

### CONSTRUCTION DETAILS

- A. **Lifting Eyes** are standard on panels exceeding 72" in height or width; optional on smaller sizes.
- B. **Back-Vent** design allows air circulation between removable component panel board and frame channel.
- C. **Wiring Diagram** shows detailed internal and external connections to panel and recommended supply wire gauges.
- D. **Load Terminals**, properly sized and clearly marked, are coordinated for connection to heater terminals.
- E. **Floor Stands** (optional) facilitate installation and allow panel to be free standing if desired.
- F. **Wall Mounting Brackets** are offset to allow air to circulate behind panel.
- G. **Ventilation Louvers** are standard on Back-Vent and NEMA 1 panels containing components required extra cooling. Grills are optional.
- H. **Line Terminals** are properly sized and clearly marked.
- I. **Lock and Key** is standard on all NEMA 1 panels over 42" wide and all NEMA 12 panels over 42" wide. All other panels are equipped with provision for locking.
- J. **Unique Frame Design** using multiple angle forming produces exceptional rigidity.

## GENERAL INFORMATION

### Application

Brasch control panels are primarily designed for the control of Brasch duct heaters but may be custom designed to control other types of space heating equipment as well.

### UL Listing

Brasch Series UCP control panels are UL listed under File No. E 46202. Brasch Series CP control panels are built to UL Standards but do not bear the UL listing mark because of special control components or applications. In addition, Series UCP control panels meet NEMA Standards (Enclosures for Industrial Control). NEMA 3R and NEMA 4 panels are not UL listed.

### Description

The control panel nameplate (located on the door) will show the catalog number, electrical ratings and UL label where applicable. One panel can contain controls for several heaters (see wiring diagram).

Additional instruction manuals covering adjustment and servicing of specific components will be supplied as required. For installation and service instructions covering associated Brasch heaters, see Bulletin I-17 for open coil heaters or Bulletin I-556 for finned tubular heaters (shipped with heater).

### Uncrating and Handling

When uncrating and handling control panels, care should be taken to prevent undue shock or stress that may cause electrical damage.

Eyebolts are provided on large surface mounted panels to facilitate handling. A visual inspection of the panel should be made before operation to detect any possible damage from shipping or handling.

## INSTALLATION

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**CAUTION** - All Brasch control panels (except NEMA 3R, 4, 12 and flush mounted panels) are ventilated through back-vent construction. Do not block ventilation openings.

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### Location

Install Brasch control panels in accordance with the National Electrical Code, Article 312.

The location selected for the installation of the control panel should allow free air circulation in the vicinity of the panel to prevent possible overheating of control devices. The control panel must be installed so that a space of at least 3/8" exists between the panel and the wall. In addition to securing the enclosure to the wall, the mounting brackets (Fig. 1) also serve as spacers.

The panel should be located so that the doors may be opened to permit convenient access for maintenance and servicing without causing an obstruction when open.

Control panels with louvers or grilles must have enough space around the openings to allow air to freely enter and leave the enclosure.

The panel should be located where no hazardous conditions exist, such as explosive vapors or combustible dust. The ambient temperature in the room should not exceed 80°F.

### **Mounting**

Mounting is accomplished by attaching control panel to wall as shown in appropriate figure below.

Note: Panel board can be removed to reduce weight of box and facilitate installation.

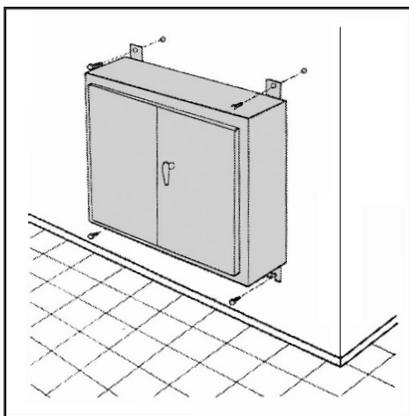


Fig. 1 - **SURFACE MOUNTED CONTROL PANEL.** Attach to wall as shown. Additional mounting brackets may be supplied on larger panels (mounting hardware by others).

