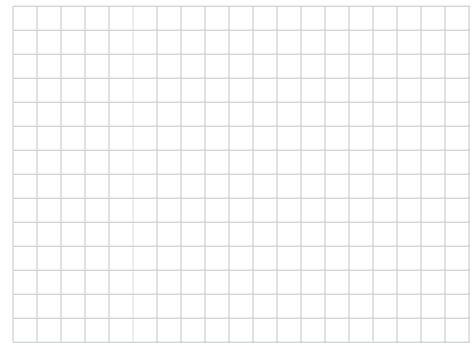
#### Doors

Qty: \_\_\_\_\_ Size: \_\_\_\_\_ ft. W \_\_\_\_\_ ft. H     Seals

Qty: \_\_\_\_\_ Size: \_\_\_\_\_ ft. W \_\_\_\_\_ ft. H     Seals

#### LEED Project

Provide building sketch with location of doors.



## Selection Criteria

Series	Typical Heater Discharge Height						
	1HP	2HP	3HP	5HP	7½HP	10HP	15HP
S400	10 - 15	15 - 25					
S800		15 - 25	15 - 25				
S950		15 - 25	15 - 25				
S1200		15 - 20	15 - 25	20 - 30			
S1600				20 - 30			
S1850				20 - 30	25 - 35		
S2200					20 - 30	25 - 35	30 - 40
S3200						25 - 35	30 - 40

(Distance in feet from bottom of discharge to finished floor)

**NOTE:** Consider accessibility and safety when selecting discharge height and mounting options.



### Typical Capacity Selection For Standard Mounting Packages<sup>3</sup> at sea level

Heater Series	Motor HP	Units without Filter Sections						Units with Filter Sections <sup>2</sup>					
		160°F Rise <sup>4</sup>			140°F Rise <sup>4</sup>			160°F Rise <sup>4</sup>			140°F Rise <sup>4</sup>		
		Input MBH <sup>5</sup>	Inlet cfm	TESP <sup>1</sup>	Input MBH <sup>5</sup>	Inlet cfm	TESP <sup>1</sup>	Input MBH <sup>5</sup>	Inlet cfm	TESP <sup>1</sup>	Input MBH <sup>5</sup>	Inlet cfm	TESP <sup>1</sup>
S400	1	400	1,850	.13	400	2,210	.16	400	1,850	.25	400	2,210	.30
S800	3	757	3,500	.39	634	3,500	.39	735	3,400	.72	616	3,400	.72
S950	2	950	4,400	.22	950	5,250	.27	950	4,400	.31	900	4,970	.34
	3										950	5,250	.39
S1200	3	1200	5,555	.26	1064	5,875	.30	1200	5,555	.44	1023	5,650	.45
	5				1200	6,625	.42				1200	6,625	.75
S1600	5	1499	6,940	.50	1257	6,940	.50	1458	6,750	.75	1223	6,750	.75
S1850	5	1850	8,565	.19	1773	9,790	.23	1850	8,565	.25	1757	9,700	.30
	7½				1850	10,215	.24				1850	10,215	.31
S2200	7½	2200	10,185	.21	2065	11,400	.26	2200	10,185	.32	2028	11,200	.40
	10				2200	12,145	.31				2200	12,145	.48
S3200	10	2718	12,585	.36	2279	12,585	.36	2678	12,400	.48	2246	12,400	.48
	15	3107	14,380	.54	2604	14,380	.54	3046	14,100	.84	2554	14,100	.84

<sup>1</sup>Total External Static Pressure (TESP) is the total of all airflow resistances from Mounting Package components. Any other system air flow resistances such as ductwork should be added to the above TESP figures.

<sup>2</sup>Pressure losses given for air filters in clean condition.

<sup>3</sup>For Indoor Vertical Mounting Package ratings, consult factory.

<sup>4</sup>The MBH and cfm ratings are based upon a discharge temperature of 160°F.

<sup>5</sup>Heater Input Capacity:  $Btu/hr = cfm \times r \times c_p \times 60 \times \Delta T \div 0.92$

Where: **cfm** is the inlet air volume of the blower  
**ρ** is the density<sup>6</sup> of the air handled by the blower (lb/ft<sup>3</sup>)  
**c<sub>p</sub>** is the specific heat of the air (0.240 Btu/lb °F)  
**60** is the conversion from minutes to hours  
**ΔT** is the temperature rise (160°F Max.)  
**0.92** is the conversion from sensible to total heat (output to input)

<sup>6</sup>Density is calculated from the following formula:  $\rho = 1.32605 \times (\text{barometric pressure} \div ^\circ R)$

