

## *PVDF/PFA Heaters Owner's Manual*



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## Materials Warranty

Heateflex® warranties the equipment offered to be free from defects in material and workmanship, under normal handling and proper usage, for a period of one year from the date of shipment. All products purchased from manufacturers by Heateflex® will carry that manufacturer's warranty period. This expressed warranty is in lieu of, and excludes all other representations made by advertisements or by agents. There are no implied warranties for the equipment.



Heateflex® agrees to correct any defect in workmanship or material which may develop under normal handling and proper usage during a period of one year from the date of shipment or, by its option, to repair or replace the defective equipment F.O.B. Arcadia, California, USA. Purchaser's remedies shall be limited exclusively to the right of repair or replacement.

Heateflex® shall not be liable for any expenses incurred by the purchaser or any other person by reason of the use, misuse, sale, or fabrication of the equipment regardless of whether the equipment conforms to the specifications.

Items returned for warranty repair must be prepaid and insured for shipment. Warranty claims are processed on the condition that prompt notification of a defect is given within the warranty period. Heateflex® shall have the sole right to determine whether, in fact, a warranty situation exists.

## Declaration of Conformity to CE

We, Heateflex®, declare under our sole responsibility that our semiconductor fabrication equipment (models listed below), as delivered, are in conformity with the following European Directives:

<b>Application of Council Directive:</b>	2006/95/EC Low Voltage Directive
	2006/42/EC Machinery Directive
	2004/108/EC Electromagnetic Compatibility (EMC) Directive
<b>Standards to which Conformity is Declared:</b>	IEC 60335-1 ed5.0 Household and similar electrical appliances - Safety - Part 1: General requirements
	IEC 60335-2-35 ed5.0 Household and similar electrical appliances - Safety - Part 2-35: Particular requirements for instantaneous water heaters
	Directive 2006/95/EC Low Voltage Directive, Annex 1
	Directive 2006/42/EC Machinery Directive, Annex 1
	Directive 2004/108/EC Electromagnetic Compatibility (EMC) Directive, Essential Requirements
	EN61000-6-2 Electromagnetic Compatibility (EMC) - Part 6-2: Generic Standards - Immunity for Industrial Environments
	EN61000-6-4 Electromagnetic Compatibility (EMC) - Part 6-4: Generic Standards - Emission Standard for Industrial Environments
<b>Type of Equipment:</b>	Heater
<b>Manufacturer's Trade Name:</b>	Heateflex® In-Line Heater
<b>Manufacturer's Model or Type Designation:</b>	All Series In-Line Heaters
<b>Year CE Mark was affixed:</b>	2019
Any modification or alteration of the above product(s) unwarranted by Heateflex® will nullify this declaration.	
<b>Authorized representative located within the European Community:</b>	SPS-Europe, B.V. Midden Engweg 41 3882 TS Putten, The Netherlands Phone: +31 341-360-590 Fax: +31 341-360-589
	 VP of Engineering



# 1. Product Information

While the official language of the “Original Instructions” is in English, any interpretation of this Instruction Manual in other Community languages will be discussed by the manufacturer (Heateflex®) and the customer on a as required basis.

## 1.1 Introduction

Your Heateflex® In-Line fluid heating system is a point of use heater that will accurately heat and maintain the temperature of your process fluid through the use of patented Heateflex® heating coil and Power-To-Flow Control® heating technologies. To obtain the best results from your unit, it is recommended that the user operating this system and the installer of this system completely read this manual and the accompanying component literature to become familiar with all the functions and features of the system.

## 1.2 Description

Your heating system is an electric heating system designed to be used in an ultrapure environment. It is a high tech piece of equipment incorporating many design innovations and precautionary measures to insure safe and reliable operation under normal conditions. This heating system incorporates features that enable it to be used with aggressive fluids, such as de-ionized water or acids, and maintain the purity of those process fluids. The safety systems incorporate over-temperature protection, low liquid level protection, over-current protection, electrical component over-temperature protection, and a user-controlled emergency disconnect switch.

These safeties combined with proven ultra-pure technology provide a unit that effectively reaches and maintains process temperature. The construction of the fluid handling components of this unit use chemically resistant fluoroplastics.