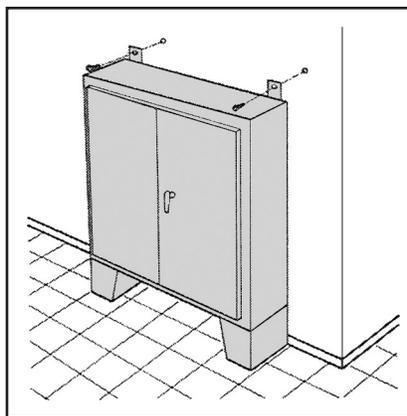


Fig. 2 - **SURFACE MOUNTED CONTROL PANEL WITH OPTIONAL FLOOR STANDS.** Attach top brackets to wall as shown. Stands may be bolted to floor (Mounting hardware by others).

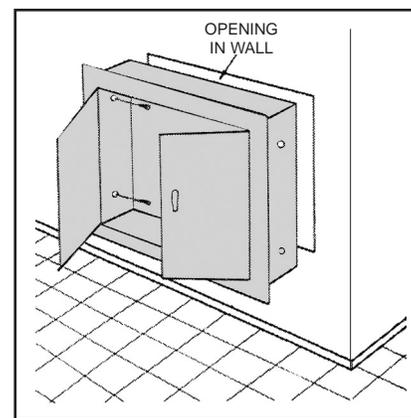


Fig. 3 - **FLUSH MOUNTED CONTROL PANEL (UL to 30" X 30").** Mount panel in wall opening as shown. Holes are provided in sides of enclosure for attaching panel to wall (mounting hardware by others).

## **WIRING INSTRUCTION**

### **Sizing of Field Conductors**

The wire gauges in the following table have been calculated to carry 125% of the line current as required by the National Electrical Code, Article 424-3(b). Supply conductors must have insulation rated at least 75°C (167°F).

Each panel contains two identical wiring diagrams. One is located on the inside of the door, the other one inside the instruction envelope. Recommended field wire gauges are shown on the wiring diagram for supply connections and connections between heater and panel. In addition, the following table can be used to select (or verify) the proper wire gauge. When using the table (or wiring diagram), be certain to read all applicable notes.

To use the table for selection of field conductor size, obtain the line current from the nameplate (if panel has one supply circuit) or calculate the line current per supply circuit by using the proper formula (see Calculation of Line Currents).

To use table for selection of wire size for field connections between panel and heater(s), the line current must be determined in one of two ways:

1. If each heater circuit has its own overcurrent protection device (fuses or circuit breaker) In the panel, the line current is the current drawn by the circuit.
2. If several heater circuits are fed by a single overcurrent protection device, the line current for each circuit must be based on the current carried by the common overcurrent device - **not** on the current by each circuit.

<b>FIELD CONDUCTOR SIZE</b>					
(6 or less conductors in a conduit) ① ④					
<b>AWG or MCM</b>	<b>LINE CURRENT ② (AMPS) ③</b>	<b>AWG or MCM</b>	<b>LINE CURRENT ② (AMPS) ③</b>	<b>AWG or MCM</b>	<b>LINE CURRENT ② (AMPS) ③</b>
14	12	0	120	600	336
12	16	00	140	700	368
10	24	000	160	750	380
8	40	0000	184	800	392
6	52	250	204	900	416
4	68	300	228	1000	436
3	80	350	248	1250	472
2	92	400	268	1500	506
1	104	500	304		

① For 7-9 conductors in a raceway or cable, reduce allowable panel line currents to 87½% of those shown above. For over 9 conductors, consult National Electrical Code.

② Based on 30°C (86°F) ambient temperature.

③ Based on 80% of ratings in Table 310-15(B)(16), of the N.E.C. for 75°C insulation.

Note: Above table is based on short runs of wire. For calculations of voltage drops on long runs of wires, use N.E.C. Chapter 9, Tables 8 and 9 which give ohms/foot for various conductors. The N.E.C. limits voltage drops in branch circuits to 3%; combined drop in feeders and branch circuits should not exceed 5%.

④ Conductors are sized at 100% of their allowable capacities for heaters ≥50KW and 3 or less conductors in a conduit per N.E.C. Article 424.22 (D).