Where: barometric pressure is in terms of inches of mercury ("Hg) and  $^\circ R = (460 + T_{inlet} \text{ } ^\circ F)$

Series	Gas Inlet Size	Gas Supply Requirements <sup>8</sup>									
		Minimum pressure requirements in inches WC natural gas <sup>9</sup>									
S400	¾"	"WC	2.2	3.1	4.2	6.3					
		MBH	200	250	300	400					
S800	1"	"WC	6.3	7.3	8.6	10.0	11.4	13.0	14.5		
		MBH	500	550	600	650	700	750	800		
S950	1"	"WC	5.3	6.0	6.7	7.5	8.4	9.4	10.5		
		MBH	650	700	750	800	850	900	950		
S1200	1¼"	"WC	6.9	7.7	8.6	9.5	10.4	11.4	12.2		
		MBH	900	950	1000	1050	1100	1150	1200		
S1600	1½"	"WC	9.7	10.3	11.0	11.6	12.4	13.0	13.8	14.5	
		MBH	1250	1300	1350	1400	1450	1500	1550	1600	
S1850	1½"	"WC	8.3	8.6	9.0	9.5	10.0	10.5	11.0	11.5	12.1
		MBH	1450	1500	1550	1600	1650	1700	1750	1800	1850
S2200	1½"	"WC	6.2	7.0	7.6	8.3	9.0	9.8	10.7	11.7	12.8
		MBH	1300	1400	1500	1600	1700	1800	1900	2000	2100
S3200	1½" <sup>7</sup>	"WC	13.0	14.8	15.9	16.8	17.8	18.7	19.8	21.2	
		MBH	2400	2600	2700	2800	2900	3000	3100	3200	

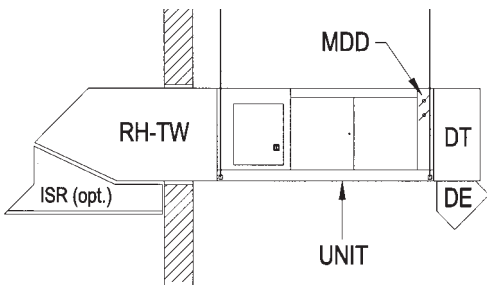
<sup>7</sup>On S3200 heaters with Gas Supply Pressure below 1 psi or over 5 psi with a high pressure regulator, the inlet pipe size is increased to 2".

<sup>8</sup>Positive shut-off pressure regulators are required when gas supply pressure exceeds 14" WC for Series S400; 1 psi for Series S800, S950 and S1200; 2 psi for Series S1600; and, 5psi for Series S1850, S2200 and S3200.

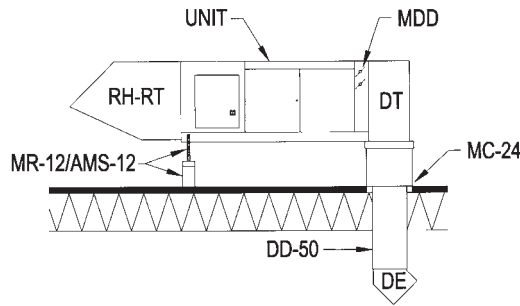
<sup>9</sup>Consult factory for LP gas requirements.

# Standard Mounting Packages

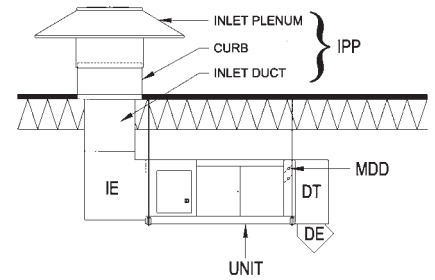
### Thru Wall (TW) Mounting



### Roof Top (RT) Mounting



### Under Roof Mounting

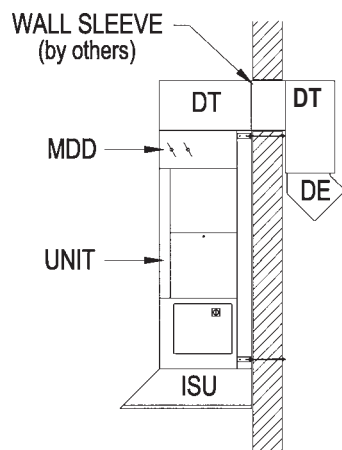


Mounting Component Item# (descriptions on following page)													
	2	4	5	6	7	8	15	16	17	18	19	20	21
	MDD	RH-TW	RH-RT	DT	DE	MB	MR-12/ AMS-12	MC-24	DD-50	IPP	IE	ISR	ISU
Thru Wall (TW) Mounting Package	✓	✓		✓	✓	✓						(A)	
Roof Top (RT) Mounting Package	✓		✓	✓	✓		✓	✓	✓				
Under Roof Mounting Package	✓			✓	✓	✓				✓	✓		
Outdoor and Indoor Vertical Mounting Packages <sup>1</sup>	✓	✓		✓	✓	✓					✓	(A)	✓

