Series 49UL

Thermal Management System

The Series 49UL Thermal Management System is a complete thermal solution. The system uses proven heater technologies with the most advanced control methods and newest high-quality, high temperature heater materials.

The unique design of putting the power and communications into one assembly allows for simplified installation and communications. Adding an intuitive User Interface System creates a configurable Thermal Management System featuring adjustable temperatures, alarm control and diagnostics for every heater on the network.

Product Features

Controller

- Comprehensive and flexible system control
- Detailed diagnostics
- High visibility LED indication

Heaters

- New, advanced materials construction
- Choice of two jacket options
  - S49UL Polyimide Heater
  - S49UL PTFE-Woven Heater
- High operating temperature and improved thermal efficiency
- Lightweight and flexible for ease of installation
- Low particulate generation and low VOC

User Interface System

- Digital communications link to one or an entire heater network
- Tablet based, easy to use software application and hardware kit
- Detailed data acquisition

Key Benefits

- UL Recognized for Measurement and Control Safety
- Intuitive Digital Communications
- Cost Effective
- Energy Efficient
- Local LED Status Display

Description

Advanced Digital Communications

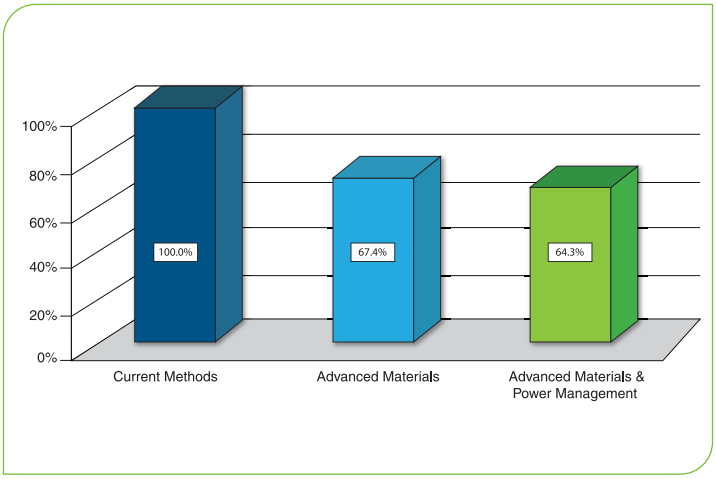
S49UL Thermal Management Systems feature an automatic self-addressing function for configuration of the controller network. Upon connection, the Tablet App or LTA+ Controller automatically identifies networked controllers and sets individual device addresses, configuring the communication network. The user interface system allows access to system settings and functions via Modbus RTU communications over serial RS485. Commands can be sent to individual heater controllers or broadcast to the entire heater network.

Significant Energy Savings

S49UL Thermal Management Systems provide greater energy savings and efficiency over competitive heater products. The new thermally efficient advanced Polyimide and PTFE materials used in the heater jacket construction provide superior insulation.

The system also offers a Standby Mode which can be used during preventative maintenance cycles, allowing for a reduction in energy consumption while minimizing heat-up and restart time.

The chart at right compares the energy use of the S49UL system to other heater solutions. Preventative maintenance cycles combined with our advanced materials delivers 35% less power usage compared to other common heater products.



S49UL heaters can provide over 35% energy savings compared to other common heater products

Superior LED Display

S49UL heater controllers use multiple LEDs to communicate controller status and diagnostic information. Common indications include at-temperature status, low and high temperature alerts, and error conditions.

Secure Safety Features

- Onboard Safety Functions
- Voltage Monitoring
- Redundant Control Circuitry
- PCB Temperature Sensing
- Over-Temperature Safety Shutdown
- Inline-Fused Power Adapter

Applications

Semiconductor

- ETCH
  - — Prevent solidification of aluminum chloride ($AlCl_3$) in an aluminum etching system
- CVD, PECVD, MOCVD, LPCVD (Nitride and TEOS)
  - — Prevent solidification of ammonium chloride (NH_4Cl) in a silicon nitride LPCVD system
  - — Reduce solid buildup in other semiconductor processes, such as Titanium Nitride and Tungsten
- EPI (Epitaxy)
- ALD
- Gauge Trees
  - — Maintain uniform temperature environments in complex shapes
- Gas Analyzers, Endpoint Detectors, Bubbler Cylinders, Mass Flow Controllers, Manometers, Isolation and Butterfly Valves

Analytical Instrumentation

- Mass Spectrometers
- Evaporators
- Chambers

Industrial Coating

- Solar Substrate Processing
- Thin Films
- LED Manufacturing

Custom and R&D Applications

- Heaters for custom and R&D applications can be engineered to meet specific requirements

1. Series 49UL User Interface Application
2. Series 49UL Heater Control Module
3. Series 49UL PTFE Heater Jacket
4. Series 49UL Polyimide Heater Jacket
5. Series 49UL LTA+ Control Module

The S49UL Thermal Management System provides a complete, integrated Thermal Heater Solution for multiple and custom applications.

Controller

The S49UL controller uses custom connectors that allow the controller to be disengaged from the heater jacket. This feature provides flexibility in system configuration and simplifies maintenance and replacement.

The S49UL controller can be configured and customized using the optional Tablet Application. The user interface application is the gateway to a comprehensive thermal management control system providing access to temperature limits, setpoints, data, and network alerts.

For user-provided communications systems, the S49UL controller is RS485 Modbus RTU ready. The S49UL User Manual provides details on communications access, register definitions, and control configuration.

Series 49UL Controller Module
Features fully adjustable control parameters and 360° view of status indicators

Features

- Plug-and-Play out of box
- Fully adjustable control parameters and alarm conditions
- Low and high temperature alerts
- Over-temperature safety shutdown
- 360° view of status indicators
- Integrated power and communications bus
- RS485 Modbus RTU communications
- Remote set-up and diagnostics
- Network communications access
- Custom configurations available on request

Specifications

Electrical Rating	100-120 VAC, 50/60 Hz 200-240 VAC, 50/60 Hz
Maximum Supply Current	10 Amps
Maximum Output Current	5 Amps Resistive Load
Environment	0°C to 50°C Indoor Use Only
Temperature Setting Range	35°C-200°C*
Enclosure	Non-Vented
Digital Communications	Modbus RTU over RS485
Compliance	CE UL 61010-1 Recognized UL File E510879

* Temperature setting range is dependent on heater jacket construction. Operating heater jacket above rated temperature will void all warranties.

Heater Materials

S49UL features a choice of either Polyimide or PTFE heater jackets. These new heater jacket materials offer improved thermal efficiency, safe-to-touch surface temperature, and ease of installation.

S49UL heater materials are suitable for use in clean room environments. The materials are low in airborne particle generation and Volatile Organic Compound outgassing.

Heater jackets are designed to conform to the shapes of the components to be heated. Square ends minimize gaps, reducing heat loss.

Series 49UL Polyimide Heater

S49UL products employ cutting edge materials technology to provide superior performance. The heater utilizes polyimide materials for both the insulation and jacketing. The heaters can be used in all critical applications where minimal outgassing, ultra-low particle generation, elevated temperatures (up to 200°C), and ease of installation are required. These patented heaters are constructed with fully squared ends and a form fit shape to maximize thermal efficiency and temperature uniformity, minimizing thermal losses and power consumption. Polyimide heaters enable lower cost heating compared to other solutions.

