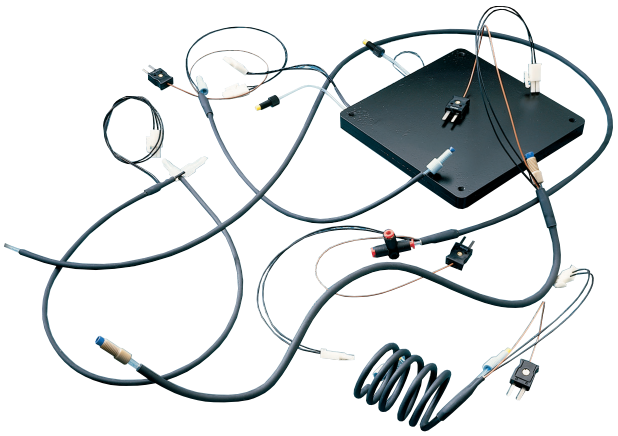
FREEFLEX® Heated Tubing

Ensures Efficient Heating and Transport of Liquids and Gases



The miniature heated polymeric tubing assemblies from Watlow® provide a flexible heat-up and transport system for moving fluids inside of tubing with an inside diameter as narrow as 1/32 in. (0.8 mm). FREEFLEX® heats fluids up to 212°F (100°C) 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 temperature needs contact your Watlow representative.

Watlow's innovative design places the heating element and sensor in direct 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 allows tubing to flex and move in a dynamic system enabling 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 designed with the ability to incorporate optional thermocouple, thermistor or RTD temperature sensors into the thermal package. Users can select power leads to exit from one or both ends of the assembly. Typical standard PTFE tubing is available in 1/32, 1/16, 1/8 or 3/16 in. (0.8, 1.6, 3.2, 4.8 mm) inside diameters. Ask your Watlow representative for other sizes and materials.

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

Available in three configurations
- 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
- Maintain close control of heater and fluid temperatures

Low voltage design
- Promotes safety

Miniature inside diameters as small as 1/32 in. (0.8 mm)
- Transports and heats fluids in the smallest spaces

Convenient retrofit
- Allows flexible tubing to be routed around system components of existing control system

UL® recognition
- Available on qualified designs by request

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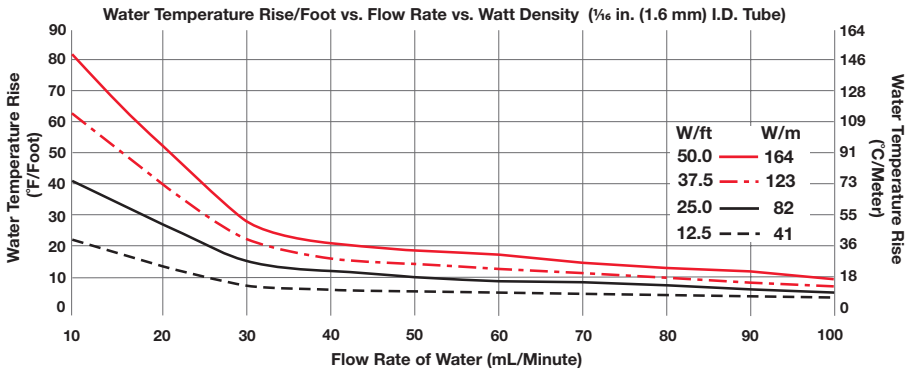
Typical Applications

- **Clinical:** automated clinical analyzers, tissue processing equipment
- **Analytical:** sample preheating for LC and HPLC systems, breathalyzers, immuno assays
- **Semiconductor processing:** wafer drying equipment, DI water heating
- **Printing:** additive manufacturing/3D printing
- **General process:** wax/paraffin processing and non-combustible gas heating
- **Water purification systems**
- **Precision cleaning equipment**
- **Aerospace**
- **Military**