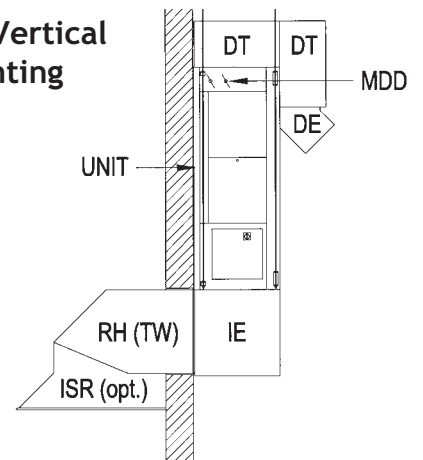
<sup>1</sup> For Vertical Mounting Packages, the Gas Train is field mounted external to the heater.

**A** = Optional Component

### Outdoor Vertical Mounting



### Indoor Vertical Mounting



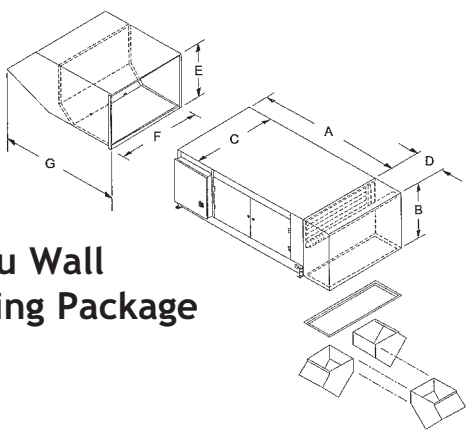
Item #	Description
1	<b>Remote Control Station-Security (RCS-S)<sup>1</sup>:</b> The RCS-S is a lockable NEMA 1 enclosure equipped with a three position keylock selector switch (Summer Ventilation - Off - Heating), an operating electronic thermostat (OET), and indicating lights for blower operation (green), burner operation (red), and reset (amber). (9" w x 14" h x 5" d)
2	<b>Motorized Discharge Damper (MDD):</b> An internally mounted two-position damper assembly that closes when the blower is not operating. Factory installed.
3	<b>Electronic discharge Local (EDL) Gas Trains<sup>1</sup>:</b> An electronic discharge air temperature control which utilizes a discharge temperature sensor in conjunction with an electronic proportioning gas valve for maintaining the selected discharge air temperature. This control will permit manual adjustment of the discharge air temperature from 110°F to 160°F via the selector on the amplifier located in the heater's electrical control enclosure. (Field mounted external to vertical units except S400.)
4	<b>Rain Hood - Thru Wall (RH-TW)<sup>2</sup>:</b> For thru wall mounting package; provided with an expanded metal inlet screen. The thru wall rain hood length includes an integral insulated collar to accommodate up to 21" thick walls.
5	<b>Rain Hood - Roof Top (RH-RT)<sup>2</sup>:</b> For the roof top mounting package; provided with an expanded metal inlet screen.
6	<b>Downturn (DT):</b> A 90° elbow with turning vanes. Thermal/acoustical insulation is factory installed.
7	<b>Directional Elbows (DE):</b> Used to optimize heat distribution by directing air to meet the requirements of specific field applications. Field mounting is required.
8	<b>Mounting Brackets (MB):</b> Provided on the vertical and horizontal heaters for installation.
9	<b>Low Temperature Cutout with Alarm (LTC)<sup>1</sup>:</b> The LTC alarm circuit functions to shut down the blower in approximately four (4) minutes if either of the following occurs: (1) The inlet temperature drops below the LTC setpoint (40, 45, 50 or 55°F) in the Ventilation mode; or (2) The gas valve fails to remain energized during a heating cycle.
10	<b>Entering Air Thermostat (EAT)<sup>1</sup>:</b> The EAT automatically turns off the burner when the outdoor temperature approaches the EAT setpoint temperature (45°F to 70°F) while maintaining blower operation for ventilation.
11	<b>Pre-Purge Timer (PT)<sup>1</sup>:</b> The PT function is supplied to provide a minimum of four air changes in the heater housing and any attached inlet accessories or field installed ductwork prior to an ignition attempt. The time is selectable at 2, 4, 8, 16, or 32 seconds.
12	<b>Low Fire Start (LFS)<sup>1</sup>:</b> The LFS function limits the initial heater firing for the first fifteen seconds of a heating cycle.
13	<b>Service Switches (SS)<sup>1</sup>:</b> Located in the heater to allow local control by Service Technician when servicing the heater.
14	<b>Non-Fused Disconnect<sup>1</sup>:</b> Provided on all heaters.
15	<b>Mounting Rail / Mounting Stand (MR-12/AMS-12):</b> An adjustable mounting stand (6.75" to 14.25") is used in conjunction with the mounting rail as the rear heater support on the roof top mounting package. The rail provides a roof interface for both rubber and built-up roof decks. A counter flashing is provided. A cant, if required, is provided by others. An additional mounting stand and mounting rail is required when a filter section is specified. A 1/2" thick piece of pressure treated wood is required (not provided) for the base of the stand to rest on to meet the overall height of 24".
16	<b>Mounting Curb (MC-24):</b> The insulated 24" mounting curb supports the discharge end of the unit and mates to the downturn. This mounting curb is designed for conventional, flat roof applications. Counter flashing is included. A cant, if required, is provided by others.
17	<b>Discharge Duct (DD-50):</b> The 50" discharge duct for roof top mounting package extends through the mounting curb.
18	<b>Inlet Plenum Package (IPP)<sup>2</sup>:</b> Used for the under roof mounting package, which consists of the inlet plenum, insulated 12" or 24" IPP mounting curb, and insulated inlet duct, 38" or 50" long. Filters are optional. Cant by others.
19	<b>Inlet Elbow (IE):</b> Equipped with turning vanes, is used in conjunction with the Inlet Plenum Package and the indoor vertical mounting option. Internally insulated bottom with non-water absorbing, closed cell insulation.
20	<b>Inlet Skirt - Rain Hood (ISR):</b> Used on the thru wall mounting package in conjunction with the thru wall rain hood. The accessory is recommended for applications subject to snow conditions. Field assembly is required.
21	<b>Inlet Skirt - Unit (ISU):</b> Required for outdoor vertical mounting package. Field assembly is required.