Series 49UL PTFE-Woven Heater

S49UL products provide maximum performance. Surface contamination is prevented by utilizing a PTFE-woven shell with ultra-low particulate generation. The low outgassing materials are also ideal for customers that need low Volatile Organic Compound (VOC) in the work area. These heaters are constructed with fully squared ends and a shape to provide maximum energy efficiency and thermal uniformity. PTFE heaters are generally used in critical applications where elevated temperatures (up to 200°C), and low VOCs are required.

Specifications

Voltage Requirements	100-120 VAC 200-240 VAC
Temperature Range	35°C to 200°C
Material Options	Polyimide PTFE
Compliance	CE

*Custom heaters available for temperatures above 200°C

Line Temperature Alert

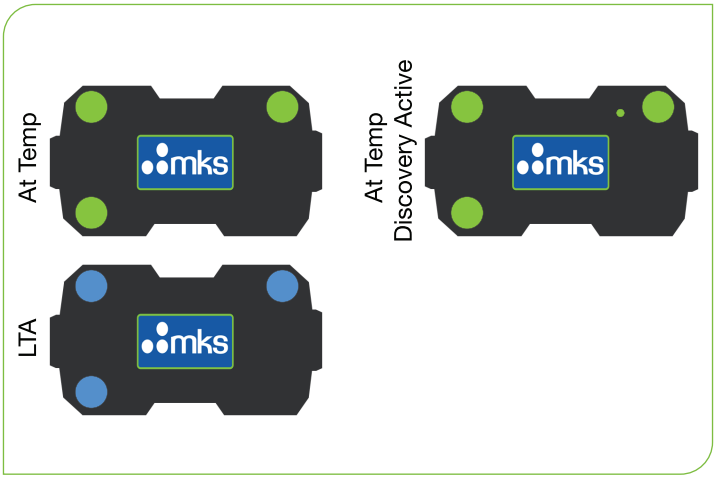
The S49UL LTA+ Controller provides a centralized Low Temperature Alert indication for the attached heater network. Installed before the first heater controller in the network, the LTA+ Controller uses information from the connected network to generate a Visual (LED) and Signal (Dry Contact Relay) condition, indicating network status.

On power-up the S49UL LTA+ establishes communications with the S49UL network and begins polling each controller in the network, confirming status. The LTA+ will generate a Low Temperature Alert condition any time one or more controllers in the network is registering a Low Temperature Alert. The LTA+ also generates a Low Temperature Alert anytime one or more controllers in the network is reporting an Error State that prevents the heater from functioning. If the heater is not reporting a Low Temperature condition and the unit is not properly functioning but still reporting a status to the LTA+, a Low Temperature Alert condition at the LTA+ is generated.

Features

- Single point indication of network status
- Automatic detection of connected heater network
- 360° view of status indicators
- Process control signal output of network status
- Remote mounting

Series 49UL Line Temperature Alert
Network status indication of line temperature alert condition; replaces the legacy MKS LTA module



LTA Controller Indicators

Process Control Connection and Function

User Interface System

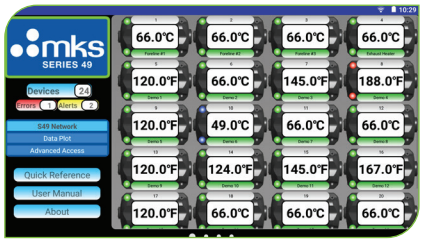
The S49UL User Interface System enables an integrated remote communications and diagnostics solution for the S49UL Thermal Management System. The user-friendly system allows quick and easy set-up and operation through an Android based Tablet software application.

On connection to the heater network the user interface initiates an auto-addressing sequence which automatically sets the address of the heater controllers on the network. The S49UL software provides access to all functions of the S49UL heater control system. The application provides intuitive system control set-up, monitoring, diagnostics, and parameter adjustments, creating a user-friendly experience.

The User Interface allows direct access to variables such as temperature setpoints, upper and lower temperature threshold alarms, and error conditions. For more advanced users the System offers password protected access to detailed control and safety parameter settings.

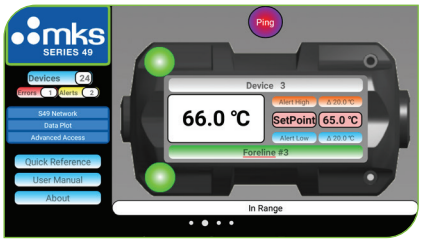
Features

- Quick and easy access to S49UL Controller set-up and diagnostics
- Android-based software app, simple to download, install and run
- Multi-functional user screens provide network monitoring and control
- On-line manual for quick reference
- Quick start guide and instructional video available



Multi-node Screen

- Indicates devices connected to the network (up to 64)
- Real-time display of temperature, LED status, and control parameters for all controllers in network



Single-node Screen

- Provides general status and any alerts or errors for a particular heater
- Adjust setpoint and temperature alert parameters
- ''Ping'' feature for physical identification of a heater on the line

Data Plot Screen

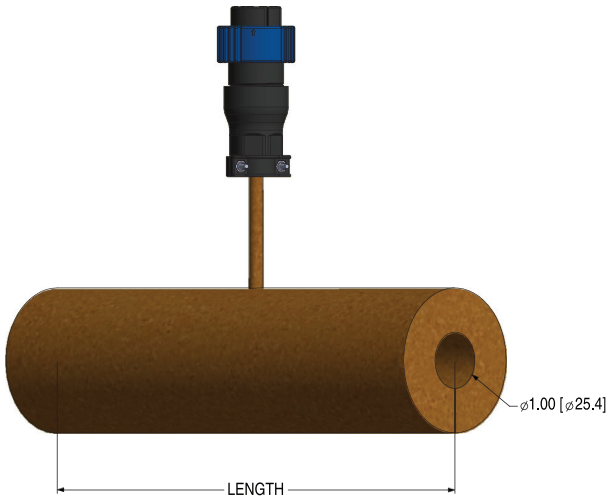
- Plotting of selected heaters with adjustable timescale

Advanced Access Screen (protected)

- Broadcast commands to the entire network
- Advanced parameter adjustment
- Network diagnostics

