General Statement

The purpose of this product manual (the "Manual") is for Watlow Electric Manufacturing Company ("Watlow") to convey certain recommendations, advisories, and requirements regarding your purchase and use of the product(s) described below (the "Product"). This Manual is not intended to be an exhaustive list of recommendations, advisories, or requirements for the use of the Products. Please visit Watlow's website (http://www.watlow.com/) or contact Watlow customer service (1-800-WATLOW2) for more information regarding Watlow's products. To ensure the proper use of the Product, each User of the Products should carefully review this Manual. FAILURE TO COMPLY WITH THE INFORMATION PROVIDED HEREIN SHALL CAUSE THE USER TO ASSUME ALL RISK AND LIABILITY ARISING OUT OF SUCH FAILURE.

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Product Description

This document is intended to convey Watlow's recommendations for Duct Heaters, Modular Duct Heaters, and individual Modular Duct Heater replacement heaters, designed to the following specifications:

Component Process Duct heaters, various sizes, may be constructed of permanently attached or replaceable individual modular heaters, with or without thermocouple temperature sensor(s), with or without process thermostat, with or without thermowell, with or without terminal enclosures, with or without terminal blocks, rated voltage up to 600 VAC for North America or 1000 VAC @ mains frequency (or 1500 VDC) for the EU, 1 or 3 phase, sheath watt density up to 100 WSI, for use in Ordinary (Non-Classified) Locations only. See product number on product label /

nameplate. For CE Marked products, see product designation on the back of the Declaration of Conformity.

NOTE: Duct heaters are primarily designed to heat air / gases in ducts.

NOTE: This style of heater is primarily designed to be powered by the Mains and hence will be operated at a frequency of 50 or 60 hertz. They may optionally be powered by DC.

NOTE: The Operating Current is important for the User to calculate, in order to properly size the feed wire and other components for the safe operation of the heater. Rated Voltage and wattage are provided for this purpose.

NOTE: The rated temperature range is not stated, since this heater is a component in the User's overall system, however it is the User's responsibility to keep the electrical enclosure temperature below 93°C (200°F). Be sure to read and understand the warnings given in the Electrical Enclosure section of this manual.

Safety Statements

The following markers utilized throughout this Manual shall have the meanings set forth below.

DANGER

This is a Danger statement that is related to the use of this heater. Failure to heed these messages will result in serious personal injury or death.

WARNING

This is a Warning statement that is related to the use of this heater. These statements warn of actions that may result in physical injury or death.

WARNING - Risk of Electric Shock

This is a Warning statement that warns of the presence of electrical voltages which can cause physical injury or death.

CAUTION

This is a Caution statement that is related to the use of this heater. These statements cautions against actions which may damage the heater or associated equipment.

Safety (Generally)

The following sets forth general safety requirements and recommendations relating to the use of the Product(s).

WARNING

The User must ensure that the installer uses all relevant PPE (Personal Protection Equipment).

WARNING

This appliance/component is not intended for use by persons (including children) with reduced sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

WARNING

Electric heaters are inherently dangerous!! Care should be taken to read and completely understand this document before installing and wiring the heater.

Due to the design intent of this component, it will inherently become hot during operation. Therefore, the User must conduct their own Risk assessment to identify if there is any residual risk pertaining to direct contact with hot surfaces.

Due to the weight of some heaters, additional lifting equipment may be required. Use caution whenever handling the heater.

WARNING – Risk of Electric Shock

Any installation and maintenance performed on this heater shall only be done by a qualified electrician, in accordance with applicable national and local electrical codes.

WARNING - Risk of Electric Shock

Never interrupt the protective earth circuit / ground.

Any interruption or disconnection of the protective earth circuit used by this heater will create a dangerous situation and could result in an electric shock that in some situations could lead to serious injuries!

If an enclosure is provided, the symbol set forth below indicates where the protective earth ground should be connected in the electrical enclosure of the heater.

WARNING – Risk of Electric Shock

There is potential risk of rupture of the component if the component is not installed as per the manufacturer's installation instructions. Use of over current device(s) is required in accordance with applicable national and local electrical codes.

CAUTION

This product does not fall under the scope of the EMC Directive. However, if the equipment into which this heater is installed falls under the scope of the EMC Directive, it is recommended that the User ensure that their equipment fully complies with all European New Approach Directives as applicable, which may include the EMC Directive.

WARNING

It is the User's responsibility to ensure that the heater being used is properly selected and installed in the application. This heater should only be used in the application that it was originally designed for, and failure to do so could result in damage to equipment or injury to personnel! For example, an immersion heater is not likely suitable to be used for heating a gas because the watt density would be too high.

These Heater components must be connected as per the Manufacturers installation instructions and therefore must only be utilized in applications suitable for the use of these components.

Typical Applications:

- **Drying ovens**
- **Autoclaves**
- **Furnaces**
- **Load banks**
- **Heat treating**
- **Reheating**
- **HVAC**
- **Paint drying**

WARNING

The User must prevent live conductors from coming into contact with any personnel.

All original enclosures and covers (where applicable), sensors and/or user controls, etc must be correctly utilized in order for the safe operation of this product.

Warning: this product has not been designed for use in Classified (hazardous) locations.

Pre Installation

The following sets forth general safety instructions and requirements relating to the preparation for installation of the product of the Product(s).

Before installing the Product(s), inspect for any damage occurring during shipment, storage or handling. If you have any concerns about the condition of the Product(s), do not install such Product(s) and contact your Watlow representative prior to taking further action with the Product(s).

Before installing the Product(s), confirm that the heater in hand is the same as that which was ordered and which is intended for use. In the event of a discrepancy, please contact your Watlow representative prior to taking further action with the Product(s).