<sup>1</sup> Items 1, 3, 9, 10, 11, 12, 13, 14 are included with all Standard Mounting Packages shown on page 6.

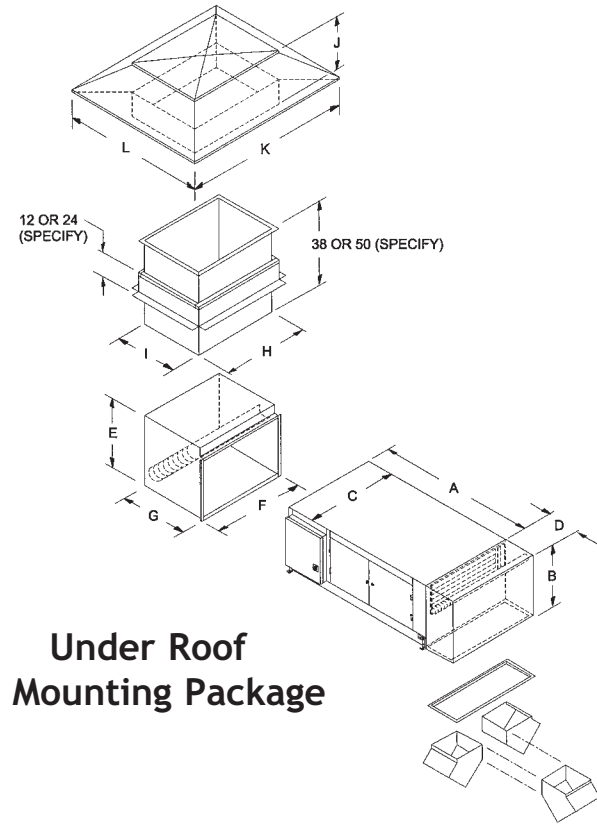
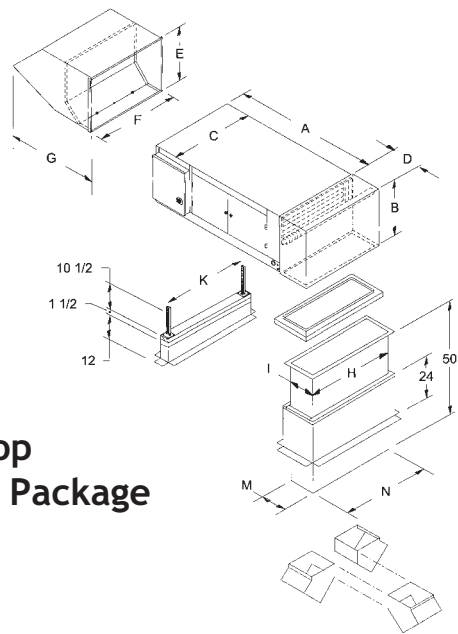
<sup>2</sup> If one of the noted inlet accessories is not ordered, an inlet screen will be provided.