Model	Wetted Surfaces		Generic Dimensions L x W x H (inches)
	Housing	Heating Element Jacket	
<b>Heaters for Deionized Water, Acids, &amp; Less Aggressive Chemicals</b>			
LH1	PVDF	PFA	5.80 x 5.80 x VH*
LH7	PVDF	PFA	6.30 x 6.30 x VH*
<b>Heaters for Aggressive Acids &amp; Chemicals</b>			
HC	PFA	PFA	8.50 x 6.25 x VH*
LHT	PFA	PFA	8.50 x 6.25 x VH*
<b>Legacy Models</b>			
LHK	PFA	PFA	4.31 x 4.31 x VH*
LHM	PFA	PFA	6.30 x 6.75 x 20.50
LHN	PFA	PFA	6.30 x 6.75 x 30.19
LHX	PTFM	PFA	11.00 x 6.75 x 20.5
LHY	PTFM	PFA	12.82 x 6.75 x 28.5

\* VH = Variable Height





## 2. Receiving Inspection Procedure

This shipment was carefully inspected, checked, and properly packaged at our company, and delivered to the carrier in good condition. We fully expect your merchandise to arrive in your hands in good condition.

**ALL PRODUCTS ARE SHIPPED F.O.B. FACTORY; THEREFORE, WHEN IT IS DELIVERED TO THE CARRIER, IT BECOMES YOUR PROPERTY. THUS, IT IS IMPORTANT THAT YOU TAKE NOTE OF ANY DAMAGE, WHETHER OBVIOUS OR HIDDEN, AND REPORT SAME TO THE TRANSPORTATION COMPANY WITHIN FIVE (5) DAYS OF RECEIPT OF THE SHIPMENT AT YOUR PREMISE TO AVOID FORFEITING CLAIMS FOR DAMAGE.**

### 2.1 What To Do If Your Shipment Is Damaged:

Leave the items, packing material, and carton "as is". Notify your carrier's local office and ask for immediate inspection of the carton and its content.

After inspection has been made by the carrier, and you have received acknowledgment in writing as to the damage, please contact our Customer Service Department at (626) 599-8566 for return authorization. If writing for return authorization, please indicate your purchase order number.

We will either repair or replace the merchandise depending upon the extent of the damage.

It is your responsibility to follow the above instructions, or the carrier will not honor any claims for damage. If there are any shortages or questions regarding this shipment, please notify us within ten (10) days.





### 3. Safety Precautions

Every effort has been made to insure that this unit will run with a minimum of user input or maintenance. However, there are still precautions to be taken whenever operating, performing maintenance, or servicing this unit. This unit makes use of heating elements and electrical components, both of which pose inherent burn, fire, and electrical shock hazards. These hazards can result in injury to personnel, plant, and/or process. Please note the following to aid in the operation of your unit and to decrease risk of the above mentioned hazards.

#### 3.1 Precautions

- Carefully and completely read this and all accompanying literature to verify that you understand the functionality and features of this system. Please become familiar with the integral safeties and controls within this system, and know their function.
- Always disconnect electrical power prior to installing, servicing or replacing electric heating elements and/or assemblies.
- Electrical termination enclosures should be selected to match the application's environment and be able to withstand worst-case failures, especially in hazardous locations.
- Avoid fire hazards. Electric heaters and their components can develop temperatures that produce an auto-ignition source. Avoid mounting heaters in atmospheres containing combustible gases, vapor or dust. Article 501 of the National Electrical Code (NEC) requires that the maximum sheath temperature when the heater is continually energized not exceed 80 percent of the surrounding atmosphere's auto-ignition temperature.
- Avoid exposing heaters to combustible materials. Keep heaters far away from combustible materials to prevent ignition.
- Be aware of labeling on the unit, such as a lightning-bolt warning symbol, which alerts you to a safety hazard, which could harm you or the unit.
- While servicing or operating this unit, it is advisable to remove all metal from your person. This includes metal bracelets, rings, jewelry, metal-rimmed glasses, and wristwatches.
- Keep your clothing, hands, and feet dry at all times whenever working with electrical equipment.
- Pull the fuses, open the circuit breakers, or disconnect the circuits from their source of power to protect yourself, the test equipment and the equipment under test.
- Do not trouble shoot or service a circuit with the primary power applied.
- Ensure that no power is applied to a circuit when making continuity or resistance checks.
- Use the correct tool (i.e. screwdriver, alignment tool, etc.) for the job.
- Do not use metal tools around the connectors when there is power to the unit, as they may cause arcing.