**Overcurrent Protection**

UL requires compliance with Article 424-22 of the N.E.C. as follows:

**(b) Resistance Elements.** Resistance type heating elements in electric space heating equipment shall be protected at no more than 60 amperes. Equipment rated more than 48 amperes and employing such elements shall have the heating elements subdivided, and each subdivided load shall not exceed 48 amperes. Where a subdivided load is less than 48 amperes the rating of the supplementary overcurrent protective device shall comply with Section 424-3(b).

**(c) Overcurrent Protective Devices.** The supplementary overcurrent protective devices for the subdivided loads specified in (b) above shall be: (1) factory installed with-in or on the heater enclosure or supplied for use with the heater as a separate assembly by the heater manufacturer; (2) accessible, but shall not be required to be readily accessible; and (3) suitable for branch circuit protection.

"Where cartridge fuses are used to provide this overcurrent protection, a single disconnecting means shall be permitted to be used for the several subdivided loads."

"Where subdivided loads are required, the heating equipment manufacturer is required to furnish the necessary overcurrent protective devices."

"The main branch-circuit conductors supplying the overcurrent protective devices for subdivided loads are considered as branch circuits to make it clear that the 125 percent requirement in Section 424-3(b) is for the branch circuit only."

This means that the fuses for heater over 48 amperes will be supplied by the heater manufacturer either built into the heater terminal box or as a remote UL listed assembly."

### **Calculation of Line Currents**

To determine the line current, use the proper following formula:

<b>SINGLE PHASE CURRENT = <math>\frac{\text{WATTS}}{\text{VOLTS}}</math></b>	<b>THREE PHASE CURRENT = <math>\frac{\text{WATTS}}{\text{VOLTS X 1.73}}</math></b>
Example: 5 KW, 208 volts $\frac{5000 \text{ Watts}}{208 \text{ Volts}} = 24 \text{ Amps}$	Example: 14.4 KW, 208 volts $\frac{14400 \text{ Watts}}{208 \text{ Volts x 1.73}} = 40 \text{ Amps}$

### **Wiring**

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**DISCONNECT ALL POWER SUPPLY SOURCES TO THE PANEL BEFORE DOING ANY WORK ON THE PANEL INSTALLATION.**

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On the inside face of the control panel door is a wiring diagram showing the wiring between all panel components and the external power and control systems. The wiring diagram also shows minimum supply wire gauge, number of circuits and circuit rating. Refer to the wiring diagram to insure that the panel is connected to the heater(s) for which it is intended.

If the panel has a built-in disconnected switch or main circuit breaker with interlocking handle, no externally supplied voltage, other than that to the main disconnecting means, may be brought into the panel, unless provided with interlocking micro-switches.

If the panel does not have a built-in disconnect switch or main circuit breaker, install a remote disconnect (furnished by others) in accordance with the National Electrical Code, Article 424-65.

The fan must be interlocked with the heater so that the heater is not energized unless the fan is on. One method of accomplishing this is shown on the wiring diagram.

The NEC Class 1 wiring for the control circuit is described in Article 725 of the National Electrical Code.

Route wiring in gutter space provided for that purpose. Do not bundle, tie or wrap power wiring in groups as this may cause overheating and eventual breakdown of the insulation.

All steps are equal in KW capacity unless otherwise marked on the wiring diagram.

If more than one set of line terminals is used, the number of steps supplied by each will be indicated by marking near the terminals and by the wiring diagram.

Ground the panel in accordance with NEC Article 250. Metallic conduit or raceway will serve as a ground if it meets the provisions of the National Electrical Code.

Before placing panel in operation, make sure all terminal connections are tight. It is recommended that all terminals be re-tightened after the first 24 hours of operation and checked for tightness at least once each year thereafter.

### MAINTENANCE

Brasch control panels are made with the finest components available, functionally tested by a trained quality control engineer and should not normally require maintenance except for periodic tightening of terminals (see Wiring). If special control equipment (such as solid state and pneumatic devices) is employed in the panel, occasional readjustment or operational inspection may be required. When special instructions are required, they will be supplied by the component manufacturer and enclosed with the installation instructions.