# Unit Weights and Dimensions

## Thru Wall Mounting Package

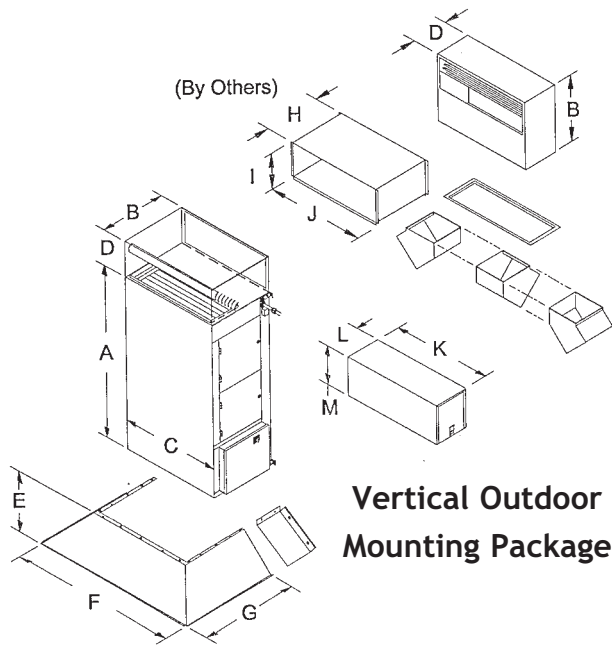


## Roof Top Mounting Package

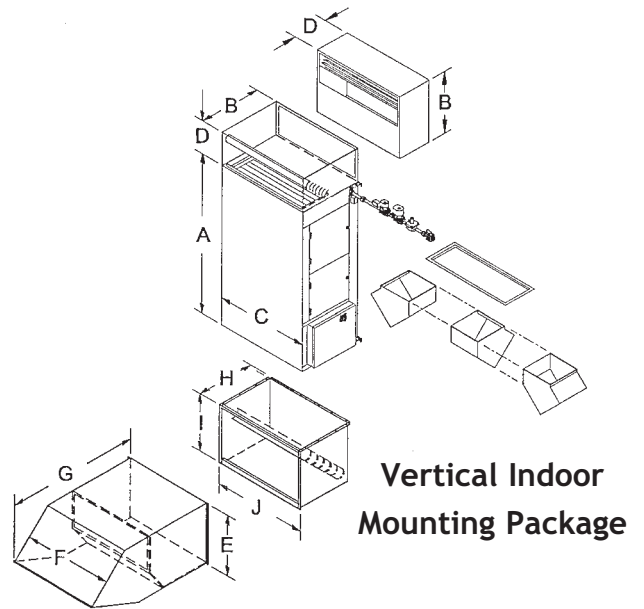


## Under Roof Mounting Package

Mounting Packages	Series	Weight lbs.	Dimensions in Inches													
			A	B	C	D	E	F	G	H	I	J	K	L	M	N
Thru Wall	S400/800	550	60	25½	25½	13	24	23¾	57¾							
	S950/1200/1600	800	72	28	42	15	27	40¼	60							
	S1850/2200/3200	1500	80	37½	47	24¾	36¾	45¼	72							
Roof Top	S400/800	600	60	25½	25½	13	24	23¾	36¾	22½	11		25½		11	22½
	S950	900	72	28	42	15	27	40¼	39	39½	13		42		11	33¾
	S1200/1600	900	72	28	42	15	27	40¼	39	39½	13		42		13	39½
	S1850	1650	80	37½	47	24¾	36¾	45¼	51	44¾	22½		47		22½	33¾
	S2200/3200	1650	80	37½	47	24¾	36¾	45¼	51	44¾	22½		47		22½	44¾
Under Roof	S400/800	750	60	25½	25½	13	27½	23¾	26½	23	23	24	60	60		
	S950/1200/1600	1150	72	28	42	15	30¼	39½	31¼	39½	28	24	76¼	65½		
	S1850/2200/3200	1900	80	37½	47	24¾	40	45¼	38½	45	35½	32	90	80½		



