# INSTALLATION, OPERATION and MAINTENANCE INSTRUCTIONS for BRASCH 227 SERIES EXPLOSION-PROOF DUCT HEATER

## I. GENERAL

BRASCH 227 SERIES Explosion-proof Electric Duct Mounted Air Heaters for Division I Hazardous Locations are cCSAus certified Class I, Division 1, Groups. B, C & D and Class II, Division 1, Groups E, F & G; Class I, Zone 1 & 2, Groups IIA, IIB+H2 as indicated on the data plate. The Heaters are also suitable for Division 2 locations as indicated, but only when wiring and sealing per Division 1 requirements. The hazard may be inside as well as outside the air duct. The heaters are also available in corrosion resistant construction, suitable for N4, and corrosive environments. The heaters are intended for flanged mounting to a horizontal air supply duct. The heaters utilize a liquid to air heat exchanger filled with a mixture of water and propylene glycol (anti-freeze) that is freeze protected to -40°C, (-40°F), and is non-toxic.

The maximum operating temperature ignition code is T3C, with a maximum surface temperature of 160°C or 320°F. NEVER operate the heater in an atmosphere with an ignition code temperature lower than this rating. The heaters are designed for a minimum airflow velocity with a maximum inlet air temperature of 26°C or 80°F, in a maximum ambient temperature of 40°C, 104°F, and for left hand or right hand horizontal airflow. See the data plate for the specific minimum airflow velocity. NEVER operate the heater in a vertical mounting orientation or with an airflow contrary to its marking.

For details on the particular hazardous environments having the potential for explosion, refer to Articles 500 through 516 of the National Electrical Code, and/or Section 18 of the Canadian Electrical Code, Part I.

A. The BRASCH Explosion-proof Electric Duct Mounted Heaters are intended to be mounted to an air duct by mounting flanges that attach to the left and right side surfaces of the heater frame. The heater frame contains the liquid to air heat exchanger, heater tank and heater. Controls for the operation of the heater may be included as an integral part of the heater or supplied for remote mounting. When included with the heater all of the controls are located in a rated enclosure mounted on the front end of the heater. Certain optional controls such as a disconnect switch or airflow switch are supplied inside their own rated enclosures mounted next to the main control enclosure. All enclosures are connected using rigid conduit and the controls are factory wired. Remotely located controls, outside the hazardous area, may be in a standard enclosure, area permitting.

Safety high temperature sensing limit switches are located so as to limit the maximum liquid temperature inside the heater tank. These safety temperature sensing limit switches are electrically connected per the wiring diagram to the heater electrical power controls so that the heater power is shut off if excessive temperatures are reached.

The heaters are specifically designed for each application and should be properly installed, operated and maintained for optimum service life.

B. Disassembly of the unit for installation is <u>not</u> required or authorized. When installing:

1. Observe <u>all</u> heater nameplate ratings, warnings and notes.
2. Follow the wiring diagram in making all electrical connections.
3. Keep all electrical connections tight.
4. Keep the heater terminal enclosure and heat exchanger clean.
5. Carefully read and comply with all warnings and cautions.

All of the WARNINGS and CAUTIONS are stated in the following Safety Summary and are repeated through these instructions.

## II. SAFETY SUMMARY

**=WARNING=**

BRASCH strongly recommends this heater be installed by qualified personnel familiar with the National Electrical Code and/or the Canadian Electrical Code requirements for hazardous locations as well as any local codes. It is the responsibility of the installer to verify the safety and suitability of the installation.

**=WARNING=**

NEVER operate the heater in an atmosphere with an ignition temperature lower than the heater marking.

**=WARNING=**

The heater must be mounted horizontally, with the airflow velocity and direction as marked on the data plate to maintain the ignition temperature rating.

**=WARNING=**

Disassembly of the unit, for installation, is not required or authorized.

**=WARNING=**

Do not drill into the heat exchanger or heater tank when making duct connections.

**=WARNING=**

The heater is intended to be electrically connected to a coordinated

air flow interlock.

**=WARNING=**

Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the off position and tag the circuit "Out for Maintenance" before working on this equipment.

**=WARNING=**

When making electrical connections to the heater, be sure to follow the wiring diagram provided with the heater. The heater must not be operated without the safety high temperature limit cutouts properly connected in the circuit.

**=WARNING=**

Replacement of electrical components should only be done by authorized personnel familiar with the requirements of maintaining electrical equipment in an explosion-hazard area.

**=WARNING=**

Replacement electrical components must be obtained from the factory to maintain the hazardous location rating.