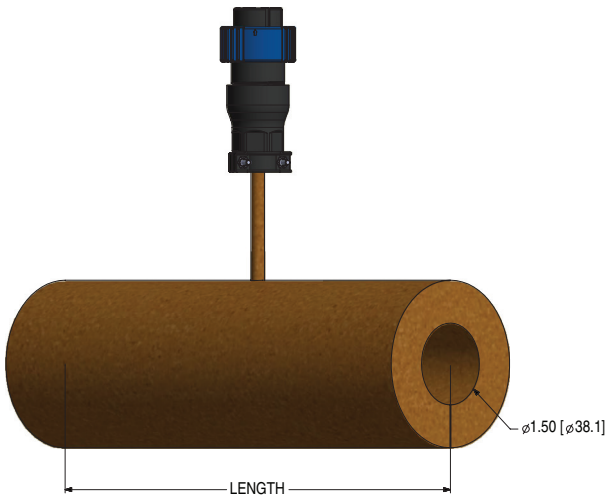
Ordering Information

Straight Section - 1.0'' Diameter Tubing



Nominal Length in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	120 VAC	240 VAC	
3.00 (76.2)	(0.15)	-	49M010V03-1150
4.00 (101.6)	(0.18)	-	49M010V04-1150
5.00 (127.0)	(0.21)	(0.18)	49M010V05-1150
6.00 (152.4)	(0.23)	(0.14)	49M010V06-1150
7.00 (177.8)	(0.27)	(0.14)	49M010V07-1150
8.00 (203.2)	(0.31)	(0.16)	49M010V08-1150
9.00 (228.6)	(0.35)	(0.18)	49M010V09-1150
10.00 (254.0)	(0.39)	(0.19)	49M010V10-1150
11.00 (279.4)	(0.43)	(0.21)	49M010V11-1150
12.00 (304.8)	(0.47)	(0.23)	49M010V12-1150
13.00 (330.2)	(0.51)	(0.25)	49M010V13-1150
14.00 (355.6)	(0.54)	(0.27)	49M010V14-2150
15.00 (381.0)	(0.58)	(0.29)	49M010V15-2150
16.00 (406.4)	(0.62)	(0.31)	49M010V16-2150
17.00 (431.8)	(0.66)	(0.33)	49M010V17-2150
18.00 (457.2)	(0.70)	(0.35)	49M010V18-2150
19.00 (482.6)	(0.74)	(0.37)	49M010V19-2150
20.00 (508.0)	(0.78)	(0.39)	49M010V20-2150
21.00 (533.4)	(0.82)	(0.41)	49M010V21-2150
22.00 (558.8)	(0.86)	(0.43)	49M010V22-2150
23.00 (584.2)	(0.89)	(0.45)	49M010V23-2150
24.00 (609.6)	(0.93)	(0.47)	49M010V24-2150
25.00 (635.0)	(0.97)	(0.49)	49M010V25-2150
26.00 (660.4)	(1.01)	(0.51)	49M010V26-2150
27.00 (685.8)	(1.05)	(0.53)	49M010V27-2150
28.00 (711.2)	(1.09)	(0.54)	49M010V28-2150
29.00 (736.6)	(1.13)	(0.56)	49M010V29-2150
30.00 (762.0)	(1.17)	(0.58)	49M010V30-2150

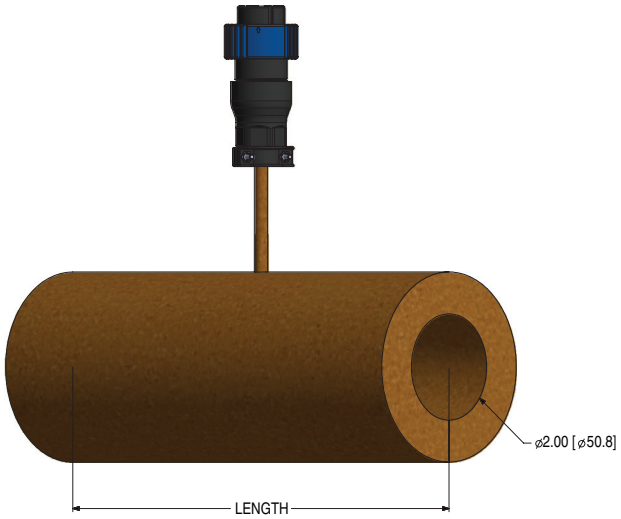
Straight Section - 1.5'' Diameter Tubing



Nominal Length in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	120 VAC	240 VAC	
2.00 (50.8)	(0.15)	-	49M015V02-1150
3.00 (76.2)	(0.20)	(0.27)	49M015V03-1150
4.00 (101.6)	(0.24)	(0.15)	49M015V04-1150
5.00 (127.0)	(0.28)	(0.14)	49M015V05-1150
6.00 (152.4)	(0.31)	(0.15)	49M015V06-1150
7.00 (177.8)	(0.36)	(0.18)	49M015V07-1150
8.00 (203.2)	(0.41)	(0.21)	49M015V08-1150
9.00 (228.6)	(0.46)	(0.23)	49M015V09-1150
10.00 (254.0)	(0.51)	(0.26)	49M015V10-1150
11.00 (279.4)	(0.56)	(0.28)	49M015V11-1150
12.00 (304.8)	(0.62)	(0.31)	49M015V12-1150
13.00 (330.2)	(0.67)	(0.33)	49M015V13-1150
14.00 (355.6)	(0.72)	(0.36)	49M015V14-2150
15.00 (381.0)	(0.77)	(0.38)	49M015V15-2150
16.00 (406.4)	(0.82)	(0.41)	49M015V16-2150
17.00 (431.8)	(0.87)	(0.44)	49M015V17-2150
18.00 (457.2)	(0.92)	(0.46)	49M015V18-2150
19.00 (482.6)	(0.98)	(0.49)	49M015V19-2150
20.00 (508.0)	(1.03)	(0.51)	49M015V20-2150
21.00 (533.4)	(1.08)	(0.54)	49M015V21-2150
22.00 (558.8)	(1.13)	(0.56)	49M015V22-2150
23.00 (584.2)	(1.18)	(0.59)	49M015V23-2150
24.00 (609.6)	(1.23)	(0.62)	49M015V24-2150
25.00 (635.0)	(1.28)	(0.64)	49M015V25-2150
26.00 (660.4)	(1.33)	(0.67)	49M015V26-2150
27.00 (685.8)	(1.39)	(0.69)	49M015V27-2150
28.00 (711.2)	(1.44)	(0.72)	49M015V28-2150
29.00 (736.6)	(1.49)	(0.74)	49M015V29-2150
30.00 (762.0)	(1.54)	(0.77)	49M015V30-2150

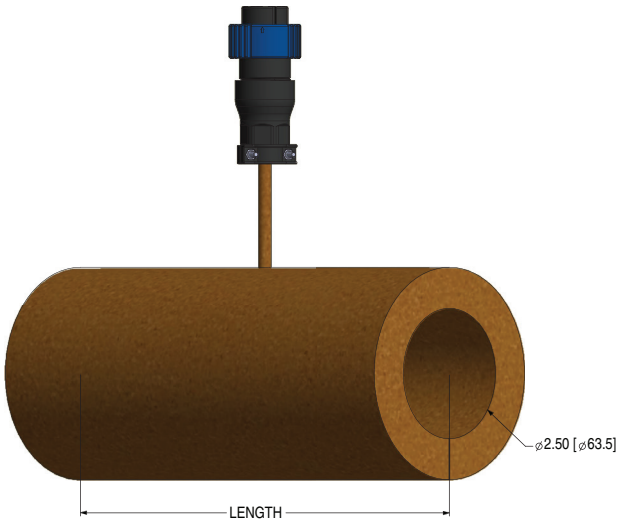
Note: Heater control temperature is factory set to 150°C.