### 3.1 Precautions (Continued)

- Turn off power before connecting alligator clips to any circuit.
- Service should be performed by trained personnel only. Check every operation before they perform it.
- The operation of this unit creates large amounts of heated process fluid. This fluid is likely to be heated to temperatures above the threshold of safety for human contact. Please be advised of this and take the necessary precautions whenever connecting or disconnecting any plumbing from the system. If you are ever in doubt, turn the unit off, and wait an appropriate amount of time before performing any operations or service involving the plumbing.
- The process fluid within this system may also become pressurized from outside flow sources. It is the user's responsibility to verify that pressure within the system has been relieved externally; in order to prevent exposure to hazardous fluid such as heated de-ionized water, or heated acids.
- This unit has several safety interlocks integrated within the system. However, it is the user's responsibility to verify that incoming power has been disconnected from a remote source prior to opening or servicing the unit. This is advised to prevent user exposure to high voltage and current, and reduce the risk of electric shock.
- The function of this unit is to heat process fluid for use in ultra-pure operations. Therefore, during normal operation, the unit will become heated within the plumbing and the heater compartment. It is our recommendation that the unit is allowed a sufficient amount of time to cool before any maintenance or inspections are made to the unit in order to prevent user exposure to heated surfaces or air.
- The processes in which this unit is used involve heated fluids. Whenever heated fluids are involved, certain precautions must be taken in order to avoid user injury. This is especially important since it is highly likely that this unit will be used with aggressive fluids, such as de-ionized water and process acids, which can further harm or injure an individual. User exposure to these types of materials can result in burning, scalding, and in some cases deep tissue damage. To avoid injury, it is the user's responsibility to take the appropriate precautions as outlined above, and in all cases dealing with heated or aggressive materials. Use the appropriate safety equipment, such as, but not limited to, safety goggles, glasses, chemically resistant gloves, and garments.
- The heater is designed to heat acid and other potentially dangerous liquids. Extreme care should be taken to properly install the heater in a safe and appropriate manner that will protect personnel, such as double containment and/or a polypro enclosure with door interlocks that depressurizes the heater when the door is opened.
- The heater is not intended for use with flammable liquids. Use of this equipment with flammable liquids will greatly increase the fire risks of the system.





### 3.2 Environmental Safety Warnings

Label	Safety Warning
 	High Voltage Electrical Equipment
 <b>WARNING</b>	<p>This Equipment Must Only Be Used Within The Range Of Environmental Conditions Listed Below.</p> <p>Operational Usage: INDOOR USE ONLY</p> <p>Max. Operating Pressure: (See Equipment Specifications Page)</p> <p>Max. Fluid Temperature: (See Equipment Specifications Page)</p> <p>Temperature Resolution: +/-1°C</p> <p>Max Operating Altitude: 6,600feet (2,000 meters)</p> <p>Ambient Temp. Range: 5°C ~ 40°C (Operating) -40°C ~ 60°C (Storage)</p> <p>Max. Relative Humidity:</p> <ul style="list-style-type: none"> <li>80% up to 31°C</li> <li>76.7% @ 32°C</li> <li>73.3% @ 33°C</li> <li>70.0% @ 34°C</li> <li>66.7% @ 35°C</li> <li>63.3% @ 36°C</li> <li>60.0% @ 37°C</li> <li>56.7% @ 38°C</li> <li>53.3% @ 39°C</li> <li>50.0% @ 40°C and below</li> </ul>
 <b>WARNING</b>	THIS EQUIPMENT MUST ONLY BE USED WITH SAFETY COMPONENTS (TEMPERATURE CONTROLLER, LEVEL CONTROLLER, HI-LIMIT CONTROLLER, ETC.) THAT IS APPROVED TO EIC/EN STANDARDS.
 <b>WARNING</b>	ALL HEATERS SHOULD BE EQUIPPED WITH A THERMAL OVER-TEMPERATURE DEVICE AND THE IN-LINE HEATER SHOULD HAVE A LIQUID LEVEL CONTROL TO REDUCE THE POTENTIAL OF FIRE. IT IS THE CUSTOMER'S RESPONSIBILITY TO PURCHASE THERMAL AND LIQUID LEVEL CONTROL PROTECTION.