### SERVICE INSTRUCTIONS

The following table is a guide to be used in servicing control panels. The table includes references to the control panel, heater(s) and associated control equipment since each of these form an integral part of the temperature regulating system. For more detailed instructions covering service of the heater, see Bulletin I-17 for open coil heaters or Bulletin I-556 for finned tubular heaters.

<b>LOCATING TROUBLE</b>	
<b>PROBLEM</b>	<b>POSSIBLE SOLUTION</b>
<b>HEATER WILL NOT OPERATE</b>	<ol style="list-style-type: none"><li>1. Check the supply voltage to the heater.<ol style="list-style-type: none"><li>a. The disconnect switch or main circuit breaker may be in the "OFF" position. If the panel has a built-in interlocking disconnect switch, the door must be closed and the switch in the "ON" position before the system will operate.</li><li>b. Check the fuses for continuity. If they have opened, determine the cause for their failure. Correct the problem before replacing fuses.</li></ol></li><li>2. Make sure that the panel is receiving the correct control signal.</li><li>3. One or more safety devices in the heater may have opened due to insufficient airflow or poor air distribution. See heater service instructions in Bulletin I-17 or Bulletin I-556.</li></ol>

<b>LOCATING TROUBLE</b>	
<b>PROBLEM</b>	<b>POSSIBLE SOLUTION</b>
<p><b>HEATER WILL NOT OPERATE (Contd.)</b></p>	<ol style="list-style-type: none"> <li>4. Check the airflow through the heater. A pressure differential of approximately .07" WC must exist in order for the airflow switch to "make" (close).</li> <li>5. Recheck the installation and wiring instructions (pages 2 through 6) and wiring diagrams to be sure equipment has been installed according to the manufacturers recommendations.</li> <li>6. Check the heater service instructions for other possible causes.</li> </ol>
<p><b>IMPROPER TEMPERATURE REGULATION *** INSUFFICIENT HEAT</b></p>	<ol style="list-style-type: none"> <li>1. Check for proper supply voltage. Make sure that a phase has not been lost on three phase systems.</li> <li>2. Check for proper airflow. Low or stratified airflow can cause cycling of the primary thermal cutout.</li> <li>3. Insufficient heat may be caused by open secondary thermal cutouts.</li> <li>4. Check for proper thermostat/controller operation               <ol style="list-style-type: none"> <li>a. Check the signal from the controller to insure that it is varying over its intended range.</li> <li>b. Make sure that field mounted controllers are located in areas unaffected by other heating or cooling sources.</li> <li>c. Make sure that all field mounted controllers are adjusted and calibrated according to the manufacturers specifications for the existing field conditions.</li> </ol> </li> </ol>
<p><b>IMPROPER TEMPERATURE REGULATION *** EXCESSIVE HEAT</b></p>	<ol style="list-style-type: none"> <li>1. Check for proper thermostat/controller operation               <ol style="list-style-type: none"> <li>a. Check for a faulty thermostat that continually calls for heat.</li> <li>b. Make sure that field mounted controllers are located in areas unaffected by other heating or cooling sources.</li> <li>c. Make sure that all field mounted controllers are adjusted and calibrated according to the manufacturers specifications for the existing field conditions.</li> </ol> </li> <li>2. Inspect/check the contractors or SCRs to determine if they are "sticking" or energized when there is not a call for heat.</li> </ol>

- NOTES: 1. Bulletins describing the operation of the heater and standard components are shipped with each unit. If unable to locate this material, it is available from the factory upon request.
2. Use only factory authorized replacement parts. Use of other materials/components will void the UL listing and could create a hazardous condition.
3. If questions arise not covered in this bulletin, consult the factory. The telephone number is (314) 291-0440 and the fax number is (314) 291-0646.

### **LIMITED WARRANTY**

BRASCH MANUFACTURING COMPANY, INC. warrants Brasch Control Panels, components and accessories for a period of one year from the date of shipment against defects in material or workmanship. Should evidence of defects in material or workmanship occur during the warranty period, Brasch Manufacturing Company, Inc. will repair or replace the product at its own discretion without charge. Brasch Manufacturing Company, Inc. shall not be held responsible for any charges in connection with the removal or replacement of allegedly defective equipment, nor for incidental or consequential damage.