Straight Section - 2.0'' Diameter Tubing



Nominal Length in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	120 VAC	240 VAC	
2.00 (50.8)	(0.18)	–	49M020V02-1150
3.00 (76.2)	(0.25)	(0.14)	49M020V03-1150
4.00 (101.6)	(0.30)	(0.15)	49M020V04-1150
5.00 (127.0)	(0.35)	(0.17)	49M020V05-1150
6.00 (152.4)	(0.38)	(0.19)	49M020V06-1150
7.00 (177.8)	(0.45)	(0.22)	49M020V07-1150
8.00 (203.2)	(0.51)	(0.26)	49M020V08-1150
9.00 (228.6)	(0.57)	(0.29)	49M020V09-1150
10.00 (254.0)	(0.64)	(0.32)	49M020V10-1150
11.00 (279.4)	(0.70)	(0.35)	49M020V11-1150
12.00 (304.8)	(0.77)	(0.38)	49M020V12-1150
13.00 (330.2)	(0.83)	(0.41)	49M020V13-1150
14.00 (355.6)	(0.89)	(0.45)	49M020V14-2150
15.00 (381.0)	(0.96)	(0.48)	49M020V15-2150
16.00 (406.4)	(1.02)	(0.51)	49M020V16-2150
17.00 (431.8)	(1.08)	(0.54)	49M020V17-2150
18.00 (457.2)	(1.15)	(0.57)	49M020V18-2150
19.00 (482.6)	(1.21)	(0.61)	49M020V19-2150
20.00 (508.0)	(1.27)	(0.64)	49M020V20-2150
21.00 (533.4)	(1.34)	(0.67)	49M020V21-2150
22.00 (558.8)	(1.40)	(0.70)	49M020V22-2150
23.00 (584.2)	(1.47)	(0.73)	49M020V23-2150
24.00 (609.6)	(1.53)	(0.76)	49M020V24-2150
25.00 (635.0)	(1.58)	(0.80)	49M020V25-2150
26.00 (660.4)	(1.64)	(0.83)	49M020V26-2150
27.00 (685.8)	(1.70)	(0.86)	49M020V27-2150
28.00 (711.2)	(1.77)	(0.89)	49M020V28-2150
29.00 (736.6)	(1.83)	(0.92)	49M020V29-2150
30.00 (762.0)	(1.89)	(0.96)	49M020V30-2150

Straight Section - 2.5'' Diameter Tubing

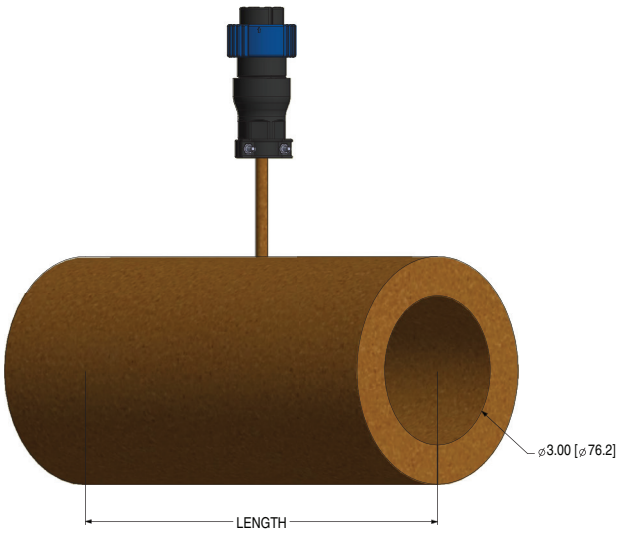


Nominal Length in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	120 VAC	240 VAC	
2.00 (50.8)	(0.22)	(0.18)	49M025V02-1150
3.00 (76.2)	(0.29)	(0.15)	49M025V03-1150
4.00 (101.6)	(0.36)	(0.18)	49M025V04-1150
5.00 (127.0)	(0.41)	(0.20)	49M025V05-1150
6.00 (152.4)	(0.45)	(0.23)	49M025V06-1150
7.00 (177.8)	(0.53)	(0.26)	49M025V07-1150
8.00 (203.2)	(0.61)	(0.30)	49M025V08-1150
9.00 (228.6)	(0.68)	(0.34)	49M025V09-1150
10.00 (254.0)	(0.76)	(0.38)	49M025V10-1150
11.00 (279.4)	(0.83)	(0.42)	49M025V11-1150
12.00 (304.8)	(0.91)	(0.45)	49M025V12-1150
13.00 (330.2)	(0.98)	(0.49)	49M025V13-2150
14.00 (355.6)	(1.06)	(0.53)	49M025V14-2150
15.00 (381.0)	(1.13)	(0.57)	49M025V15-2150
16.00 (406.4)	(1.21)	(0.60)	49M025V16-2150
17.00 (431.8)	(1.29)	(0.64)	49M025V17-2150
18.00 (457.2)	(1.36)	(0.68)	49M025V18-2150
19.00 (482.6)	(1.44)	(0.72)	49M025V19-2150
20.00 (508.0)	(1.51)	(0.76)	49M025V20-2150
21.00 (533.4)	(1.59)	(0.79)	49M025V21-2150
22.00 (558.8)	(1.66)	(0.83)	49M025V22-2150
23.00 (584.2)	(1.74)	(0.87)	49M025V23-2150
24.00 (609.6)	(1.81)	(0.91)	49M025V24-2150
25.00 (635.0)	(1.89)	(0.95)	49M025V25-2150
26.00 (660.4)	(1.97)	(0.98)	49M025V26-2150
27.00 (685.8)	(2.04)	(1.02)	49M025V27-2150
28.00 (711.2)	(2.12)	(1.06)	49M025V28-2150
29.00 (736.6)	(2.19)	(1.10)	49M025V29-2150
30.00 (762.0)	(2.27)	(1.13)	49M025V30-2150

Note: Heater control temperature is factory set to 150°C.