## III. INSTALLATION

**A. Site Selection.**

1.) BRASCH Explosion-proof Electric Duct Mounted Heaters for Division I Hazardous Locations are designed for use only while permanently mounted in a forced ventilation air duct in a horizontal orientation with an airflow velocity and direction as stamped on the data plate.
2.) The site must allow sufficient free space around the heater for safe and easy installation and maintenance access. Workspace for heater maintenance should be at least 3 feet all around the terminal box.
3.) Airflow through the duct should not be restricted or blocked in any manner, and should be uniformly distributed across the full face area of the heat exchanger.
4.) The site must have adequate means to support the weight of the heater.

**=WARNING=**

BRASCH strongly recommends this heater be installed by qualified personnel familiar with the National Electrical Code and/or the Canadian Electrical Code requirements for hazardous locations as well as any local codes. It is the responsibility of the installer to verify the safety and suitability of the installation.

**=WARNING=**

The heater must be mounted horizontally, with the airflow velocity and direction as marked on the data plate to maintain the ignition temperature rating.

**B. Mechanical Installation.** Once an acceptable location has been determined, follow these instructions to complete the mechanical installation.

**=WARNING=**

Disassembly of the unit for installation is not required or authorized.

1.) Confirm the air duct has sufficient air flow, (cubic feet per minute, CFM), to provide the minimum air velocity, (feet per minute, FPM), per the data plate. To determine velocity:

   a. Calculate velocity; $FPM = \frac{CFM}{A\text{-}Ft^2}$

   b. See table on page 4 for face area.

2.) The air duct must be installed in accordance with the standards of the National Fire Protection Association for Installation of air conditioning and ventilating systems of other than residence type (Pamphlet No. 90A) and residence type warm air heating and air conditioning systems (Pamphlet No. 90B).

**=WARNING=**

Do not drill into the heat exchanger or heater tank when making duct connections.

3.) The top and bottom frame covers may be removed during installation to observe clearances to the heat exchanger and heater tank.
4.) Reinstall the top and bottom covers, if removed, before operating the heater.
5.) For proper operation of a heater with a built on airflow switch, see the air flow switch manufacturer's instructions supplied with the heater.

**=WARNING=**

6.) Multiple heaters designed for mounting in series are designed for a specific "hand" of airflow. Right hand airflow, is defined as an airflow direction from left to right, and left hand direction is air flowing from right to left when facing the front of the main control enclosure. An R or L in the catalog number special feature code denotes the hand of airflow the heater has been designed for.
7.) Exercise care when installing the heater so as not to damage the heat exchanger fins.
8.) Be sure sufficient flange screws are installed to properly support the heater and that they are securely tightened.
9.) Due to the weight of the heater the duct work must be adequately supported at the heater by installing additional hangers.

**C. Electrical Installation.** Follow these instructions to complete the electrical installation:

**=WARNING=**

The heater is intended to be electrically connected to a coordinated air flow interlock.

**=WARNING=**

Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the off position and tag the circuit "Out for Maintenance" before working on this equipment.

1.) Follow the wiring diagram and any Code recommendations in making all electrical connections.
2.) Conduit seals must be installed as identified on the nameplate or within 18 inches of the enclosure on all field installed conduit connections.
3.) Use only an approved Explosion-proof means of wiring, such as mineral insulated cable or copper conductors in rigid conduit with threaded connections and conduit seals per the NEC, or CEC requirements to make electrical connections to the heater.
4.) Follow the NEC and/or CEC and any local electrical and building codes related to the installation and intended use of the heater in an explosion-hazard area.
5.) When doing any work on a heater, including the initial electrical connection, disconnect the electrical current at the main branch circuit switch, and lock the switch in the off (open) position and tag the circuit "Out for Maintenance" to prevent potential lethal shock hazards.
6.) Confirm that the electrical power supply matches the name plate voltage, phase and amperage rating of the heater to be connected.
7.) Ensure conductors are of appropriate gauge size. Size all input conductors according to accepted standards consistent with the temperature rating of the wire being used. Use minimum 75°C rated wire.
8.) Use the power input and control wiring conduit entrances provided. Plug any unused openings using a rated plug.
9.) Conduit connections to the heater cannot impose any loads on, or carry any mounting loads of the heater.
10.) Proper installation of the heater requires that an adequate grounding conductor be connected to the ground terminal. This terminal is painted green or marked with the letter "G" and is located on the inside of the control enclosure next to the power input terminals.
11.) Refer to the wiring diagram to ensure that all connections are as required.
12.) Check and confirm all connections are securely fastened.
13.) Ensure that input conductors and conduit have adequate strain relief at installation.
14.) Before application of electrical power, recheck all connections to ensure compliance with the wiring diagram and any code requirements. Remove any foreign objects from the terminal enclosure. Reinstall cover tightly.
15.) See operating instructions, Section V, before operating the heater.

## IV. FIELD INSTALLED CONTROLS

Contact the factory for co-ordination of any field installed controls. Field installed controls not shown on the wiring diagram may void the BRASCH warranty and the agency certification. Any field installed controls cannot exceed the electrical ratings of the high temperature limit switches. These switches are rated for 125 VA at 480 VAC maximum.