CAUTION

Elements may come in contact with each other during shipment. Minor adjustments to elements may be required prior to installation to separate them. Extensive bending of elements should be avoided since dielectric strength between coil and sheath may be compromised. For FIREBAR elements, Watlow does not recommend field bending of the elements. However, if the element must be bent in the field, please consult your local Watlow representative for assistance

It may be necessary due to atmospheric conditions / humidity, to perform a dielectric test prior to startup. Refer to Insulation Resistance (Megohmmeter) Pre-check under Installation section.

Installation

Proper heater selection and installation will help to ensure heat transfer efficiency, safety, and increased Product life. The following sets forth instructions and requirements relating to the installation of the Product(s).

WARNING

The User must ensure that the installer uses all relevant PPE (Personal Protection Equipment).

Insulation Resistance (Megohmmeter) Pre-check

WARNING – Risk of Electric Shock

The bake-out procedures listed below should only be performed by properly qualified personnel. If the procedure calls for connecting electric power to the heater, this shall only be performed by a qualified electrician, in accordance with applicable national and local electrical codes.

During shipping and/or storage, the possibility of moisture absorption by the insulation material within the heater element is possible. To determine if the proper Megohm value is present, use a 500 VDC (minimum) Megohmmeter to measure the dielectric isolation resistance between the heater terminal and the heater sheath. This value should be greater than 1 Megohm when the unit is at room temperature.

If a low Megohm value exists, the following options may be used to dry the elements and return the Megohm value to an acceptable range.

One method is to place the product in an oven and raise the entire product temperature to remove moisture. In order to maintain termination integrity, the terminal enclosure should be kept below 93°C (200°F), unless different value is specified on the product design drawing or data sheets.

A second method for units with solid state power control devices, the soft start mode is recommended if available. The Watlow Power Series controller offers soft start and heater bakeout operating modes to assure the safest possible startup of heaters that have absorbed moisture. All solid state power control devices must be protected with fuses designed to prevent damage to the device in the event of a short circuit. For SCR protection I^2t fusing is required and must be sized below the I^2t rating of the SCR to insure protection. If a fuse opens during operation, contact your Watlow representative to discuss why the fuse blew, and determine what the necessary corrective action is. In order to maintain termination integrity, the terminal enclosure should be kept below 93°C (200°F), unless different value is specified on the product design drawing or data sheets.

Protection of heater elements from over temperature

The use of automatic temperature controls to regulate the heating process and prevent heater over temperature is highly recommended to ensure safe heater operation. All temperature limit devices must have appropriate third party approval and be applied in the classification for which it was tested and approved. The high temperature limiting device(s) should function independently from the process temperature control.

High Temperature Limit controllers with temperature feedback and relays that are independent from the heater control system can be used to provide an automatic means of interrupting the electrical power circuit when/if excessive temperatures occur.

WARNING

It is the User's responsibility to ensure safety of the installation. Heaters are components of thermal systems. Unless otherwise provided by Watlow in writing, it is the User's responsibility to ensure that the thermal system is safe and that it performs as intended.

Install high temperature control protection in systems where an over temperature fault condition could present a fire or other hazard. Failure to install temperature control protection where a potential hazard exists could result in damage to equipment and property, and injury to personnel.

NOTE: Some heaters are supplied with thermocouples or thermostats, however it is still the responsibility of the User to properly use these devices in the control or protection circuit.

CAUTION

Failure of components in a temperature control loop, such as the sensor, heater control relay or main temperature control, can result in damage to a product in process, a meltdown of a heater, and/or damaging fire. To protect against this possibility, over temperature protection must be provided to interrupt or remove power from the heater circuit. To limit this risk, perform a functional test of all temperature limiting devices on a regular interval.

A bulb and capillary thermostat is not recommended for this function since it may not respond quickly enough to adequately protect the heater. In cases where the thermostat bulb gets too hot before the system is turned off, the thermostat bulb could rupture. This could result in the thermostat remaining in the "ON" condition since there is insufficient fluid to move contacts apart.

CAUTION

Ensure that the heater is installed in the correct orientation. The Hi limit sensor orientation (if so equipped) is critical!

Electrical Enclosures and Electrical Connection Protection

WARNING

Typically an enclosure is provided. It is the User's responsibility to determine the correct rating of the electrical (terminal) enclosure. This should be based on appropriate national and local electrical codes, as well as the environment in which the heater will be located. Failure to use a compatible enclosure could result in heater damage and personnel danger.

The User must ensure that any enclosure opening(s) are suitably glanded / filled / plugged to thus maintain the Type / IP environmental rating of the enclosure (after any wiring to the enclosure is completed).

In order to maintain termination integrity, the terminal enclosure should be kept below 93°C (200°F), unless different value is specified on the product design drawing or data sheets.

Standard terminal enclosures are designed for general purpose (NEMA Type 1 / IP20). These enclosures should be applied where there will be no danger of spilled liquids, dampness, dirt, and gaseous conditions. Enclosures for wet locations are also available, but must be installed at the factory.

When enclosures are supplied over the terminals, units should be located in an area that will minimize the chance of being hit by falling or moving objects. The terminals must be protected at all times from moisture or vapor.

Orientation and Mounting

WARNING

Avoid incorrect handling and installation of the component parts. For example, do not lift the heater by the leadwires and avoid direct contact with fiberglass insulation.

CAUTION

Heater orientation can be important in order to ensure intended heat transfer and safe operation. Refer to the documentation for the thermal system design for the proper orientation and ensure that the heater is installed accordingly. Observe any markings on the flange that may indicate required orientation, for example "Flow" with an directional arrow.

The Hi limit sensor orientation (if so equipped) is critical!

Care should be taken to allow enough room for heater expansion without compromising heat transfer.

WARNING

Electric heaters are capable of developing high temperatures, so to minimize the risk of fire extreme care should be taken to locate the heater in a safe location and environment.

Ensure that combustible materials are maintained far enough away from the Product to ensure that they are free of the effects of high temperatures.