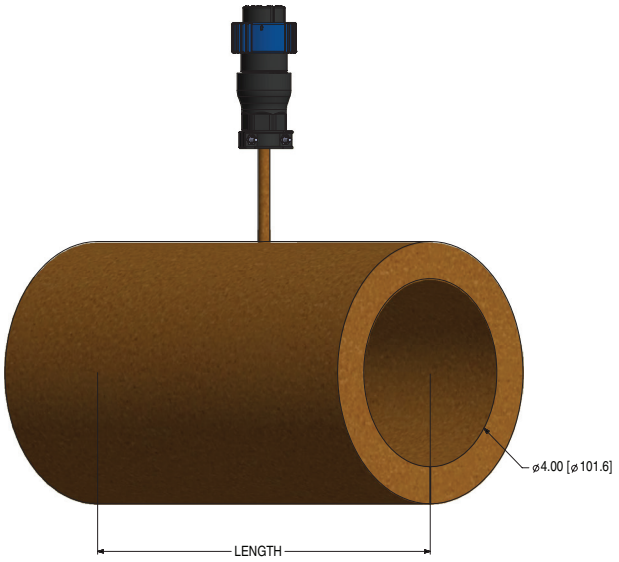
Ordering Information

Straight Section - 3.0'' Diameter Tubing



Nominal Length in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	120 VAC	240 VAC	
2.00 (50.8)	(0.25)	(0.15)	49M030V02-1150
3.00 (76.2)	(0.34)	(0.17)	49M030V03-1150
4.00 (101.6)	(0.41)	(0.21)	49M030V04-1150
5.00 (127.0)	(0.47)	(0.24)	49M030V05-1150
6.00 (152.4)	(0.53)	(0.26)	49M030V06-1150
7.00 (177.8)	(0.61)	(0.31)	49M030V07-1150
8.00 (203.2)	(0.70)	(0.35)	49M030V08-1150
9.00 (228.6)	(0.79)	(0.39)	49M030V09-1150
10.00 (254.0)	(0.88)	(0.44)	49M030V10-1150
11.00 (279.4)	(0.96)	(0.48)	49M030V11-1150
12.00 (304.8)	(1.05)	(0.53)	49M030V12-1150
13.00 (330.2)	(1.14)	(0.57)	49M030V13-2150
14.00 (355.6)	(1.23)	(0.61)	49M030V14-2150
15.00 (381.0)	(1.31)	(0.66)	49M030V15-2150
16.00 (406.4)	(1.40)	(0.70)	49M030V16-2150
17.00 (431.8)	(1.49)	(0.74)	49M030V17-2150
18.00 (457.2)	(1.57)	(0.79)	49M030V18-2150
19.00 (482.6)	(1.66)	(0.83)	49M030V19-2150
20.00 (508.0)	(1.75)	(0.87)	49M030V20-2150
21.00 (533.4)	(1.84)	(0.92)	49M030V21-2150
22.00 (558.8)	(1.92)	(0.96)	49M030V22-2150
23.00 (584.2)	(2.01)	(1.01)	49M030V23-2150
24.00 (609.6)	(2.10)	(1.05)	49M030V24-2150
25.00 (635.0)	(2.19)	(1.09)	49M030V25-2150
26.00 (660.4)	(2.27)	(1.14)	49M030V26-2150
27.00 (685.8)	(2.36)	(1.18)	49M030V27-2150
28.00 (711.2)	(2.45)	(1.22)	49M030V28-2150
29.00 (736.6)	(2.54)	(1.27)	49M030V29-2150
30.00 (762.0)	(2.62)	(1.31)	49M030V30-2150

Straight Section - 4.0'' Diameter Tubing



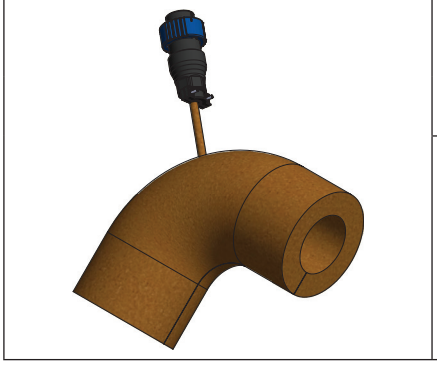
Nominal Length in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	120 VAC	240 VAC	
2.00 (50.8)	(0.32)	(0.16)	49M040V02-1150
3.00 (76.2)	(0.44)	(0.22)	49M040V03-1150
4.00 (101.6)	(0.53)	(0.26)	49M040V04-1150
5.00 (127.0)	(0.60)	(0.30)	49M040V05-1150
6.00 (152.4)	(0.67)	(0.33)	49M040V06-1150
7.00 (177.8)	(0.78)	(0.39)	49M040V07-1150
8.00 (203.2)	(0.89)	(0.45)	49M040V08-1150
9.00 (228.6)	(1.00)	(0.50)	49M040V09-1150
10.00 (254.0)	(1.12)	(0.56)	49M040V10-1150
11.00 (279.4)	(1.23)	(0.61)	49M040V11-1150
12.00 (304.8)	(1.34)	(0.67)	49M040V12-2150
13.00 (330.2)	(1.45)	(0.73)	49M040V13-2150
14.00 (355.6)	(1.56)	(0.78)	49M040V14-2150
15.00 (381.0)	(1.67)	(0.84)	49M040V15-2150
16.00 (406.4)	(1.79)	(0.89)	49M040V16-2150
17.00 (431.8)	(1.90)	(0.95)	49M040V17-2150
18.00 (457.2)	(2.01)	(1.00)	49M040V18-2150
19.00 (482.6)	(2.12)	(1.06)	49M040V19-2150
20.00 (508.0)	(2.23)	(1.12)	49M040V20-2150
21.00 (533.4)	(2.34)	(1.17)	49M040V21-2150
22.00 (558.8)	(2.46)	(1.23)	49M040V22-2150
23.00 (584.2)	(2.57)	(1.28)	49M040V23-2150
24.00 (609.6)	(2.68)	(1.34)	49M040V24-2150
25.00 (635.0)	(2.79)	(1.40)	49M040V25-2150
26.00 (660.4)	(2.90)	(1.45)	49M040V26-2150
27.00 (685.8)	(3.01)	(1.51)	49M040V27-2150
28.00 (711.2)	(3.12)	(1.56)	49M040V28-2150
29.00 (736.6)	(3.24)	(1.62)	49M040V29-2150
30.00 (762.0)	(3.35)	(1.67)	49M040V30-2150

Note: Heater control temperature is factory set to 150°C.

90° Elbow For ISO Flanged Elbows, Standard Modulus

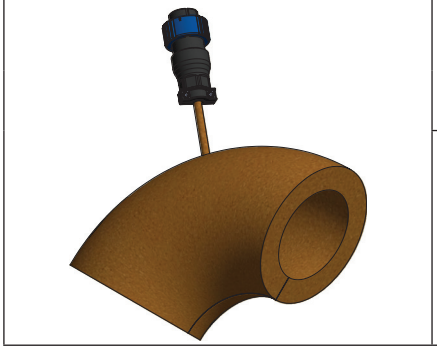
Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	2.25 (57.2)	1.50 (38.1)	(0.24)	(0.22)	100314505	49M015V61-1150
2.00 (50.8)	2.38 (60.5)	2.00 (50.8)	(0.30)	(0.15)	100314506	49M020V61-1150
2.50 (63.5)	2.56 (65.0)	3.75 (95.3)	(0.33)	(0.16)	100764606	49M025V63-1150
3.00 (76.2)	3.75 (95.3)	4.50 (114.3)	(0.50)	(0.25)	100764608	49M030V63-1150
4.00 (101.6)	5.25 (133.4)	6.00 (152.4)	(0.88)	(0.44)	100764610	49M040V63-1150

90° Elbow For ISO Flanged Elbows, Long Radius



Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	4.75 (120.7)	2.25 (57.2)	(0.44)	(0.36)	100314415	49M015V63-1150
2.00 (50.8)	5.13 (130.3)	3.00 (76.2)	(0.57)	(0.29)	100314416	49M020V63-1150

90° Elbow For Weld Elbows, Long Radius

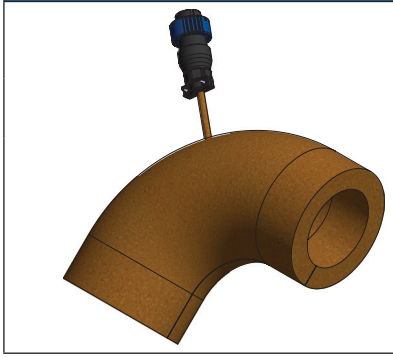


Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	2.25 (57.2)	2.25 (57.2)	(0.22)	(0.20)	1002390150	49M015V66-1150
2.00 (50.8)	3.00 (76.2)	3.00 (76.2)	(0.33)	(0.17)	1002390200	49M020V66-1150
2.50 (63.5)	3.75 (95.3)	3.75 (95.3)	(0.45)	(0.22)	1002390250	49M025V66-1150
3.00 (76.2)	4.50 (114.3)	4.50 (114.3)	(0.62)	(0.31)	1002390300	49M030V66-1150
4.00 (101.6)	6.00 (152.4)	6.00 (152.4)	(1.05)	(0.53)	1002390400	49M040V66-1150

Note: Heater control temperature is factory set to 150°C.

