

## FIREROD® Product Guide

### General

The purpose of this product guide (the “Guide”) 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 guide is not intended to be an exhaustive list of recommendations, advisories, or requirements for the use of the products.

To ensure the proper use of the product, each user of the product should carefully review this guide. FAILURE TO COMPLY WITH THE INFORMATION PROVIDED HEREIN SHALL CAUSE YOU TO ASSUME ALL RISK AND LIABILITY ARISING OUT OF SUCH FAILURE.

### Product Description

This guide applies to Watlow FIREROD® heaters. The product can be distinguished via marking on the outer metal sheath and/or a lead wire tag with “WATLOW FIREROD” or simply “FIREROD”.

### Safety

The following markers utilized throughout this guide shall have the meanings set forth below:



**DANGER** – *This is a danger statement that is related to the use of this product. 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 product. 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 product. These statements caution against actions, which may damage the product or associated equipment.*



**DANGER** – *Care should be taken to read and completely understand this guide before installing and wiring the product. The product is designed to become **hot** while in operational use. The end user must conduct their own risk assessment to identify if there is any residual risk pertaining to direct contact with hot surfaces. There is potential risk of rupture or other malfunction of the product if it is not installed in accordance with this guide or other installation instructions provided by Watlow. It is the end user's responsibility to ensure that the product is properly selected and installed in accordance with applicable recommendations given within this guide. **Note:** this guide does not cover all foreseeable end-use applications, therefore, consult your local Watlow representative with any additional questions or concerns.*



**WARNING – Risk of Electric Shock** – *Any installation and maintenance performed on this product shall be performed by a qualified electrician in accordance with applicable national and local electrical codes. It is the end user's responsibility to ensure that proper precautions are taken to ensure that necessary personal protective equipment is utilized by persons installing and maintaining any equipment.*

## Pre Installation

The following sets forth general safety instructions and requirements relating to the use and maintenance of the product.



**CAUTION** – Due to environmental shipping and/or storage conditions, it may be necessary to perform a dielectric test prior to startup. (Refer to megohm test under Installation section.)

1. Upon receipt of the product, inspect for any damage occurring during shipment. If you have any concerns about the condition of the product, do not install such product and contact your Watlow representative prior to taking further action with the product.
2. Upon receipt of the product, confirm that the product received is the same as the product that was ordered. In the event of a discrepancy, please contact your Watlow representative prior to taking further action with the product.

## Installation

Proper product 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.

### 1. Megohm pre-check



**WARNING – Risk of Electric Shock** – The bake-out procedures listed below should only be performed by qualified personnel. If the procedure calls for connecting electric power to the product, 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 a heater element is possible. To determine if the proper megohm value is present, use a 500VDC (minimum) megohm meter to measure the insulation resistance between the product's power terminals and the product's outer sheath. This value should be greater than 1 megohm when the unit is at room temperature.
- If a low megohm value exists, bake the product in an oven at 350°F (177°C) ± 50°F (27°C) for a duration of 12 to 24 hours. **See caution note below**, not all electrical insulating components are capable of this temperature. After baking, repeat the megohm insulation resistance test to verify that 1 megohm insulation resistance has been achieved. If the product fails a second insulation resistance test, contact your Watlow representative.



**CAUTION** – Do not exceed temperature rating of any lead wire insulation materials if an oven bake is performed.

- A second method to dissipate moisture within the heating element is to energize the unit at low voltage (recommend 50% of design voltage with a maximum of 120VAC) until the insulation resistance reaches an acceptable level. Precautions should be taken to **prevent the heater sheath from exceeding 752°F (400°C)** for 304 SS and Alloy 800.
- Whenever possible, the installed product should remain energized at an intermediate temperature to prevent moisture accumulation.
- Operation of any oven or any other heating or electrical equipment in performing any oven bake shall be done at user's sole and absolute risk.

## 2. Protection of heater elements from over temperature

The use of a temperature controller to regulate the heating process and prevent product over temperature is critical to ensure the safe operation. User shall also ensure that the thermal insulating materials used in the process do not come in contact with any portion of the product. It is the user's responsibility to ensure safety of the installation.