This Product is not suitable for use in Hazardous (Classified) Locations.

A typical duct heater may be mounted vertically, or horizontally, from the left to right, top or bottom. Where orientation is important to the high limit sensing, observe and follow any instructions from the systems designer. The inlet side of the unit must be at least 1.2m (48 in) downstream from any transition in duct size or direction, or from any air handling equipment. See **Figure 1** for locations that should be avoided.

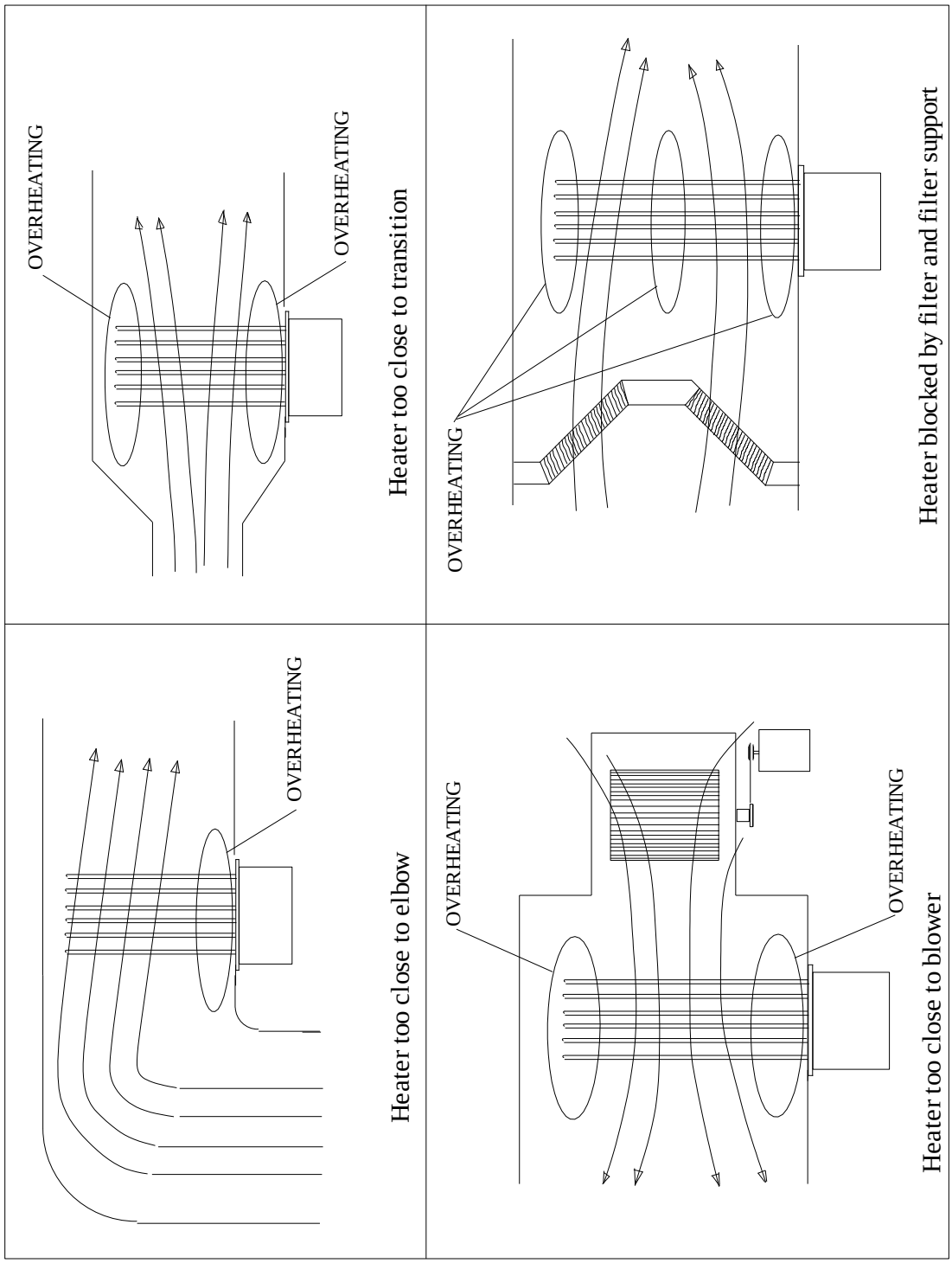

OVERHEATING
OVERHEATING
Heater too close to transition
OVERHEATING
Heater blocked by filter and filter support
OVERHEATING
Heater too close to elbow
OVERHEATING
OVERHEATING
Heater too close to blower

Figure 1

Heaters may be ganged in parallel for various total wattages desired. The temperature control thermocouple if so equipped should be located near the outlet to sense exiting air temperature. It may be desirable to use in inlet and outlet temperature sensor for cascade style control. Conduct process temperature sensing in the outlet stream away from the heater.

Minimum air velocity through the heater is 61 m/min (200 ft/min) for air temperatures approaching 412°C (800°F). Lower velocities will jeopardize element life.

Air flow over the entire face of the heater should be uniform throughout the cross section of the ductwork before entering the heater bundle at the design velocity.

The units screw or bolt in place through the 9.53 mm (3/8 in) dia. holes in the mounting flange. When installed vertically through the top of the duct, they are self supporting, when the duct is capable of supporting the heater weight.

When installed horizontally the user must determine whether the duct wall has sufficient strength to support the unit by the flange only. A frame may be necessary to support the unit in the duct. This frame can have tapped holes or captive nuts to receive mounting bolts. An access panel in the duct can facilitate installation.

Mounting Holes / Bolts

Standard mounting holes are 9.53 mm (3/8 in) diameter with a tolerance of 0.13 mm (0.005 in). The center line to center line spacing on the mounting holes of the flange have a tolerance of 0.38 mm (0.015 in), therefore the mounting holes on the duct should also have a center line to center line tolerance of 0.38 mm (0.015 in).