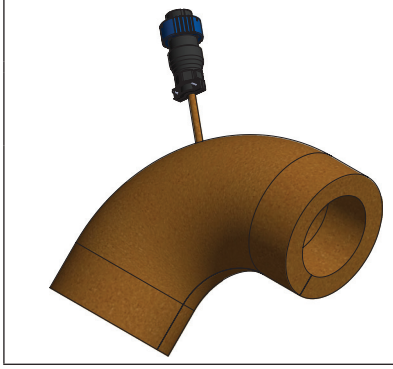
Ordering Information

90° Elbow For Weld Elbows, with Tangents



Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	2.88 (73.2)	2.25 (57.2)	(0.27)	(0.23)	1002390WT150	49M015V67-1150
2.00 (50.8)	4.00 (101.6)	3.00 (76.2)	(0.43)	(0.21)	1002390WT200	49M020V67-1150
3.00 (76.2)	6.25 (158.8)	4.50 (114.3)	(0.92)	(0.46)	1002390WT300	49M030V67-1150
4.00 (101.6)	8.25 (209.6)	6.00 (152.4)	(1.55)	(0.78)	1002390WT400	49M040V67-2150

90° Elbow For Weld Elbows, with One Clamp

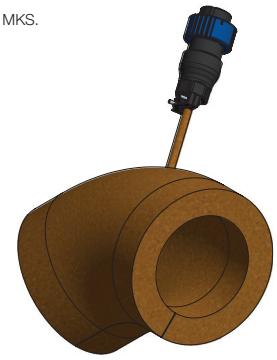


Tube Size in. (mm)	Modulus in. (mm)		Bend Radius in. (mm)	Amps		Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	A	B		120 VAC	240 VAC	
1.50 (38.1)	2.25 (57.2)	1.75 (44.5)	2.25 (57.2)	(0.20)	(0.18)	49M015V68-1150
2.00 (50.8)	3.00 (76.2)	2.50 (63.5)	3.00 (76.2)	(0.31)	(0.16)	49M020V68-1150
2.50 (63.5)	3.75 (95.3)	3.25 (82.6)	3.75 (95.3)	(0.43)	(0.21)	49M025V68-1150
3.00 (76.2)	4.50 (114.3)	4.00 (101.6)	4.50 (114.3)	(0.57)	(0.29)	49M030V68-1150
4.00 (101.6)	6.00 (152.4)	5.50(139.7)	6.00 (152.4)	(1.00)	(0.50)	49M040V68-1150

Note: Heater control temperature is factory set to 150°C.

45° Elbow For ISO Flanged Elbows, Standard Modulus

*Contact MKS.



Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps 120 VAC		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	1.37 (34.8)	2.25 (57.2)	(0.18)	*	100318705	49M015V62-1150
2.00 (50.8)	1.62 (41.1)	3.00 (76.2)	(0.26)	(0.17)	100318706	49M020V62-1150
3.00 (76.2)	2.94 (74.7)	4.50 (114.3)	(0.51)	(0.26)	100764408	49M030V62-1150
4.00 (101.6)	4.05 (102.9)	6.00 (152.4)	(0.87)	(0.44)	100764410	49M040V62-1150

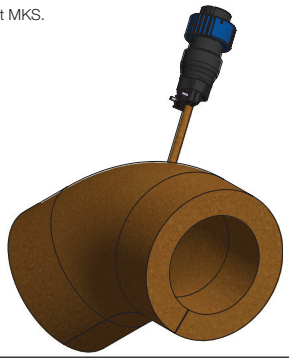
45° Elbow For Weld Elbows, Standard Modulus

*Contact MKS.

Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	0.93 (23.6)	2.25 (57.2)	*	*	1002345150	—
2.00 (50.8)	1.24 (31.5)	3.00 (76.2)	(0.21)	*	1002345200	49M020V64-1150
2.50 (63.5)	1.55 (39.4)	3.75 (95.3)	(0.29)	(0.15)	1002345250	49M025V64-1150
3.00 (76.2)	1.86 (47.2)	4.50 (114.3)	(0.38)	(0.19)	1002345300	49M030V64-1150
4.00 (101.6)	2.49 (63.2)	6.00 (152.4)	(0.58)	(0.29)	1002345400	49M040V64-1150

45° Elbow For Weld Elbows, with Tangents

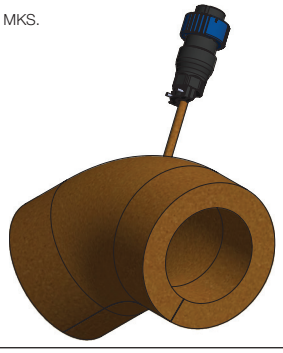
*Contact MKS.



Tube Size in. (mm)	Modulus in. (mm)	Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	1.56 (39.6)	2.25 (57.2)	(0.20)	*	1002345WT150	49M015V65-1150
2.00 (50.8)	2.24 (56.9)	3.00 (76.2)	(0.32)	(0.16)	1002345WT200	49M020V65-1150
3.00 (76.2)	3.61 (91.7)	4.50 (114.3)	(0.62)	(0.31)	1002345WT300	49M030V65-1150
4.00 (101.6)	4.74 (120.4)	6.00 (152.4)	(1.03)	(0.51)	1002345WT400	49M040V65-1150

45° Elbow For Weld Elbows, with One Clamp

*Contact MKS.

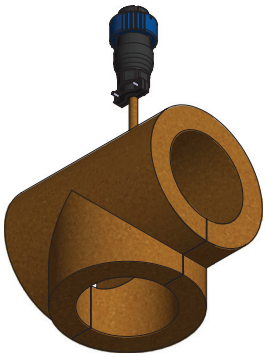


Tube Size in. (mm)	Modulus in. (mm)		Bend Radius in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
	A	B		120 VAC	240 VAC		
2.00 (50.8)	1.24 (31.5)	0.74 (18.8)	3.00 (76.2)	(0.17)	*	100314506	49M020V60-1150
2.50 (63.5)	1.55 (39.4)	1.05 (26.7)	3.75 (95.3)	(0.25)	*	100764606	49M025V60-1150
3.00 (76.2)	1.86 (47.2)	1.36 (34.5)	4.50 (114.3)	(0.34)	(0.17)	100764608	49M030V60-1150
4.00 (101.6)	2.49 (63.2)	1.99 (50.5)	6.00 (152.4)	(0.55)	(0.27)	100764610	49M040V60-1150

Note: Heater control temperature is factory set to 150°C.