## V. OPERATION

The BRASCH Explosion-proof Electric Duct Mounted Heaters may be operated normally with inlet air temperatures of 80°F (26°C) or less, in ambients less than 40°C or 104°F and in atmospheres containing less than 21% oxygen by volume. All of these conditions must be met before attempting to operate the heater. The heater should <u>never</u> be operated in an oxygen-enriched atmosphere or with inlet temperatures above 80°F. At higher inlet conditions the safety high temperature limit cutouts may activate. If this occurs, the installation should include some means to de-energize the heater during high ambient conditions, such as an automatic temperature control thermostat or a manually operated disconnect switch, to prevent excessive cycling of the controls.

**=WARNING=**

NEVER operate the heater in an atmosphere with an ignition temperature lower than the heater marking.

**=WARNING=**

The heater must be mounted horizontally, with the airflow velocity and direction as marked on the data plate to maintain the ignition temperature rating.

**<u>A. Initial Operation.</u>** Check to make sure the mechanical and electrical installation is complete and that it is safe to operate the heater.

<u>Air Supply.</u> The air supply rate must match the required nameplate velocity and direction.

<u>Fan Interlock/Airflow Switch.</u> The supply fan interlock must be connected to the supply fan starter circuit as shown on the diagram. If a factory installed airflow switch is supplied it may require adjustment. See the instructions supplied with the air flow switch.

<u>Temperature Limit Switches.</u> There are two high temperature limit controls. One is an automatic reset that resets automatically once the temperature drops 20°F to 30°F below its trip point. The other limit control has a

manual reset. The reset push button, located inside the main control enclosure if it has a screwed cover, or through the side of the main enclosure if it has a bolted cover must be pressed to reset the limit if it trips.

Power Controls. The heaters are controlled by magnetic contactors or solid state zero cross over firing SCR's. The type of temperature control used must match the style of power control.

Inlet Temperature Thermostat. For multiple heaters mounted in series a maximum inlet temperature adjustable thermostat is provided on heaters after the first inlet side heater. The thermostat should be set to 80°F.

Optional Pilot Lights. A green pilot light is available to indicate that the heater is "ON" and a red pilot light is available to indicate that a high limit switch has operated.

**B. Normal Operation.**

1.) Inspect the heater installation for loose bolts, covers, signs of overheating or corrosion that could impair the ability of the heater to operate safely. Loose bolts should be tightened prior to operation. Signs of overheating or corrosion should be reported to the factory.
2.) Check the air duct for restrictions, or blockages, and uniform flow.
3.) Place the heater in service.

## VI. MAINTENANCE

**A. Electrical**

**=WARNING=**
Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the off position and tag the circuit "Out for Maintenance" before working on this equipment.

**=WARNING=**
Replacement of electrical components should only be done by authorized personnel familiar with the requirements of maintaining electrical equipment in an explosion-hazard area.

**=WARNING=**
Replacement electrical components must be obtained from the factory to maintain the hazardous location rating.

1.) Annually inspect all terminal connections and visible insulation for damage, looseness, fraying, etc., as applicable. Tighten any loose terminals and replace or repair damaged or deteriorated insulation.
2.) If reduced heat output is suspected verify the condition of the heating elements by using an ammeter to check the current draw of each input line. All input lines should draw approximately equal current which should agree with nameplate rating. If they do not, one or more of the heating elements could be burned out.

**B. Mechanical**

1.) Check the terminal enclosure, and conduit connections for evidence of water leaks or moisture collection. Tighten connections and check covers as required.
2.) The Explosion-proof control box is designed with threaded joints and metal-to-metal contact at the cover joint to prevent an explosion. Do not attempt to install gasket material of any type at these joints.
3.) Annually check the tightness of all mounting bolts and nuts.
4.) Check heat exchanger for dirt build up or corrosion, and clean as required. Report signs of overheating or corrosion to the factory.

## VII. REFERENCE DATA

1.) Wiring Diagrams. Please refer to the enclosed wiring diagrams in making all electrical connections to the heater and in performing any required maintenance.
2.) Data Plate Information. The data plate contains the catalog number and rating information. Please copy this information down and have it available when communicating with the factory.

**Heat Exchanger Face Areas**

| Unit Size Code | Heat Exchanger H (in) | Heat Exchanger W (in) | Area A-Ft$^2$ |
|---|---|---|---|
| A,G,N,U | 12 | 12 | 1 |
| B,H,P,V | 16 | 16.5 | 1.83 |
| C,J,Q,W | 21 | 21 | 3.06 |
| D,K,R,X | 12 | 24 | 2.0 |
| E,L,S,Y | 16 | 33 | 3.67 |
| F,M,T,Z | 21 | 42 | 6.12 |

**Keep these instructions for future reference**.

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