For duct heaters with Carbon Steel Flanges M8 x 1.25 x length ASTM A449 (5/16” – 16 UNC-2B Grade 5, SAE J429) bolts should be used. For 304 Stainless Steel Flanges M8 x 1.25 x length ASTM A320 (5/16” – 16 UNC-2B Grade B8, ASTM A320) bolts should be used. Recommended washers are 7.94 mm (5/16 in) spring type in the corresponding material. For other flange materials consult your Watlow representative. The thread engagement on the bolts should be equal to or exceed the cross section diameter of the bolt.

It is important when tightening the bolts that enough torque is used to seat the gasket. A minimum torque of 67.8 N·m (50 ft-lbs) is recommended to seat a 3.18 mm (1/8 in) thick gasket of the materials recommended in the Gasketing section.

Gasketing

It is important to completely seal off the process air flow from the terminal enclosure using a gasket. For air applications we recommend the following gaskets depending on the process temperature. For applications other than air or at higher temperatures consult the factory or a gasket manufacturer.

Process Temperature (°F)	Thickness	Material Line Call Out	ASTM F104
Up to 370°C (700 °F)	3.18 mm (1/8”)	Compressed Asbestos-Free Fiber Reinforced	F712100A9B4E22K5M6
Up to 500°C (932 °F)	3.18 mm (1/8”)	Flexible Graphite	F517100B1M3

If the opening in the duct work is larger than the area required for the duct heater, the terminal area may be exposed to air at temperatures which exceeds the terminal enclosures rating. Therefore, it is recommended that gaps the duct and the heater be sealed off using tadpole gaskets that are rated to the process temperature. This will help to lower the terminal enclosure temperature and save energy. See Figure 2 for an example of how tadpole gaskets will seal off the terminal from being exposed to process temperatures.

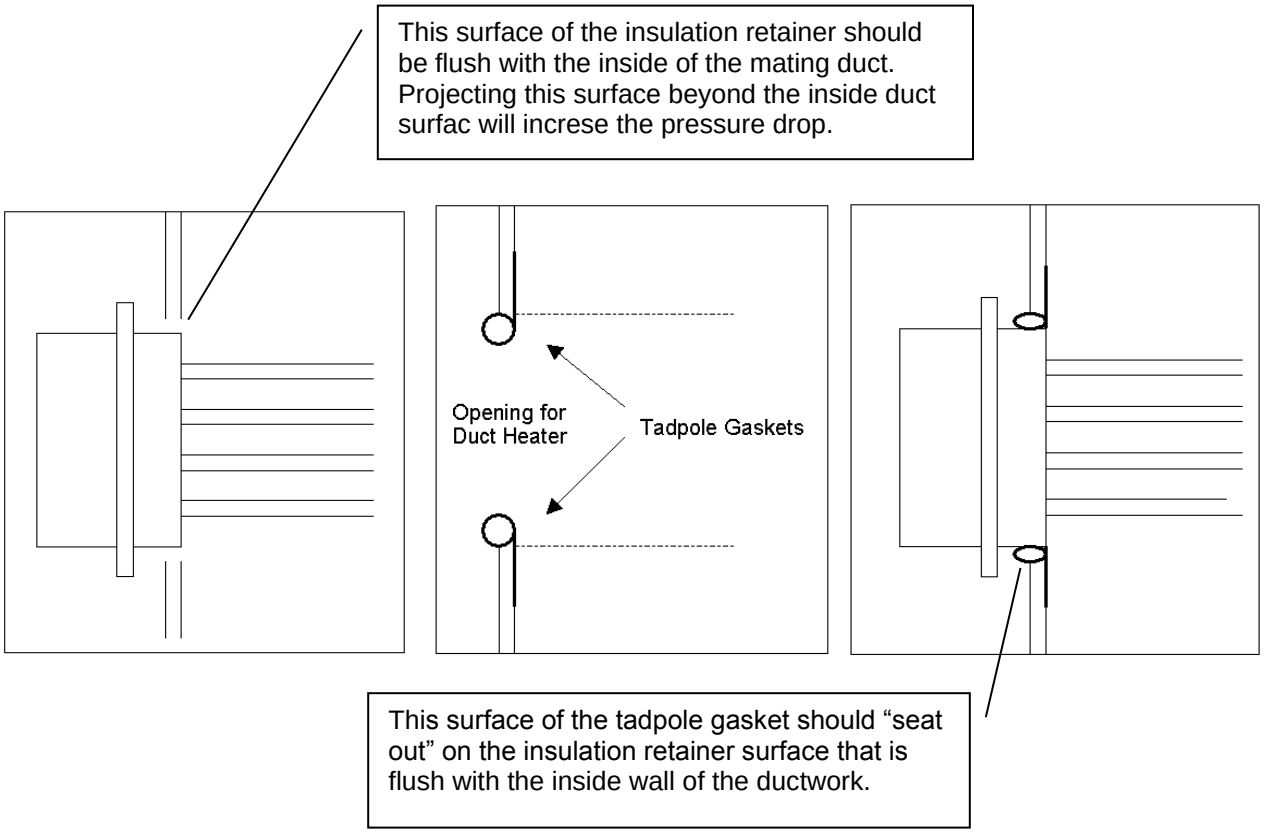


Figure 2 - Using Tadpole Gaskets to Seal off the Air Flow

Lifting / Installing

Duct heaters can be lifted in the horizontal or vertical position as long as straps are used that are suitable for the size and the weight of the heater. For horizontal lifting it is recommended to use two straps; one supporting the bundle using the element supports, and the other supporting the terminal enclosure. The strap for the element bundle should not be looped through the elements, only the support rods. This protects the elements from possible damage during lifting. The second strap shoud support the terminal housing. See Figure 3 below for locations for straps.