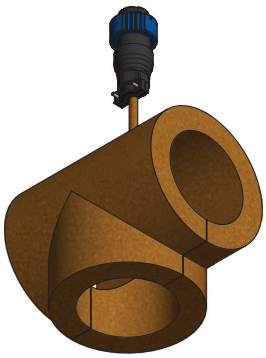
Ordering Information

Tee - For ISO Flanged Tees



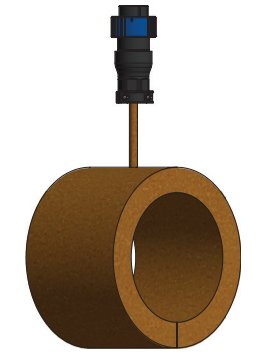
Tube Size in. (mm)	Modulus in. (mm)	Length in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	2.25 (57.2)	4.50 (114.3)	(0.34)	(0.17)	100314605	49M015V38-1150
2.00 (50.8)	2.38 (60.5)	4.75 (120.7)	(0.41)	(0.21)	100314606	49M020V38-1150
2.50 (63.5)	2.56 (65.0)	5.13 (130.3)	(0.49)	(0.25)	100761406	49M025V38-1150
3.00 (76.2)	3.00 (76.2)	6.00 (152.4)	(0.62)	(0.31)	100761408	49M030V38-1150
4.00 (101.6)	3.38 (85.9)	6.75 (171.5)	(0.85)	(0.42)	100761410	49M040V38-1150

Tee - For Weld Tees



Tube Size in. (mm)	Modulus in. (mm)	Length in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	2.19 (55.6)	4.38 (111.3)	(0.33)	(0.16)	10023T150	49M015V39-1150
2.00 (50.8)	2.94 (74.7)	5.88 (149.4)	(0.48)	(0.24)	10023T200	49M020V39-1150
2.50 (63.5)	2.94 (74.7)	5.88 (149.4)	(0.55)	(0.27)	10023T250	49M025V39-1150
3.00 (76.2)	3.19 (81.0)	6.38 (162.1)	(0.67)	(0.34)	10023T300	49M030V39-1150
4.00 (101.6)	3.81 (96.8)	7.63 (193.8)	(0.99)	(0.50)	10023T400	49M040V39-2150

Bellows - For ISO Flanged Bellows

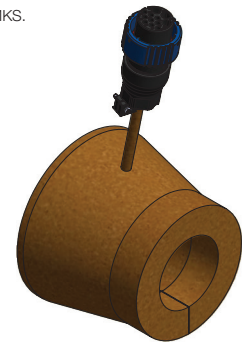


Tube Size in. (mm)	Length in. (mm)	Bellows Diameter in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	3.31 (84.1)	1.81 (46.0)	(0.25)	(0.19)	100314915	49M015V69-1150
2.00 (50.8)	3.19 (81.0)	2.41 (61.2)	(0.30)	(0.15)	100314916	49M020V69-1150
3.00 (76.2)	4.00 (101.6)	3.80 (96.5)	(0.51)	(0.25)	100763508	49M030V69-1150
4.00 (101.6)	4.00 (101.6)	4.70 (119.4)	(0.61)	(0.30)	100763510	49M040V69-1150

Note: Heater control temperature is factory set to 150°C.

Reducer - For ISO Flanged Reducers

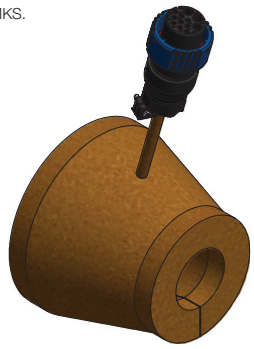
*Contact MKS.



Tube Size in. (mm)	Length in. (mm)	Large End Tangent in. (mm)	Small End Tangent in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
				120 VAC	240 VAC		
2.50 (63.5) x 1.50 (38.1)	2.44 (62.0)	0.20 (5.1)	0.70 (17.8)	(0.19)	*	100765006	49M025V43-1150
3.00 (76.2) x 1.50 (38.1)	3.53 (89.7)	0 (0.0)	0.87 (22.1)	(0.29)	(0.17)	100765016	49M030V43-1150
3.00 (76.2) x 2.00 (50.8)	3.55 (90.2)	0.20 (5.1)	0.92 (23.4)	(0.32)	(0.19)	100765008	49M030V47-1150
4.00 (101.6) x 2.00 (50.8)	3.60 (91.4)	0 (0.0)	0.93 (23.6)	(0.36)	(0.22)	100765018	49M040V43-1150
4.00 (101.6) x 3.00 (76.2)	2.73 (69.3)	0 (0.0)	0 (0.0)	(0.36)	(0.19)	100764908	49M040V47-1150

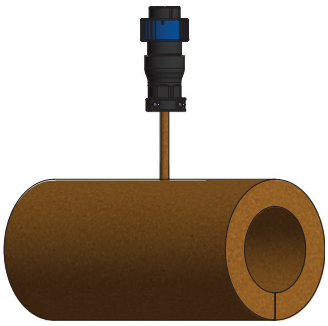
Reducer - For Weld Reducers

*Contact MKS.



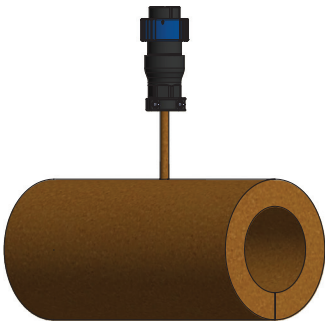
Tube Size in. (mm)	Length in. (mm)	Large End Tangent in. (mm)	Small End Tangent in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
				120 VAC	240 VAC		
2.00 (50.8) x 1.50 (38.1)	2.37 (60.2)	0.50 (12.7)	0.50 (12.7)	(0.19)	(0.20)	10023200CR150	49M020V45-1150
2.50 (63.5) x 1.50 (38.1)	2.37 (60.2)	0.50 (12.7)	0.50 (12.7)	(0.21)	*	10023250CR150	49M025V41-1150
2.50 (63.5) x 2.00 (50.8)	2.38 (60.5)	0.59 (15.0)	0.50 (12.7)	(0.23)	(0.19)	10023250CR200	49M025V45-1150
3.00 (76.2) x 1.50 (38.1)	3.63 (92.2)	0.50 (12.7)	0.50 (12.7)	(0.32)	(0.18)	10023300CR150	49M030V41-1150
3.00 (76.2) x 2.00 (50.8)	3.63 (92.2)	0.70 (17.8)	0.50 (12.7)	(0.34)	(0.20)	10023300CR200	49M030V45-1150
4.00 (101.6) x 2.00 (50.8)	3.63 (92.2)	0.50 (12.7)	0.50 (12.7)	(0.40)	(0.23)	10023400CR200	49M040V41-1150
4.00 (101.6) x 3.00 (76.2)	3.63 (92.2)	0.50 (12.7)	0.50 (12.7)	(0.44)	(0.26)	10023400CR300	49M040V45-1150

Hose - For ISO-KF Flanged Thin Wall Hose



Tube Size in. (mm)	Length in. (mm)	Bellows Diameter in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	9.19 (233.4)	1.95 (49.5)	(0.56)	(0.28)	100317415	49M015V77-1150
2.00 (50.8)	9.06 (230.1)	2.50 (63.5)	(0.69)	(0.34)	100317416	49M020V77-1150

Hose - For ISO-KF Flanged Thick Wall Hose



Tube Size in. (mm)	Length in. (mm)	Bellows Diameter in. (mm)	Amps		For Use With	Part Number Replace M with 4=PTFE; 5=Polyimide Replace V with 1=120V; 2=240V
			120 VAC	240 VAC		
1.50 (38.1)	9.19 (233.4)	2.12 (53.8)	(0.61)	(0.31)	100315905	49M015V79-1150
2.00 (50.8)	9.06 (230.1)	2.71 (68.8)	(0.73)	(0.36)	100315906	49M020V79-1150

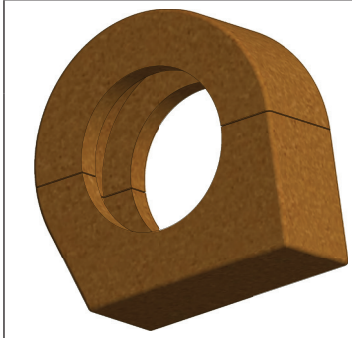
Note: Heater control temperature is factory set to 150°C.