 **WARNING** – Always install high temperature control protection in systems where an over temperature fault condition could cause a fire or other hazard. Failure to install temperature control protection where such a hazard exists could result in damage to equipment, property, and/or injury to personnel.  
**NOTE:** It is the responsibility of the user to properly use overtemperature control devices or protection circuits, even if the product has been supplied with thermocouples or thermostats.

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

 **CAUTION** – Ensure that the heater is installed in the correct orientation. A hi limit sensor (if so equipped) is critical! For more information regarding the correct orientation for your product, contact your Watlow representative.  
*For Immersion applications, in order to help prevent premature failure and a potentially hazardous condition in cases where consequences of failure may be severe, use an appropriate third party approved liquid level protection device. The liquid level should be such that the entire heater sheath (other than non-immersed cold section) is fully submerged with enough liquid above the heater to adequately dissipate heat from itself as under normal operating conditions*

 **CAUTION** – Certain heating applications may accompany volumetric expansion and/or phase change. In all cases, ensure that appropriate safeguards against over-pressurization are included in system design.

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.

## 3. Termination/Environment

### Do not handle the product by the lead wires or sensor wires!

Handling by the leads can compromise electrical and/or mechanical integrity of the product. Certain wires such as fiberglass jacketed wires may also cause skin irritation or other personal injuries.

In order to maintain termination integrity, the termination area should be kept below 400°F (222°C) or the maximum temperature rating of the lead wire insulation. Keep terminations clean, dry and tight. Do not allow oil, moisture or other possible contaminants to come in contact with the lead wires or the electrical termination end of the product.

 **CAUTION** – Heater orientation is important in order to ensure efficient heat transfer and safe operation. Care should be taken to allow enough room for heater expansion without compromising heat transfer.

 **WARNING** – Electric heaters are capable of developing high temperatures. To minimize the risk of fire or other personal injury or property damage, extreme care should be taken at all times to use and maintain the product in a safe environment. Operating this product in atmospheres containing combustible gases and vapors should be avoided.

*This product is not suitable for use in hazardous (classified) locations.*

#### 4. Wiring



**WARNING – Risk of Electric Shock** – The installation and wiring of this product shall only be done by a qualified electrician, in accordance with applicable national and local electrical codes. It is the end user's responsibility to ensure that proper precautions are taken in reference to applicable personal safety equipment needed by those installing and maintaining equipment.

Never interrupt the protective earth circuit/ground. Any interruption or disconnection of the protective earth circuit used by this product will create a dangerous situation and could result in an electric shock that in some situations could lead to serious personal injury or property damage. It is the user's responsibility to properly size the ground wire for the protective earth circuit/ground and to ensure that the impedance of such wire is low enough to avoid dangerous conditions.

In some equipment or installations a GFI style breaker or circuit should be installed to ensure the safe operation of the product. Determining if this is a requirement is the responsibility of the user.

The mains/line voltage applied to the product must always be equal to or less than the voltage rating marked on the product's name plate/label.

Some heaters are supplied as dual voltage (e.g. 240V / 480V) units and hence the user should check the wiring diagram to ensure that the product is wired correctly for its supply voltage.

Thermostats should not be used as an "OFF" or disconnect device. The use of a disconnect switch or circuit breaker is highly recommended and will allow the isolation of the product when maintenance is required



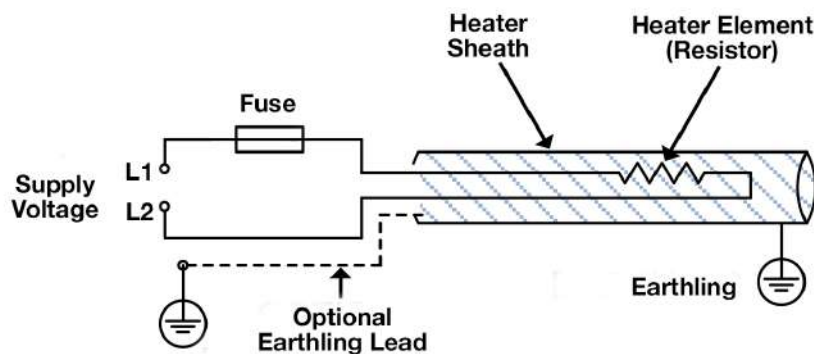
**WARNING** – It is the user's responsibility to properly size and install the feeder wires to the product. Feeder wire should be properly selected based on amperage, electrical power rating, ambient temperature, and type of environment.