Once the heater has been lifted and is being installed into the ductwork, the strap in the bundle should be removed, only after the bundle has been placed inside of the ductwork. The strap on the housing should be removed just prior to the heater being securely mounted into place.


Figure 3 - Install Lifting strap between element bundle and support bracket. Do not entwine straps between elements. Place second strap around terminal enclosure.

For vertical lifting a strap can be attached vertically around the terminal enclosure and the insulation retainer. In order to do this, the strap can be slipped through the space between the element bundle and the insulation retainer. Avoid putting the strap through the elements to prevent possible damage from lifting. See Figure 4 below for examples.


Figure 4 - For Vertical lifting place strap through the space between the element bundle and the insulation retainer. Do not slip the strap through the elements.

For other optional lifting procedures please consult your Watlow representative.

Wiring

WARNING

The User must ensure that the installer uses all relevant PPE (Personal Protection Equipment).

WARNING – Risk of Electric Shock

The installation and wiring of this heater shall only be done by a qualified electrician, in accordance with applicable national and local electrical codes.

For heaters that do not already have insulated supply leads provided, the User must take action to cover any exposed conductive surfaces by adding suitable insulating material such as sleeving, heat shrink sleeve insulation, ceramic beads, etc.

WARNING – Risk of Electric Shock

Do not interrupt the protective earth circuit / ground.

Any interruption or disconnection of the protective earth circuit used by this heater will create a dangerous situation and could result in an electric shock that in some situations could lead to serious injuries!

If an enclosure is provided, this symbol indicates (shown below) where the protective earth ground should be connected in the electrical enclosure of the heater.

Electric heaters can be a source of stray current (aka leakage). Further, a short to ground is a common end-of-life failure mode for many kinds of electric heaters. To guard against injury or damage to equipment a GFI style circuit breaker selected to accommodate the electrical leakage during normal operation may need to be installed to ensure the safe operation of the heater.

WARNING – Risk of Electric Shock

It is the User's responsibility to properly size the ground wire for the Protective Earth / Safe Ground and to assure that the impedance of this is low enough to assure a person's safety.

WARNING

It is the User's responsibility to properly size and install the feeder wires for the heater. Feeder wire should be properly selected based on amperage, electrical power rating, ambient temperature, and type of environment. Feeder wire should also be housed in either rigid or flexible conduit which carries the same classification as the electrical enclosure.

For heaters that do not already have insulated supply leads provided, the User must take action to cover any exposed conductive surfaces by adding suitable insulating material such as sleeving, heat shrink sleeve insulation, ceramic beads, etc

It is essential that these connections be tight. The top nut of the element stud terminals should be tightened to a maximum torque of 2.3 N·m (20 in-lbs) while the bottom nut is supported. NOTE: The top nut of stud terminals that do not have a buss bar or factory installed ring connector should only be tightened to 1 N·m (9 in-lbs).

It is the User's responsibility to ensure that the adjacent edge radii and bending radius of conductors/cables are large enough at the point of entry to prevent any damage and that connection of conductors, including their covering, shall be possible without risk of damage.

Consult the wiring diagram, if supplied with the heater, for the correct feeder wires connections. If one was not supplied with the heater, the system designer or your Watlow representative should be consulted for the appropriate wiring diagram.

Feeder wire line connections may be made directly to stud terminals or box type compression fittings. Box type compression fittings will accept a 21.1mm² (#4 AWG) maximum wire while stud terminals will accept a M6 (#10) ring connector (T&B, Amp, etc.). A protective earth / ground connection terminal is also supplied inside the housing for ground wire. This terminal is painted "green" for easy identification within the electrical enclosure.

Stud terminals should be tightened to a maximum torque of 2.3 N·m (20 in-lb) while the bottom nut is supported. NOTE: Stud terminals that do not have a bussbar or factory installed ring connector should only be tightened to 1 N·m (9 in-lb)

Torque Values for Terminal Connections

To prevent arcing, it is important that all of the terminals connections be tightened, whether it be the individual element terminals or the connection blocks. See Figure 5. Watlow recommends the following torque specifications for the feeder wire connection blocks:

Wire Size	Recommended Torque (in-lb)	Recommended Torque (N·m)
21.1 – 13.3 mm² (#4-#6 AWG)	45	5.1
8.36 mm² (#8 AWG)	40	4.5
5.26 – 2.08 mm² (#10-#14 AWG)	35	4.0

A 1/8” hex head drive is required for tightening the compression block set screw.

The top #10-32 threaded hex nuts on the individual element terminals may need to be tightened to 2.3 N·m (20 in-lb) using a 3/8” hex nut driver.

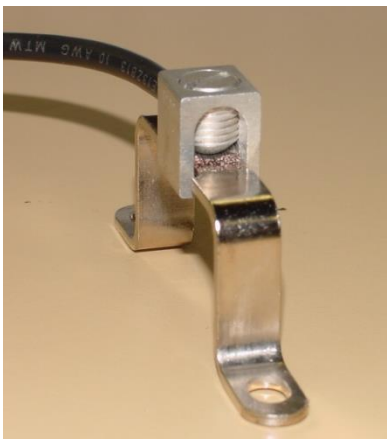


Figure 5 - Tin Plated Aluminum Connection Block with lead wire

It is the User’s responsibility to ensure that the power circuit includes a branch circuit overcurrent protective device, a disconnect and a secondary thermal cut-out with manual reset. The control circuit should include the temperature controller, the primary thermal cut-out and an interlock with the fan motor. The system designer may include a pressure air flow switch. Typically, it will open the control circuit and de-energize the heater when any circumstance prevents sufficient air flow through the heater. The air handler should be set up to run on a time delay after the heater is de-energized. The correct time delay will depend on the blower rating, amount of duct insulation, and the total power output of heaters(s). The time delay allows the elements to cool and prevents overheating the adjacent duct and terminal areas.