## 4. Heater Operating Instructions

### 4.1 Heater Module Operation

For proper operation of your Heateflex® heater, we recommend that you thoroughly read through and understand the section of this manual entitled "SAFETY PRECAUTIONS". This section will help you understand some of the hazards and potential risks when dealing with electrical components and heating systems.

1. Heater should be installed in a manner consistent with the supplied drawings.
2. Note the orientation of the heater and location of the input and output fittings.
3. This heater is designed under certain installation and mounting conditions, and attempting to operate it in a manner inconsistent with the documentation may result in serious injury to the user and damage to the facility.

Once the heater is plumbed into your system and prior to filling the unit with process fluid, check all of the fittings to ensure that they are tight. Some of the fittings can loosen during shipping. As the heater is heat cycled during start-up, you will need to recheck all the fittings and tighten them to avoid any potential leaks. After the heat cycle and fitting check, the unit should perform for years without further fittings checks, but if your system produces vibrations (from pumps, etc.) you should check your fittings every three months.

Prior to being powered on, this equipment must be installed with customer supplied external over-current protective devices. (IMPORTANT: See Equipment Specifications page for Current Rating, Operating Voltage, and Type Rating.)

Please see the appropriate accompanying wiring diagram for details on how to wire your heater to the appropriate safeties and controls.

To maintain a safe operating condition, no power should be applied to heater without a minimum flow of 1/2 GPM and 20-PSI minimum output pressure. Operating the heater outside these conditions can result in premature heater failure, heater short, or potentially hazardous heater burn out.

Failure to conform to this warning may result in severe damage. Heateflex assumes no risk for noncompliance. Heateflex does not guarantee any equipment that does not use the recommended safety equipment.

Verify Heater has the following safeties:

- Hi-Limit
- Liquid Level
- Thermal Cut-Off
- Process Fluid Over Temperature

For questions, please contact Heateflex's customer service department at (626) 599-8566.







## 4.2 Hi-Limit

Hi-limit safety consists of a thermocouple used to monitor the temperature at the heater and is connected to a hi-limit controller which signals when the heater exceeds the hi-limit set point to prevent the heating element from getting to an unsafe condition.

1. Connect the thermocouple bundled with the lead wire to the Hi-limit controller. This thermocouple now becomes the Hi-limit or over-temperature thermocouple.
  - 1.1. If the supplied heater does not have a Hi-limit or over-temperature thermocouple, we highly recommend that you purchase one on future units. The purpose of this safety is to protect the heater and your equipment from a boil-dry situation. This is a redundant safety backup in case the process over temperature and liquid level safeties fall.
2. Connect the thermocouple that is by itself on the output port of the heater to the process temperature controller. This thermocouple now becomes the process thermocouple.
  - 2.1. If the supplied heater does not have a process thermocouple, we highly recommend that you purchase one on future units. The purpose of this safety is to protect the heater and your equipment from an over-temperature situation.
3. Set the process temperature controller to desired operating temperature. (Example: Process set point = 60°C.)
4. Temporarily the Hi-limit controller set point at 150°C.
5. When the process temperature reaches about 80% of the process set point (Example: About 48°C), bring down the Hi-limit temperature set point until the control relay trips the heater. (Note the Hi-Limit set point). At this point, add 5°C to 10°C to the Hi-limit temperature controllers. This is the Hi-limit safety set point for the heater.
  - 5.1. Example: Hi-limit control set point (110°C + 10°C = 120°C)
6. The process alarm set point should be set at 5°C above the process set point.

## 4.3 Liquid Level

Your heater should always be under liquid when operating. Operating heater in air or with a crystalline or precipitate solution that may coat the heater or sensors may result in damage to the heater and severely damage your equipment.

Non-compliance to Heater Operating Instructions will void warranty.  
See safety connections and drawing for recommended wiring and installation.

## 4.4 Thermal Cut-Off

A mechanical one-shot sensor which opens when process fluid exceeds set temperature.

