

Assures Reliable, Efficient Heating and Transport of Liquids and Gases

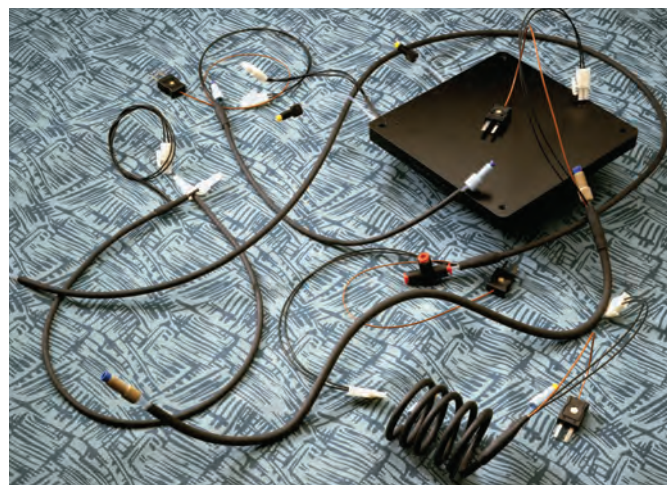
Watlow's miniature heated polymeric tubing assemblies provide a flexible heat-up and transport system for moving fluids in tubing as small as 1/32 inch (0.792 mm) inside diameter. FREEFLEX® heats fluids up to 100°C (212°F) and maintains temperature during transfer from a reservoir to a point of use. In some applications, the tubing can actually serve as the reservoir for limited volumes of fluid, helping to reduce start-up times. For higher temperatures consult the factory.

Watlow's innovative design places the heating element and sensor directly in contact with the perimeter of the tubing to produce efficient, responsive heating and temperature control of the tube contents. The element is evenly wound to ensure reliable, close contact for uniform heating along a portion or the entire length of the line. A flexible, durable jacket covers the wound element and lets the tubing flex and move in a dynamic system. This allows for fluid delivery to multiple locations from a single supply source. In stationary applications, the FREEFLEX heated tubing is conveniently routed through available space or around other system components. This saves space and provides for an uncomplicated retrofit in existing systems.

The superior construction employs an efficient heating element design with the ability to incorporate optional thermocouple, thermistor or RTD temperature sensors into the thermal package. Users can select leads to exit one or both ends of the assembly. Typical standard Teflon® tubing comes in 1/32-, 1/16-, 1/8- or 3/16-inch (0.792, 1.59, 3.18, 4.76 mm) inside diameters, although other sizes and materials are available.

Applications

- **Medical:** automated clinical analyzers, tissue processing equipment
- **Analytical:** sample preheating for LC and HPLC systems, breathalyzers
- **Semiconductor processing:** wafer drying equipment, DI water heating
- **Printing:** ink jet printers, rapid prototyping systems, photolithography
- **General Process:** wax/paraffin processing and non-combustible gas heating
- **Water purification systems**
- **Precision cleaning equipment**
- **Aerospace**
- **Military**



Features and Benefits

Flexible heat-up and transport system

- Eliminates the need for heated reservoir systems in many applications

Heating element directly contacts tubing

- Provides fast, efficient more responsive heating

Three configurations available

- FREEFLEX design - allows tubing to flex, coil or bend around system components
- Pre-formed design - allows longer tube length in smaller volume
- Molded design - provides a compact heating assembly for easy installation

Integral sensors

- Maintains close control of heater and fluid temperatures

Low voltage design

- Promotes safety

Miniature sizes as small as 1/32 inch (0.792 mm) inside diameter

- Transports and heats fluids in even the smallest spaces

Convenient retrofit

- Allows for routing flexible tubing around system components and using existing control system

UL® recognition

- Available on qualified designs by request



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Quote and Ordering Information

For a quote, please request, fill out and return a FREEFLEX application data sheet.

To order, please specify:

Fluid Type

Inlet Temperature

Outlet Temperature

Flow Rate

Voltage - Typically less than 36 volts

Watts/ft - See chart below for typical values

Maximum Allowable Outside Surface Temperature

Tube Size

- 1/32 in. (0.792 mm) I.D. x 1/16 in. (1.59 mm) O.D.
- 1/16 in. (1.59 mm) I.D. x 3/16 in. (3.18 mm) O.D.
- 1/8 in. (3.18 mm) I.D. x 3/16 in. (4.76 mm) O.D.
- 3/16 in. (4.76 mm) I.D. x 1/4 in. (6.35 mm) O.D.
- Other (specify size)

Tube Material

- Teflon® (standard)
- Silicone rubber
- Others upon request

Tube Length - 12 to 120 in. (305 to 3048 mm) typical

- Total
- Heated
- Unheated (specify)

Tube Fittings

- No fittings (1 in. (25 mm) bare tubing at each end)
- Other (specify)