WARNING – Risk of Electric Shock

The Mains / Line voltage applied to the heater must always be equal to or less than the voltage rating marked on the heater's nameplate.

Some heaters are supplied as dual voltage (e.g. 240V / 480V) units and hence the User needs to check the wiring diagram supplied with the heater to ensure that the heater is wired correctly for their supply voltage. In most cases (unless specified by User) the heater as received will be wired for the higher operating voltage.

WARNING – Risk of Electric Shock

If thermostats are supplied with the heater, they are for pilot duty use only. Consult specific product wiring diagram supplied with the heater for the allowable wiring of thermostats.

Thermostats should not be relied upon to remove electrical power for maintenance. The use of a disconnect switch or circuit breaker is highly recommended and will allow the isolation of the heater when maintenance is required.

Start Up

The following sets forth instructions and requirements relating to the initial startup of the Product(s).

CAUTION

Before energizing the heater the following items should have been checked with the Main / Line voltage disconnected. Failure to do so could result in damage to the heater when it is energized.

1. ***Electrical terminations are tight and wiring is per wiring diagram supplied with heater***
2. ***Proper disconnecting means and fusing have been installed***
3. ***The voltage rating of the heater is the same as that being applied***
4. ***Leg to Leg voltage is equal on 3 phase unit.***
5. ***Megohm value of the heater element(s) are within acceptable limits***
6. ***Proper temperature controls and safety limiting devices are in place with proper set point***
7. ***The heater is securely installed in the duct and no leaks are present.***
8. ***The heater is properly grounded.***
9. ***For circulating type applications, assure that the correct gas flow has been started and is being maintained over the heater bundle to ensure that heater elements do not overheat and fail once the heater is energized.***

WARNING

After restarting the system and enabling power to be applied to the heater in normal operating mode, make sure that the system is being controlled properly before leaving it to run unattended. Failure to do this could result in the heater overheating in a "run away" condition that could lead to damage to equipment, fire or personal injury.

NOTE: Thermal cycling may cause the gasket or sealed joints to relax, allowing an air leak. On flange units, tighten bolts to re-seat gasket. If the leak persists, replace the gasket. Care should be taken to observe the orientation of the flange to its original position.

Troubleshooting

The information provided below contains potential causes and corrections for functional problems with the Product(s). This is a nonexhaustive list of potential problems and corrections and is not meant to cover all potential issues. Please do not hesitate to contact your Watlow representative if you have any questions regarding the performance of your Product(s).

WARNING – Risk of Electric Shock

High voltage is present when the heater is energized and hence troubleshooting of this heater shall only be done by qualified personnel. It is the User's responsibility to ensure that proper precautions are taken in reference to applicable personal protective equipment (PPE) needed by those installing and maintaining equipment.

PROBLEM	Cause / Correction
No power available to heater	Check disconnect switch to ensure it is in the "ON" position And that fuses are not blown. Replace fuses if they are blown
Fuses blowing	Check heater electrical rating. Applied voltage may be wrong Check fuse rating. Fuses should be at least 25% more than full Load Amperage Disconnect heater power source. Check the heater resistance To ground. This should be no less than 1 Megohm. Refer to Megohm checking. Check heater enclosure for loose or oxidized connections. repair and tighten as necessary Check heater enclosure for presence of condensation. Conduit seals or drains may be required
Not enough power	Check line voltage to ensure it is within specification Check full line current if voltage is correct. If line current is lower, the heater may be wired wrong or has open elements
Air/gas not heating to desired Temperature	Not enough Kw Too much heat loss
High limit tripping / alarm	Not enough air/gas flow Too much kW Line voltage higher than designed / allowable

Preventative Maintenance

WARNING

The User must ensure that the installer uses all relevant PPE (Personal Protection Equipment).

WARNING – Risk of Electric Shock

High voltage is present when the heater is energized and hence preventative maintenance of this heater shall only be done by qualified personnel.

Turn all power off to the heater and "Lock Out / Tag Out" the power disconnect switch(es) for the heater before performing any preventative maintenance.

It is the User's responsibility to ensure that proper precautions are taken in reference to applicable personal protective equipment needed by those installing and maintaining equipment.

WARNING

The heater, vessel and system can remain hot for a long period of time after the power has been removed, so make sure the equipment has cooled down to a safe temperature before performing any preventative maintenance.

WARNING – Risk of Electric Shock

If an enclosure is provided, the terminal enclosure cover is bonded to enclosure body to ensure an effective ground fault current path. If this bonding conductor is disconnected for any reason it must be reconnected for safety. The typical connection utilizes two external tooth lockwashers to sandwich the conductor ring terminal against the connection base and the tightening nut/screw. All hardware must be replaced. Retighten connections to 2.3 N·m (20 in-lb).

Thermal cycling, corrosion and vibration can cause degradation of thermal system and electrical interfaces. Follow system designer's guidelines for periodic checking of the condition of the installed heater and the electrical connections.

Check line connections on a regular basis (6 months recommended) to make sure they are tight, free of oxide build-up, and that no dust or dirt build-up is present. Retighten as necessary per the instruction found in Wiring Section of this manual.

If an enclosure is provided, check enclosure (inside) for rust, dirt or dust. Remove rust if present, with steel wool (or equal) and thoroughly blow clean with dry, oil-free air. If enclosure is moisture resistant, check condition of cover gasket. If the gasket is damaged or is in needed of replacement, please contact the Watlow representative for further assistance in resolving this issue.

Duct heaters should be checked periodically for scale build-up. Clean as required. Scale can cause high sheath temperature and result in inefficiency and shortened life.

Thermal cycling may cause sealed joints to relax causing a leak. Inspect all sealing-related features and replace gaskets and/or tighten connections if necessary.