It is the user's responsibility to ensure that the bending radius of the products and/or any conductors/ cables and coverings (even if supplied by Watlow) are large enough to prevent any damage.

For components that do not already have insulated supply leads provided, user must take suitable action to either add suitable insulating sleeving or equivalent (with appropriate temperature and environmental rating) to suitably cover any exposed conductive surface.

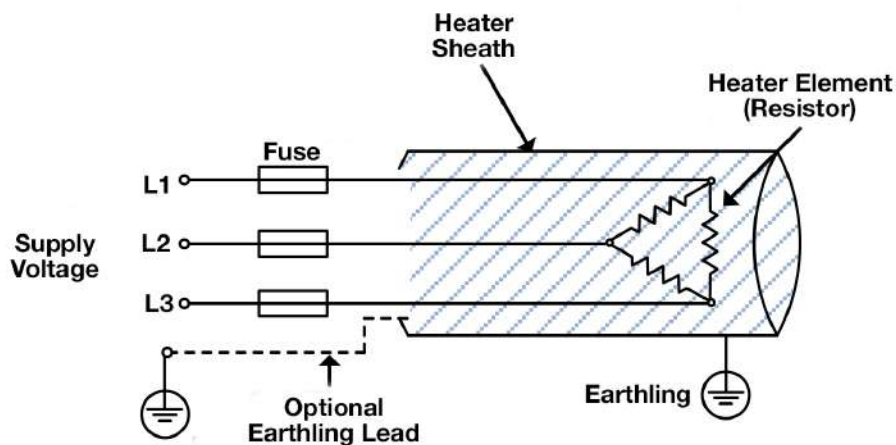
#### Minimum Circuit Requirements

##### Minimum Recommended Circuit Requirements



## Minimum Circuit Requirements (Con't)

### Minimum Recommended Circuit Requirements (AC - Three Phase Delta)



#### Notes:

- 1) Above depictions represent the basic protection requirements in a simple circuit.
- 2) Multiple heating elements may be wired in series or parallel.
- 3) Heating elements considered "live" must be isolated from protective ground circuit.

The tables below list standard specifications for the preferred lead wires for the product. **Note:** not all lead wire options are shown below, please reference descriptions in your quote and/or purchase order for additional or non-standard lead wire specifications.

**Note:** lead wires should not be assumed to be agency recognized unless marked as such. Contact your Watlow representative if you have further questions.

#### Standard/Default Lead Wires

| Heater Sheath Nominal Outer Diameter | Product Size Designation                                                          |                                                                                      |                                                                                       |                                                  |
|--------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------|
|                                      | 3.1 < 9.4 mm<br>( <sup>1</sup> / <sub>8</sub> - <sup>5</sup> / <sub>16</sub> in.) | 9.4 < 12.6 mm<br>( <sup>3</sup> / <sub>8</sub> and <sup>7</sup> / <sub>16</sub> in.) | 12.6 < 15.8 mm<br>( <sup>1</sup> / <sub>2</sub> and <sup>9</sup> / <sub>16</sub> in.) | ≥ 15.8 mm<br>(≥ <sup>5</sup> / <sub>8</sub> in.) |
| Fiberglass insulated                 | 24 Ga. MGT 300V                                                                   | 22 Ga. MGT 300V                                                                      | 18 Ga. MGT 300V                                                                       | 18 Ga. MGT 600V                                  |
| PTFE insulated                       | 24 Ga. black<br>PTFE 300V                                                         | 22 Ga. black<br>PTFE 300V                                                            | 18 Ga. black<br>PTFE 300V                                                             | 14 Ga. black<br>PTFE 600V                        |