## 4.5 Process Fluid Over Temperature

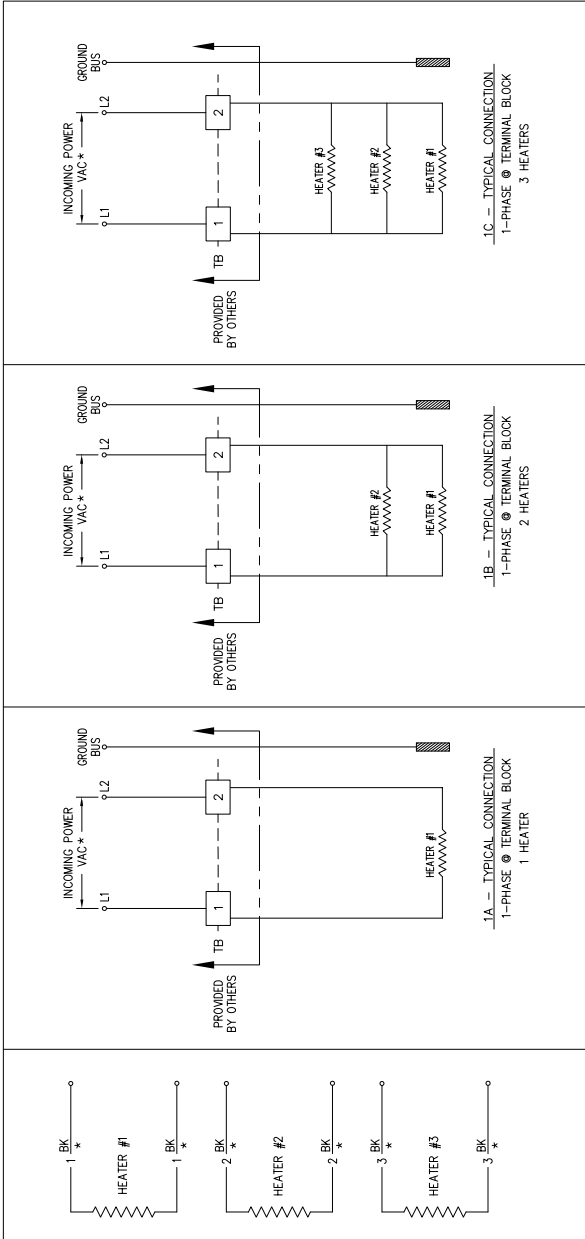
The process over temperature set point should be set at 5°C above the process set point.







### 5.2 Typical Single Phase Wiring



REV	DATE	DESCRIPTION	JIN	DATE
01	09/05/19	REVISED TITLE BLOCK		

<p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN MILLIMETERS (IN PARENTHESES). DIMENSIONS ARE GIVEN TO THE CENTERLINE UNLESS OTHERWISE SPECIFIED.</p> <p>ALL DIMENSIONS ARE TO THE CENTERLINE UNLESS OTHERWISE SPECIFIED.</p> <p>ALL DIMENSIONS ARE TO THE CENTERLINE UNLESS OTHERWISE SPECIFIED.</p> <p>ALL DIMENSIONS ARE TO THE CENTERLINE UNLESS OTHERWISE SPECIFIED.</p> <p>ALL DIMENSIONS ARE TO THE CENTERLINE UNLESS OTHERWISE SPECIFIED.</p>			
DATE REC.	DATE	APPROVED BY	REV
M. Thorpe	10/15/07		01

<p>COMMENTS:</p> <p>1. * SEE ENGINEERING SPECIFICATIONS SHEET FOR LEAD WIRE GAUGE &amp; VOLTAGE DETAILS.</p> <p>2. IT IS THE CUSTOMER'S RESPONSIBILITY TO DETERMINE THE CORRECT CONTROL &amp; HEATER VOLTAGE, WIRING, FUSING &amp; THE SIZING OF ALL CONTACTORS USED FOR THIS UNIT.</p>	
	<p>TYPICAL CONNECTION FOR 1-PH HEATER LEADS</p>
<p>REV: B</p> <p>OF: 1</p> <p>FILE: LHPH-R01</p>	<p>DATE: 10/15/07</p>