Replacement Parts

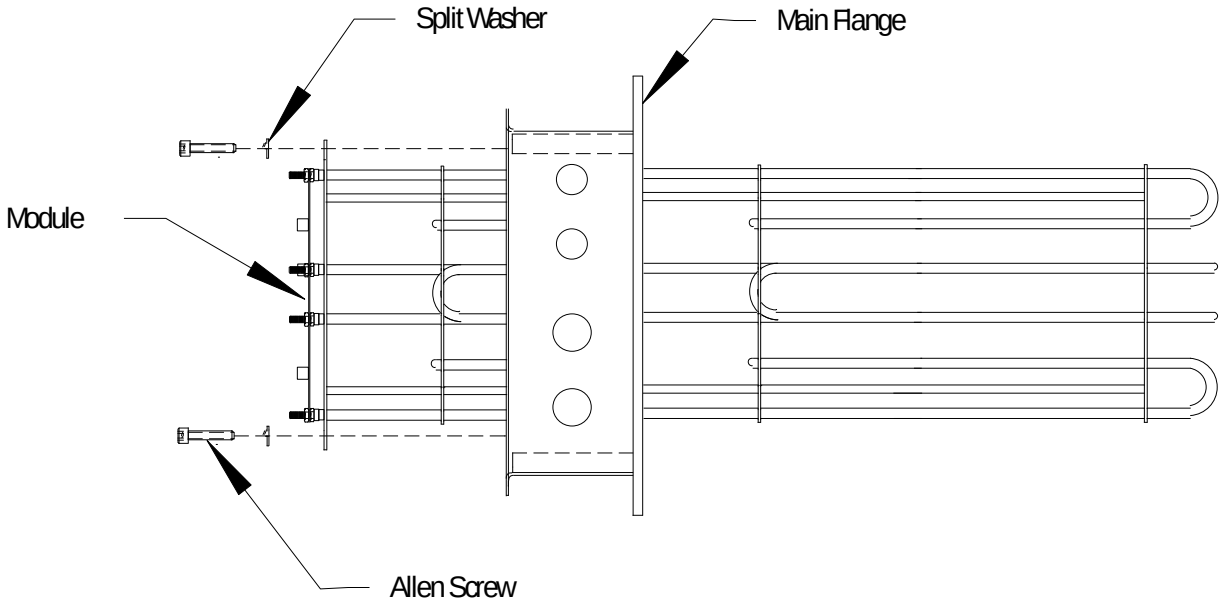
Please contact a Watlow representative directly to order additional or replacement parts. If your Watlow representative is not known, please visit our website http://www.watlow.com and use the interactive “Sales & Distributor Locator” tool to identify and contact your local Watlow distributor for ordering replacement parts.

When ordering any additional or replacement products from Watlow, please reference the part number, which should be located on the Product’s marking, nameplate or tag.

Recommended spare parts for a Duct Heater would include a high limit thermocouple or high limit thermocouple kit. In addition, for Modular Duct Heaters, individual replacement heater modules are available.

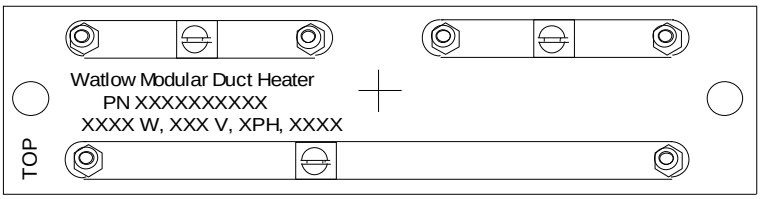
***To replace individual heater module*:**

a) Disconnect power and then feeder wire
b) Remove terminal hardware connecting module to be replaced and other adjacent modules.
c) Remove the two Allen head screws and split washers holding module to main flange.
d) Pull module through main flange as shown below.
e) Reinstall new module through main flange and retighten using Allen head screws and split washers.
f) Reinstall jumpers and feed wire
g) Check circuit resistance to ensure that modules have been properly wired

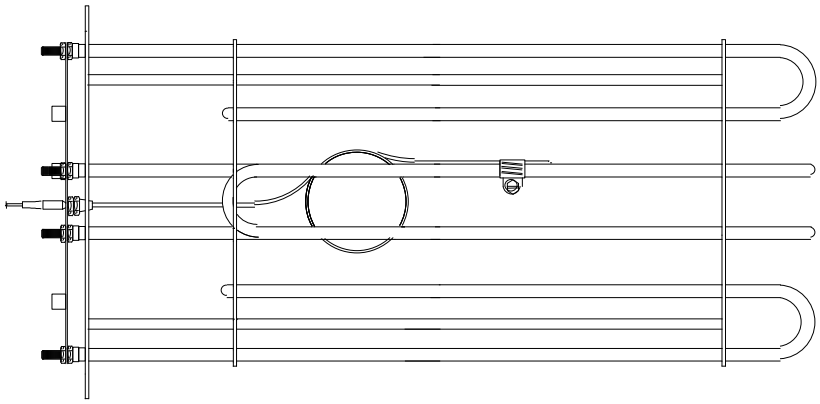


To install high limit thermocouple kit:

a) Perform steps a - d above.
b) Use a 11/32” drill to drill a pilot hole at the location depicted by the “+” mark shown on the flange below.



c) Use a 1/8 NPT tap to thread the hole drilled in step b. Make certain that the hole being tapped is perpendicular to the flange. If it is not perpendicular, electrical shorting may occur between the compression fitting and the nearby electrical jumpers.
d) Thread the lower portion of the compression fitting in the hole tapped above.
e) Insert thermocouple through lower portion of compression fitting threaded into flange and through hole in upper support bracket until transition fitting of thermocouple is bottomed out.
f) Tighten upper portion of compression fitting to firmly hold thermocouple in place.
g) Wrap thermocouple as shown in the diagram below about two times on a 50.8 mm (2 in) diameter.
h) Attach tip of thermocouple to mid section of element using the hose clamp provided. The tip of the thermocouple should not be covered by the hose clamp, but should extend about 4.8 mm (3/16 in) from the hose clamp.
i) Pass heat shrink provided over thermocouple leads and compression fitting. Heat shrink sleeving so that it adheres to the shape of the compression fitting and thermocouple.