Tube Flexing

- Static (to route around components in system)
- Dynamic (subject to more continuous flexing)
- Occasional, frequent or continuous

Note: Minimum recommended flexing radius

- 1/32 in. (0.792 mm) I.D. x 1/16 in. (1.59 mm) O.D. Teflon® 1 in. (25 mm)
- 1/16 in. (1.59 mm) I.D. x 3/16 in. (3.18 mm) O.D. Teflon® 1 1/2 in. (38 mm)
- 1/8 in. (3.18 mm) I.D. x 3/16 in. (4.76 mm) O.D. Teflon® 2 in. (51 mm)
- 3/16 in. (4.76 mm) I.D. x 1/4 in. (6.35 mm) O.D. Teflon® 3 in. (76 mm)

Heater Leads

- One at each end
- Both at one end
- Standard lead insulation (UL® Style 1180 white Teflon®)
- Other insulation (specify)

Heater Lead Length

- Standard 12 in. (305 mm) w/customer end stripped/tinned 1/2 in. (13 mm)
- Other (specify)

Heater Lead Exit Direction

- Inboard/outboard

Temperature Sensor

- Standard thermocouple (#30 AWG Teflon® - Type J)
- Thermistor (specify) 10KΩ at 25°C (72°F) standard
- Other temperature sensors size/types (specify)
- Sense heater element or tube temperature

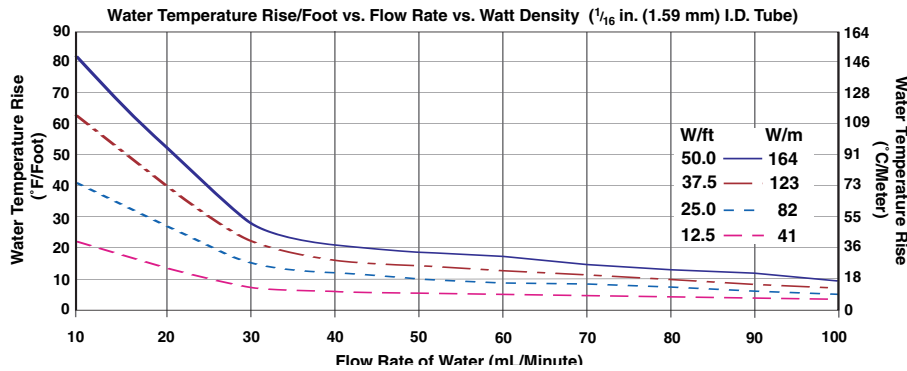
Sensor Lead Exit Direction

- Inboard/outboard

Temperature Sensor Lead Length

- Standard 12 in. (305 mm)
- Other (specify)

Water Temperature Rise/Length Versus Flow Rate Versus Watt Density



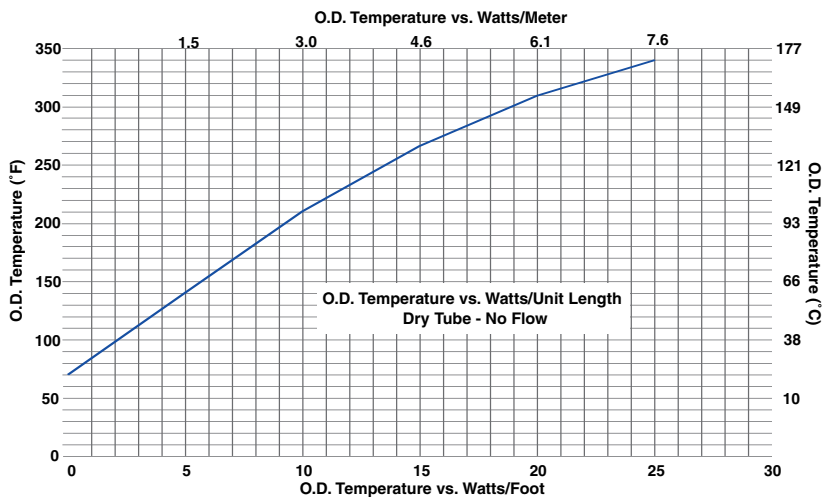
Water Temperature Rise °F/foot

W/ft	10	30	50	100
Flow Rate (mL/minute)	82	29	19	10
37.5	64	22	14	7
25.0	41	16	10	5
12.5	22	8	5	3

Water Temperature Rise °C/Meter

W/m	10	30	50	100
Flow Rate (mL/minute)	149	52	35	18
123	116	40	26	13
82	75	29	18	9
41	40	15	9	5

FREEFLEX Outside Diameter Temperature Versus Watts/Length



W/ft	W/m	O.D. Temperature °C	O.D. Temperature (°F) (Ambient)
0	0	21	(70)
5	1.5	60	(140)
10	3.0	99	(210)
15	4.6	129	(265)
20	6.1	154	(310)
25	7.6	171	(340)

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