#### Fiberglass Lead Wire Specifications

MGT fiberglass lead wire maximum temperature = 842°F (450°C)

| Heater Sheath Nominal Outer Diameter | Product Size Designation                                                          |                                                                                      |                                                                                       |                                                  |                                                               |
|--------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------|
|                                      | 3.1 < 9.4 mm<br>( <sup>1</sup> / <sub>8</sub> - <sup>5</sup> / <sub>16</sub> in.) | 9.4 < 12.6 mm<br>( <sup>3</sup> / <sub>8</sub> and <sup>7</sup> / <sub>16</sub> in.) | 12.6 < 15.8 mm<br>( <sup>1</sup> / <sub>2</sub> and <sup>9</sup> / <sub>16</sub> in.) | ≥ 15.8 mm<br>(≥ <sup>5</sup> / <sub>8</sub> in.) | Alternate<br>≥ 15.8 mm<br>(≥ <sup>5</sup> / <sub>8</sub> in.) |
| Recognition                          | UL® 5128 / CSA                                                                    |                                                                                      |                                                                                       | UL® 5107 / CSA                                   |                                                               |
| Max voltage                          | 300 Volts                                                                         |                                                                                      |                                                                                       | 600 Volts                                        |                                                               |
| Strands                              | 7/32                                                                              | 7/30                                                                                 | 7/26                                                                                  | 7/26                                             | 41/30                                                         |
| Design description                   | 24 Ga. MGT<br>nickel leads                                                        | 22 Ga. MGT<br>nickel leads                                                           | 18 Ga. MGT<br>nickel 300V                                                             | 18 Ga. MGT<br>nickel 600V                        | 14 Ga. MGT<br>nickel leads                                    |
| Max amperage                         | 3.1                                                                               | 4.4                                                                                  | 7.6                                                                                   | 7.6                                              | 12.5                                                          |
| Design description                   | 24 Ga. MGT NCC<br>leads                                                           | 22 Ga. MGT NCC<br>leads                                                              | 18 Ga. MGT NCC<br>300V                                                                | 18 Ga. MGT NCC<br>600V                           | 14 Ga. MGT NCC<br>leads                                       |
| Max amperage                         | 5.2                                                                               | 7.2                                                                                  | 12.6                                                                                  | 12.6                                             | 21.0                                                          |

## PTFE Insulated Lead Wire Specifications (NPC Conductors)

PTFE insulated lead wire maximum temperature = 482°F (250°C)

| Heater Sheath Nominal<br>Outer Diameter | Product Size Designation                                                          |                                                                                      |                                                                                       |                                                  |
|-----------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------|
|                                         | 3.1 < 9.4 mm<br>( <sup>1</sup> / <sub>8</sub> - <sup>5</sup> / <sub>16</sub> in.) | 9.4 < 12.6 mm<br>( <sup>3</sup> / <sub>8</sub> and <sup>7</sup> / <sub>16</sub> in.) | 12.6 < 15.8 mm<br>( <sup>1</sup> / <sub>2</sub> and <sup>9</sup> / <sub>16</sub> in.) | ≥ 15.8 mm<br>(≥ <sup>5</sup> / <sub>8</sub> in.) |
| Recognition                             | UL® 1815 / CSA                                                                    |                                                                                      |                                                                                       | UL® 1659 / CSA                                   |
| Max voltage                             | 300 Volts                                                                         |                                                                                      |                                                                                       | 600 Volts                                        |
| Strands                                 | 7/32                                                                              | 7/30                                                                                 | 7/26                                                                                  | 19/27                                            |
| Design description                      | 24 Ga. black PTFE leads                                                           | 22 Ga. black PTFE leads                                                              | 18 Ga. black PTFE leads                                                               | 14 Ga. black PTFE leads                          |
| Max amperage                            | 7.5                                                                               | 10.5                                                                                 | 18.0                                                                                  | 30.0                                             |
| Design description                      | 24 Ga. white PTFE leads                                                           | 22 Ga. white PTFE leads                                                              | 18 Ga. white PTFE leads                                                               | 14 Ga. white PTFE leads                          |
| Max amperage                            | 7.5                                                                               | 10.5                                                                                 | 18.0                                                                                  | 30.0                                             |
| Design description                      | 24 Ga. red PTFE leads                                                             | 22 Ga. red PTFE leads                                                                | 18 Ga. red PTFE leads                                                                 | 14 Ga. red PTFE leads                            |
| Max amperage                            | 7.5                                                                               | 10.5                                                                                 | 18.0                                                                                  | 30.0                                             |
| Design description                      | 24 Ga. green PTFE leads                                                           | 22 Ga. green PTFE leads                                                              | 18 Ga. green PTFE leads                                                               | 14 Ga. green PTFE leads                          |
| Max amperage                            | 7.5                                                                               | 10.5                                                                                 | 18.0                                                                                  | 30.0                                             |