Disposal and Recycling

Heaters are classified under the RoHS and WEEE directives as electronic components with respect to disposal, and as such, must be recycled as per the requirements of the national regulations of the End User.

Terms and Conditions and Product Returns

Unless otherwise expressly agreed to in writing by Watlow, Watlow's standard terms and conditions shall apply to your purchase and use of the Product in all respects. Such terms and conditions include, but are not limited to applicable warranty obligations and payment terms. The terms and conditions may be found attached to any order acceptance or bid prepared by Watlow. For a copy of such terms and conditions, please contact Watlow's customer service department.

In the event that you desire to make a warranty claim against any Product because it does not comply with the warranty provisions provided under the applicable terms and conditions, please contact Watlow customer service to obtain a Return Material Authorization (RMA) number before returning any item for repair or replacement. The following information is needed to process a returned Product expeditiously:

- Customer name
- Contact Name
- Part number
- Quantity
- Reason for return
- Customer account number
- Phone Number
- E-mail Address
- P.O. number
- Application information
- MSDS sheet of material(s) that came in contact with heater, if used.

Prior approval and an RMA number are required when returning any unused Product for credit. Make sure the RMA number is on the outside of the carton, and on all paperwork. Return all material on a Freight prepaid basis.

Stock Products which have not been used or modified can be returned to Watlow for a 20% restocking charge. Modified stock units can only be returned if they are not permanently modified, for a minimum 30% restocking charge. Please contact Watlow customer service for further instructions. All stock and modified stock Products must have a date code no later than 2 years from the date of shipment in order for Watlow to accept such returns.

Declaration of Conformity (page 1)

CE CE

WATLOW

CE DECLARATION OF CONFORMITY

Manufacturer:

Watlow Electric Manufacturing Company
6 Industrial Loop Road
Hannibal, MO 63401

Product Families:

WATROD™ Heater, FIREBAR® Heater, Screw Plug Heater, Duct Heater, Flange Heater, MULTICELL™ Heater, ECO-HEAT® Heater, and Over-the-Side Heater.

SEE OPPOSITE SIDE FOR PRODUCT DESIGNATION

Description:

Metal-Sheathed Heating Elements and Heating Assemblies

We, as the manufacturer, hereby declare that the Products described above (and on the opposite side), are in conformity with the applicable requirements in accordance with the following European Directive(s):

Low Voltage Directive 2014/35/EU
RoHS Directive 2011/65/EU

The object of the declarations described above is in conformity with the relevant Union harmonization legislation. This declaration of conformity is issued under the sole responsibility of the manufacturer for the aforementioned product(s).

The following Harmonized Standard(s) and normative references were complied with -

BS EN 60335-1:2012+A11:2014 - Safety of household and similar electrical appliances

EN 50581:2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

European person authorized to compile the Technical File, on behalf of the Manufacturer, is:

Martin Wallinger
Watlow Plasmatech GmbH Brennhoflehen-Kellau 156
5431, Kuehl, Austria
+43 6244 20129-0

Signed for and on behalf of:
Watlow Electric Manufacturing Company
6 Industrial Loop Road
Hannibal, MO 63401

Name of Signatory: Jana Yarrington **Signature:**

Function/Position: Director of Operations **Date:** March 22, 2017

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Declaration of Conformity (page 2)

CE CE

Product Designation:

Catalog Product(s) Code Number(s)	Description
Series R, may be followed by additional letters and numbers	WATROD Element
Series F, may be followed by additional letters and numbers	FIREBAR Element
Series B, may be followed by additional letters and numbers	Screw Plug Heater
Series D, LDH, MDH may be followed by additional letters and numbers	Duct Heater
Series F, may be followed by additional letters and numbers	Flange Heater
Series MX or TX, may be followed by additional letters and numbers.	MULTICELL Heater
Series EH, may be followed by additional letters and numbers	ECO-HEAT
Series O and V, may be followed by additional letters	Over-the-Side Heater

The above table describes typical catalog model designations. Custom products are defined with a part number as shown below. The part number prefix typically designates the base element construction. May also be preceded by the letter "U".

Prefix	DESCRIPTION
0	0.210 in. (5.3 mm) dia. WATROD
1	0.260 in. (6.6 mm) dia. WATROD
2	1-Inch FIREBAR 1.010 in (25.7 mm) height X 0.235 in. (5.9 mm) thickness
3	0.315 in. (8.0 mm) dia. WATROD
4	5/8-Inch FIREBAR 0.650 in. (16.5 mm) height X 0.235 in. (5.9 mm) thickness
5	0.375 in. (9.5 mm) dia. WATROD
6	0.430 in. (10.9 mm) dia. WATROD
7	0.475 in. (12.1 mm) dia. WATROD
8	0.490 in. (12.5 mm) dia. WATROD

The number following the first dash typically designates the product family and/or application as shown below:

Miscellaneous application with WATROD or FIREBAR as base element construction:
2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, 28, 29, 31, 32, 33, 34, 35, 45, 46, 47, 48, 49, 50, 51, 55, 56

Screw Plug Heater: 36, 38, 39, 41, 43, 44

Duct Heater: 1

Flange Heater: 18, 21, 22, 23, 26, 27 or alternately 700 Series (700-799) followed by 2 digit date and three digit sequence number (7XX-YYSSS)

MULTICELL Heater may be designated with 9xxx, or 10xxx part number only.

ECO-HEAT: 67

Over-the-Side Heater: 30

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