**Vertical Outdoor Mounting Package**

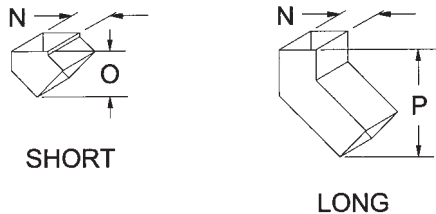


**Vertical Indoor Mounting Package**

Series	Vertical Mounting	Weight lbs.	Dimensions in Inches												
			A	B	C	D	E	F	G	H	I	J	K	L	M
<b>S400/800</b>	Outdoor	500	60	25½	25½	13	12	49½	37¾	(A)	11	22½	34	14	16
<b>S400/800</b>	Indoor	650	60	25½	25½	13	24	23½	57¾	25½	25½	25½			
<b>S950/1200/1600</b>	Outdoor	750	72	28	42	15	12	66	40	(A)	13	39½	34	14	16
<b>S950/1200/1600</b>	Indoor	950	72	28	42	15	27	40½	60	28	28	42			
<b>S1850/2200</b>	Outdoor	1500	80	37½	47	24¾	12	71	49	(A)	22½	44¾	34	14	16
<b>S1850/2200/3200</b>	Indoor	1750	80	37½	47	24¾	36¾	45½	72	37½	37½	47			
<b>S3200</b>	Outdoor	1500	80	37½	47	24¾	12	71	49	(A)	22½	44¾	42	18	26

A = To be determined at installation

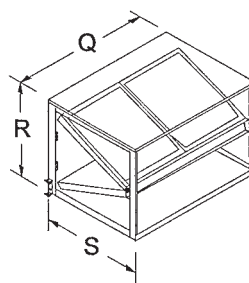
### Directional Elbows



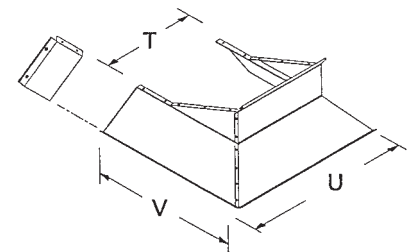
SHORT

LONG

### Optional Filter Section



### Optional Inlet Skirt for Rain Hood



**Collar for Downturn<sup>1</sup>**

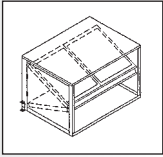
Series	N	O	P	W <sup>1</sup>	QTY
<b>S400/800</b>	11½	13¾			2 short
<b>S950</b>	11½	13¾		3	3 short
<b>S1200/1600</b>	13¾	15			3 short
<b>S1850</b>	11½	13¾	21½	5	3 each
<b>S2200/3200</b>	11½	13¾	21½		4 each

Weight	Q	R	S
67	25½	25½	33
90	42	28	33
90	42	28	33
130	47	37½	35½
130	47	37½	35½

Weight	T	U	V
39	23½	47½	46½
42	40¼	64¼	49¾
42	40¼	64¼	49¾
50	45½	69¾	60¾
50	45½	69¾	60¾

<sup>1</sup>Does not apply to Roof Top applications

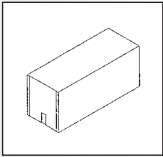
## S-Series Selection



### Filter Section (FS)

The Filter Section is an in-line, V-bank filter with 2" Permanent, or Throw-away filters. The Filter Section is attached directly to the inlet end of the heater, with any additional inlet accessories attached directly to the inlet end of filter section. Each S-Series heater has the following number of filters in each filter section:

Series	Quantity	Dimensions
<b>S400/S800</b>	2	20" x 25" x 2"
<b>S950/S1200/S1600</b>	4	20" x 25" x 2"
<b>S1850/S2200/S3200</b>	12	16" x 25" x 2"

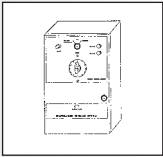


### Gas Train Enclosure (GTE)

The GTE is provided on all outdoor applications which require external mounting of gas train components. The following applications normally require this accessory:

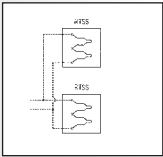
- All vertical units over 400 MBH
- FM applications with filter sections or without a discharge damper

## Electrical Control Options



### Temperature Setback System (TSS)

The TSS is a lockable NEMA 1 enclosure equipped with a three position keylock selector switch (Summer Ventilation - Off - Heating), a combination operating electronic thermostat and seven day programmable time clock, an override timer and indicating lights for blower operation (green), burner operation (red) and reset (amber). The TSS accommodates separate programming for summer ventilation and heating modes. An auto-tuning, optimum start algorithm is available to maximize energy savings. (9"w x 14"h x 5"d).



### Temperature Averaging System (TAS-2)

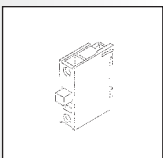
The TAS-2 option is used in conjunction with the operating electronic thermostat to average the space temperature between two points within a facility. It consists of four thermistors which are wired in a series parallel combination in order to simulate a single thermistor response.