## 5. Platen Applications

Ensure that platen holes have been machined to the proper inside diameter for suitable hole-fit as determined by the “Maximum Watt Density – Heating Metals” chart

## 6. Miscellaneous

For immersion applications, ensure the heated sections of the product are extended completely into the fluid media to maximize heat transfer and heater reliability.

Any product that has been sealed in plastic during shipment should not have the plastic removed until the product is ready for installation and use.

After installation, ensure that the heating system fully complies with all applicable European New Approach Directives and may also include the EMC Directive.

## Start Up

The following sets forth instructions and requirements relating to the initial startup of the product:



**CAUTION** – Before energizing the product, the following items should be checked with the main/line voltage disconnected. Failure to do so could result in damage to the product, equipment and/or operator injury when it is energized.

1. Electrical terminations are tight and wiring is per wiring diagram supplied (if applicable).
2. Proper disconnecting means and fusing have been installed.
3. The voltage rating of the product is the same as that being applied.
4. Leg to leg voltage is equal (for 3-phase units).
5. Megohm value of the heater elements are within acceptable limits.
6. Proper temperature controls and safety limiting devices are in place with proper set point(s).
7. The product is properly grounded.
8. For immersion applications:
  - 8.1 The heater is securely installed in tank header and no leaks are visible.
  - 8.2 The immersed section of the heater is completely covered by liquid.
  - 8.3 Check for correct fluid flow and fluid level is being maintained in operation.



**WARNING** – After applying power to the product, make sure that the system is being controlled properly before leaving it to run unattended. Failure to do this could result in the product overheating in a “run away” condition that could lead to damage to equipment, fire or personal injury.

## Troubleshooting

The information provided below contains potential causes and corrections for functional problems with the product. This is a non-exhaustive 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.



**WARNING – Risk of Electric Shock** – High voltage is present when the product is energized and hence troubleshooting of this product shall only be done by qualified personnel.

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

| Problem                                                         | Cause/Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No power available to product                                   | 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. Verify line voltage is within specification.<br>Check fuse rating. Fuses should be at least 25 percent more than full load amperage.<br>Disconnect product power source. Check the heater resistance to ground. This should be no less than one megohm. Refer to ‘megohm pre-check’ in the Installation section of this guide.                                                                                                                                                                                 |
| Not enough power/application not heating to desired temperature | Verify line voltage is within specification.<br>If voltage is correct, check full line current draw. If line current is lower than designed, the heater circuit may be wired incorrectly or the temperature controller and/or power switching settings may need to be adjusted to deliver a greater duty cycle percentage.<br>Heat losses to other system components and to the ambient environment may be higher than initially calculated/estimated. A higher wattage heater or additional thermal insulation in the system may be required. |

## Preventative Maintenance



**WARNING – Risk of Electric Shock** – High voltage is present when the product is energized and hence preventative maintenance of this product shall only be done by qualified personnel.

*Turn all power off to the product and “lock out/tag out” the power disconnect switch(es) for the product before performing any preventative maintenance.*

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



**WARNING** – The product, 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.

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

## Disposal and Recycling

This product is classified under the RoHS and W.E.E.E. 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.

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 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:

- Customer name
- Contact name
- Part number
- Quantity
- Reason for return
- MSDS sheet of material(s) that came in contact with product, if used
- Customer account number
- Phone number
- Email address
- P.O. number
- Application information

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.