Ordering Information

Flange Insulators - Standard, Fits Most Clamps

Flange Size NW	Hole 1 I.D.	Hole 2 I.D.	For Use With	Part Number Replace X with 1=PTFE 2=Polyimide
40	2.70 (68.6)	2.70 (68.6)	MKS ISO-KF Clamps	50X015-0016
40	2.70 (68.6)	3.20 (81.3)	MKS ISO-KF Clamps	50X015-0017
50	3.25 (82.6)	3.25 (82.6)	MKS ISO-KF Clamps	50X020-0016
50	3.25 (82.6)	3.95 (100.3)	MKS ISO-KF Clamps	50X020-0017
63	3.75 (95.3)	3.75 (95.3)	MKS Double Claw Clamp 100761106	50X025-0016
63	3.68 (93.5)	4.28 (108.7)	MKS Double Claw Clamp 100761106	50X025-0017
80	4.25 (108.0)	4.25 (108.0)	MKS Double Claw Clamp 100761106	50X030-0016
80	4.25 (108.0)	5.05 (128.3)	MKS Double Claw Clamp 100761106	50X030-0017
100	5.25 (133.4)	5.25 (133.4)	MKS Double Claw Clamp 100761106	50X040-0016
100	5.25 (133.4)	5.95 (151.1)	MKS Double Claw Clamp 100761106	50X040-0017

Flange Insulators - ISO-KF Flanges, Compact



Flange Size NW	Hole 1 I.D.	Hole 2 I.D.	For Use With (will only work with MKS clamps)	Part Number Replace X with 1=PTFE 2=Polyimide
25	2.08 (52.8)	2.08 (52.8)	MKS Toggle clamp 100318803	50X010-0038
25	1.07 (27.2)	1.60 (40.6)	MKS Wing Nut Clamp 100312903	50X010-0082
25	2.57 (65.4)	2.57 (65.4	MKS Toggle Clamp 100318805	50X010-0803
40	2.68 (68.1)	2.68 (68.1)	MKS Wing Nut Clamp 100312905	50X015-0269
40	2.68 (68.1)	3.19 (81.0)	MKS Toggle Clamp 100318805	50X015-0270
40	2.58 (65.5)	3.60 (91.4)	MKS Wing Nut Clamp 100312905	50X015-0280
50	3.09 (78.5)	3.09 (78.5)	MKS Wing Nut Clamp 100312906	50X020-0247
50	3.09 (78.5)	4.00 (101.6)	MKS Wing Nut Clamp 100312906	50X020-0248
50	3.09 (78.5)	3.60 (91.4)	MKS Wing Nut Clamp 100312906	50X020-0285
50	3.38 (85.8)	3.38 (85.8)	MKS Toggle Clamp 100318806	50X020-0806
50	3.38 (85.8)	3.88 (98.5)	MKS Toggle Clamp 100318807	50X020-0807

1'' Long Tube Insulators

Use to fill straight gaps.

Tube Size	Length	Part Number Replace X with 1=PTFE 2=Polyimide (Qty 1 Insulator)	Part Number Replace X with 1=PTFE 2=Polyimide (Qty 5 Insulator)
1.00	1''	50X010-0001	50X010-0005
1.50	1''	50X015-0001	50X015-0005
1.66	1''	50X017-0001	50X017-0005
1.90	1''	50X019-0001	50X019-0005
2.00	1''	50X020-0001	50X020-0005
2.38	1''	50X024-0001	50X024-0005
2.50	1''	50X025-0001	50X025-0005
3.00	1''	50X030-0001	50X030-0005
3.50	1''	50X035-0001	50X035-0005
4.00	1''	50X040-0001	50X040-0005
4.50	1''	50X045-0001	50X045-0005

Note: Heater control temperature is factory set to 150°C.

Power

Description	Volts	Amps	Part Number
Power Kit, 120V, 8ft cable, 5-15P connector	120	10 max	20021379-001
Power Kit, 240V, 8ft cable, L6-15P connector	240	10 max	20021381-001
Power Kit, 120V, 15ft cable, 5-15P connector	120	10 max	20021380-001
Power Kit, 240V, 15ft cable, L6-15P connector	240	10 max	20021382-001

Communications

Description			Part Number
Communications Kit, 120/240V	120/240	–	20014265-001
Communications Kit, 50 ft cable, flying	120/240	–	20015929-001
LTA Kit	120/240	–	20014267-001

Accessories

Description			Part Number
Speed Straps			
Strap, Heater, Large, Black	–	–	20018033-001
Strap, Speed, Small, Black	–	–	20002133
Controller-to-Controller Extension Cables			
Cable, UL, Ext 12 inch	120/240	–	20003387
Cable, UL, Ext 24 inch	120/240	–	20003388
Cable, UL, Ext 36 inch	120/240	–	20003389
Cable, UL, Ext 48 inch	120/240	–	20003390
Cable, UL, Ext 120 inch	120/240	–	20003610
Cable, UL, Ext, 300 inch	120/240	–	20007170-001
Heater-to-Controller Extension Cables			
Cable, UL, Heater Ext, 12 inch	120/240	–	20008474-001
Cable, UL, Heater Ext, 24 inch	120/240	–	20008476-001
Cable, UL, Heater Ext, 36 inch	120/240	–	20008477-001
Cable, UL, Heater Ext, 48 inch	120/240	–	20008478-001

Heater Ordering Information

Ordering Code Example: 495020202	Code	Configuration
Product Type		
Heater	49	49
Material		
PTFE	4	5
Polyimide	5	
Heater Form[1]		
Standard	0	0
Custom	9	
Diameter Size[2]		
1.0''	10	20
1.5''	15	
2.0''	20	
2.5''	25	
3.0''	30	
4.0''	40	
Voltage		
100-120 VAC	1	2
200-240 VAC	2	
Shape		
Straight 1.0'' increments	02-30	02
Tee	38-39	
Reducer	41, 43, 45, 47	
Elbow	60-68	
Bellows/Hose	69, 77, 79	

Example for a polyimide, Ø2.0'', 2 inch long heater, using 240V the part number is: 495020202

Notes:
[1] If this is a custom heater (9) then all subsequent numbers lose their significance. The custom heater part number has no diameter, voltage, or shape.
[2] These are standard tube diameters that are offered. Standard pipe diameters are available in certain sizes not mentioned in this brochure.

Controller Ordering Information

Ordering Code Example: 49-1105	Code	Configuration
Product Type		
Controller	49	49
Cable Length		
10''	-1	-1
20''	-2	
Control Setpoint Temperature		
95°C	095	105
105°C	105	
150°C	150	
170°C	170	
180°C	180	
200°C	200	

Example for a small heater that needs factory setting of 105°C: 49-1105

Complete Part Number Configuration

- Complete number means a heater and controller shipped together in one bag, as one part number.
- You will drop everything to the left of the dash on the controller part number (49), everything else in the controller part number including the dash goes to the end of the heater part number.
- With the examples from the heater and controller configuration pages, the complete part number is: 495020202-1105

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Series 49UL_11/19