### Fused Disconnect Switch (FDS)

The FDS provides for line fusing of power supply voltage.

### Exhaust Fan Interlock (EFI)

Terminals are provided for wiring of EFI contacts provided by others. Typically used when the heater will be a slave to an exhaust fan.



### Exhaust Fan Contact (EFC)

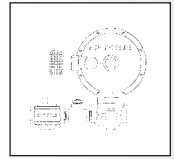
The EFC is an auxiliary dry contact mechanically interlocked to the operation of the motor starter of the heater. The dry contact is typically wired into an exhaust fan control circuit to activate an exhaust fan.

### Fire Protection Interlock (FPI)

Terminals are provided for wiring of FPI contacts provided by others. Typically used when the heater is required to be disabled by the fire protection system.

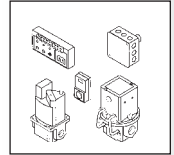
### High Pressure Regulator (HPR)

A positive shut-off high pressure regulator is required when the gas supply pressure exceeds the maximum gas pressure requirements or specified by local codes or utilities. It is sized according to the gas supply pressure and the capacity requirements of the heater. It must be vented to the outdoors. (Specify gas supply pressure.)



### Electronic Discharge Space Modulation (EDSM)

The EDSM temperature control utilizes the Maxitrol Series 44 modulation controls to maintain a constant space temperature (adjustable from 40° to 80°F). Discharge temperature modulates between the minimum (adjustable from 40° to 80°F) and maximum (adjustable from 80° to 140°F) setpoints on the amplifier. Includes an adjustable space temperature control and sensor.

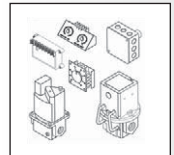


### Electronic Discharge Space Modulation / Tamper Proof (EDSM/TP)

The EDSM/TP temperature control is similar to the EDSM temperature control system above except the adjustable space temperature control is mounted in the Remote Control Station and the non-adjustable sensor is mounted in the space.

### Electronic Discharge Remote (EDR)

The EDR temperature control utilizes the Maxitrol Series 14 modulation controls to maintain the pre-selected discharge temperature that is set on the Remote Heat Adjust control which is mounted in either the Remote Control Station or the heater's Electrical Control Enclosure.



### Insurance Controls

Controls and gas train to comply with the requirements of Factory Mutual (FM) and/or Industrial Risk Insurers (IRI). Specify heater input and insurer for proper selection of insurance controls.

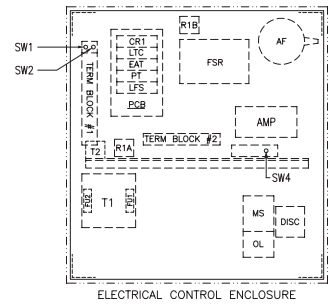
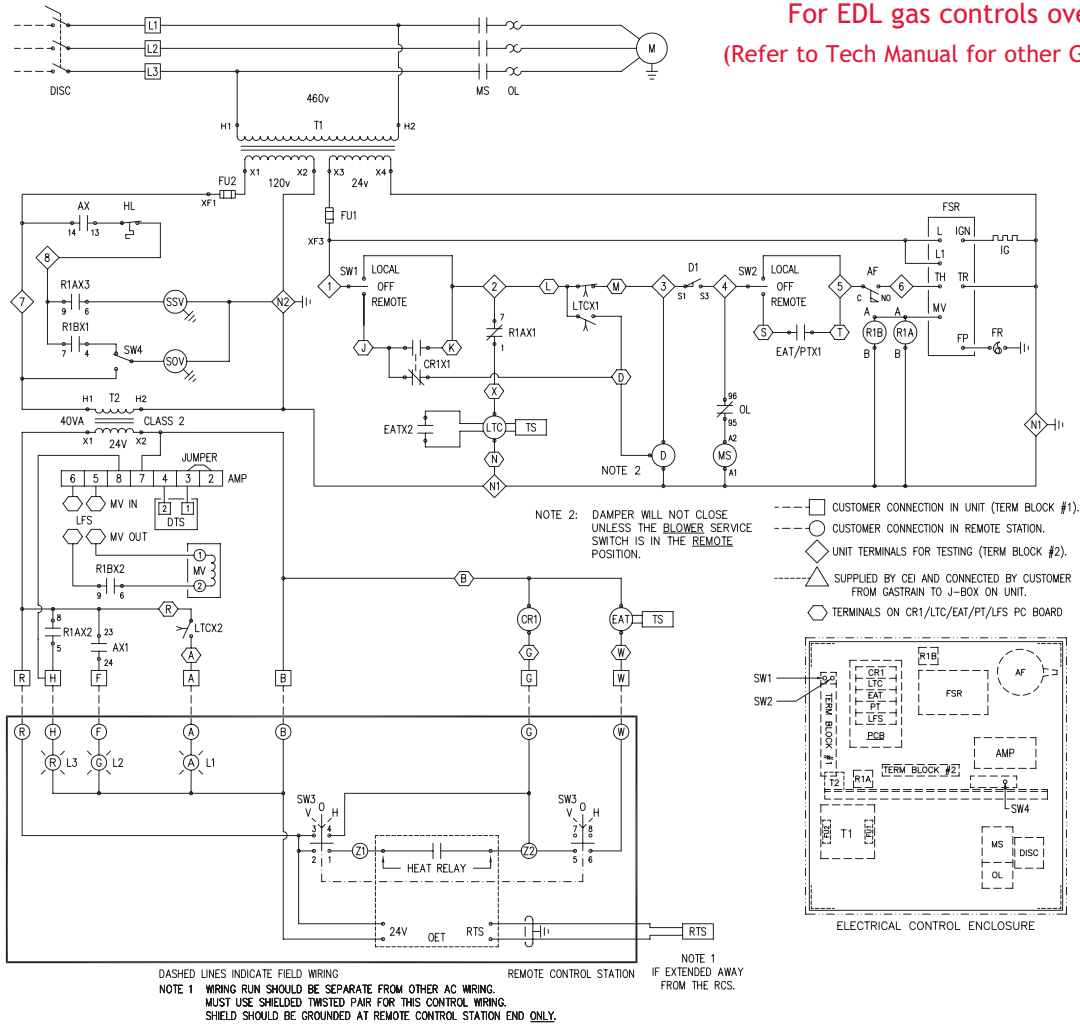
## Summary of Limited Warranty