## 6. High-Limit Controller

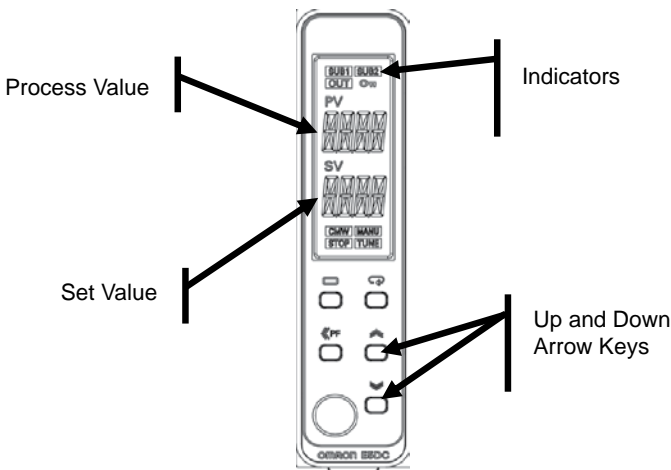
PN: (306035\_/ 306036\_)

### 6.1 Operating Instructions

The FM limit controller is to be used with a High Limit temperature sensor to detect the temperature at the heater element. This temperature reading is shown as the Process Value (PV) and is monitored to assure that the heater element does not exceed the specified High Limit temperature Set Value which would occur in heater burnout condition. This High Limit temperature Set Value (SV) is set on the High Limit temperature controller to the desired temperature value. The factory setting for the High Limit temperature Set Value (SV) is 0°C (unless otherwise stated).

- To change the SV, press the Up and Down keys to change the value of the digit. The new SV will be taken immediately by the controller. (See Figure 1 for location)
- The limit controller is equipped with two relays. One relay (AUX1) to control the heater and the other relay to control an external indicating light. See Relay Position section for detail.
- See Part Number Legend Chart for temperature range, input sensor type, and voltage.
- The High Limit Alarm correlates to the limit controller's Indicator SUB1/SUB2 (see Figure 1 for location).
- The limit controller is password protected. Only Set Value can be changed.
- This Limit Controller is FM approved. Conforms to FM (Factory Mutual) Standards (FM3545/3810).

Figure 1 –Limit Temperature Controller Layout







## 6.2 Relay Positions

### Power off state

- When the limit controller is not powered, the relay to control the heater (AUX1) is open and the relay to control the indicating light (AUX2) is closed.

### Powered on with no alarm condition

- When the limit controller is powered and high limit temperature is below SV, the relay to control the heater (AUX1) is closed, the relay to control the external indicating light (AUX2) is open, and the limit controller indicator (SUB1/SUB2) is off.

### Powered on with alarm condition

- When the limit controller is powered and high limit temperature is above SV, the relay to control the heater (AUX1) is open, the relay to control the external indicating light (AUX2) is closed, and the limit controller indicator (SUB1/SUB2) is on.

### Powered on with no alarm condition and reset has not been initiated

- When the limit controller is powered and high limit temperature is below SV but reset has not been initiated, the relay to control the heater (AUX1) is open, the relay to control the external indicating light (AUX2) is closed, and the limit controller indicator (SUB1/SUB2) is on.





## 6.3 Specifications Ratings

### Power supply voltage

- 306036X: 100 to 240 VAC, 50/60 Hz.
- 306035X: 24 VAC, 50/60 Hz; 24 VDC.

### Operating voltage range

- 85% to 110% of rated supply voltage. Power consumption
- 4.9 VA max. at 100 to 240 VAC, and 2.8 VA max. at 24 VDC or 1.5 W max. at 24 VDC.

### Auxiliary/ Limit Output

- Number of outputs: 2
- Output specifications (AUX1 & AUX2): SPST-NO relay outputs: 250 VAC, 2 A (resistive load), Electrical life: 100,000 operations, Minimum applicable load: 10 mA at 5 V (reference value).

### Event input (EV1)

### External contact input specifications

- Contact input ON: 1 kΩ max., OFF: 100 kΩ min.

### PART NUMBER LEGEND CHART

PART NUMBER	INPUT SENSOR	TEMPERATURE RANGE	POWER SUPPLY VOLTAGE
306035A	TYPE J	0-160°C	24 VAC/DC
306035B	TYPE J	0-300°C	24 VAC/DC
306036A	TYPE J	0-160°C	100-240 VAC
306036B	TYPE J	0-300°C	100-240 VAC
306035C	TYPE K	0-160°C	24 VAC/DC
306035D	TYPE K	0-300°C	24 VAC/DC
306036C	TYPE K	0-160°C	100-240 VAC
306036D	TYPE K	0-300°C	100-240 VAC
306035E	RTD 100Ω	0-160°C	24 VAC/DC
306036E	RTD 100Ω	0-160°C	100-240 VAC



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