Cambridge Engineering, Inc. warrants all S-Series products, including all components and sub-components thereof, to be free from defects in material and workmanship for a period of **twenty-four (24) months** from date of shipment, with the exception of the burner which is warranted for **five (5) years**, provided the product is properly installed and operated under normal conditions in accordance with the Cambridge Technical Manual and any other applicable instructions and in conformance with national and local codes.

*For complete warranty, see Standard Terms and Conditions  
in the product catalog or the Technical Manual.*

# Wiring Diagram

For EDL gas controls over 400 MBH only  
(Refer to Tech Manual for other Gas Control Wiring)



SYMBOL	DESCRIPTION
AF	Air Flow Switch
AMP	Amplifier Solid State
AX	Auxiliary Contact
AX1	Auxiliary Contact
CR1	Control Relay
D & D1	Damper Motor & End Switch
DISC	Service Disconnect Non - Fused
DTS	Discharge Temperature Sensor
EAT	Entering Air Thermostat
FR	Flame Rod
FSR	Flame Safeguard Relay (HSI)
FU1	Fuse 24 Volt Control
FU2	Fuse 120 Volt Control

SYMBOL	DESCRIPTION
HL	High Limit
IG	Igniter
L1	Light - Alarm
L2	Light - Fan
L3	Light - Heat
LFS	Low Fire Start
LTC	Low Temperature Cutout
M	Motor
MS	Motor Starter
MV	Modulating Valve
OET	Operating Electronic Thermostat
OL	Overload Relay

SYMBOL	DESCRIPTION
RTS	Remote Temperature Sensor
R1A&B	Relay Gas Valve
SOV	Shut-Off Valve - Gas
SSV	Safety Shut-Off Valve - Gas
SW1	Service Switch - Fan
SW2	Service Switch - Heat
SW3	Switch - Fan/Off/Heat
SW4	Switch - SOV Leak Test
T1	Transformer (24 & 120 Volt)
T2	Class 2 Transformer (24 Volt)
TS	Temperature Sensor (LTC/EAT)

HEATER AMPERAGE RERQUIREMENTS							
Motor Size	120V/1Ph	208V/1Ph	230V/1Ph	208V/3Ph	230V/3Ph	460V/3Ph	575V/3Ph
1HP	18.6	9.8	9.3	6.0	5.5	2.8	2.2
2HP	26.6	14.6	13.3	8.9	8.1	4.1	3.2
3HP	36.6	20.1	18.3	12.0	10.9	5.5	4.4
5HP		32.2	29.3	18.1	16.5	8.3	6.6
7HP				25.6	23.3	11.7	9.5
10HP				32.2	29.3	14.7	11.5
15HP				47.6	43.3	21.7	17.5