Technical Data

Water Temperature Rise/Length Versus Flow Rate Versus Watt Density



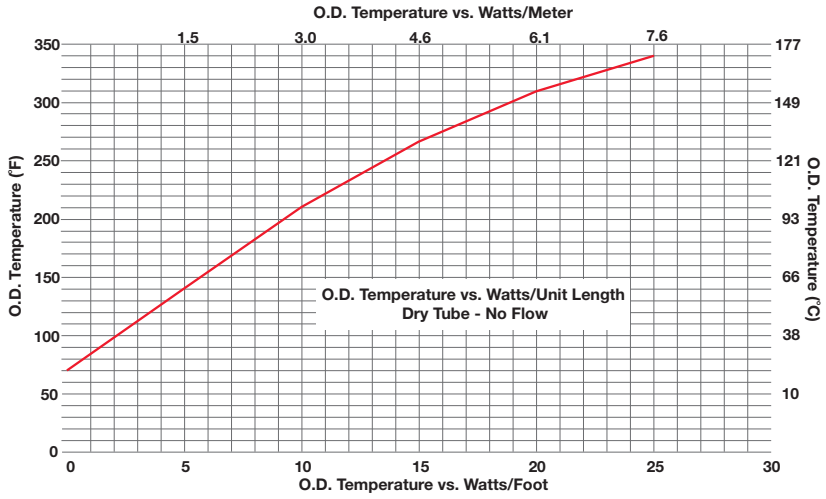
Water Temperature Rise °F/Foot

Flow Rate (mL/minute)				
W/ft	**10**	**30**	**50**	**100**
50.0	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

Flow Rate (mL/minute)				
W/m	**10**	**30**	**50**	**100**
164	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 °F	(°C) (Ambient)
0	0	70	(21)
5	1.5	140	(60)
10	3.0	210	(99)
15	4.6	265	(129)
20	6.1	310	(154)
25	7.6	340	(171)

Details Required for Application Support/ Product Requirements

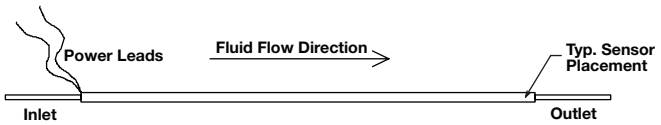
- **Fluid Type**
- **Inlet Temperature**
- **Outlet Temperature**
- **Flow Rate**
- **Voltage** - Typically less than 36V
- **Watts/ft** - See chart on previous page for typical values
- **Maximum Allowable Outside Surface Temperature**
- **Tube Size**
  - 1/32 in. (0.8 mm) I.D. x 1/16 in. (1.6 mm) O.D.
  - 1/16 in. (1.6 mm) I.D. x 1/8 in. (3.2 mm) O.D.
  - 1/8 in. (3.2 mm) I.D. x 3/16 in. (4.8 mm) O.D.
  - 3/16 in. (4.8 mm) I.D. x 1/4 in. (6 mm) O.D.
  - Other (specify size)
- **Tube Material**
  - PTFE
  - Others available upon request
- **Tube Length** - 24 to 165 in. (610 to 4191 mm) typical
  - Total
  - Heated
  - Unheated (specify)
- **Tube Fittings**
  - No fittings (1 in. [25 mm] bare tubing each end)
  - Other (specify)
- **Tube Flexing**
  - Static (to route around components in system)
  - Dynamic (subject to more continuous flexing)
    - Occasional, frequent or continuous

Note: Min. recommended flexing radius

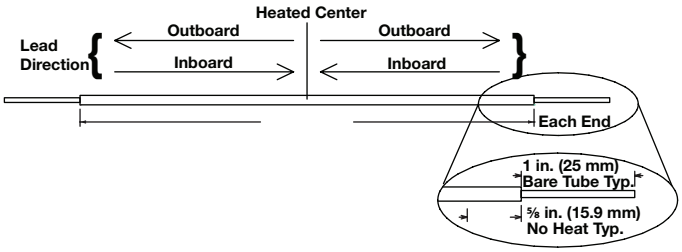
- 1/32 in. (0.8 mm) I.D. x 1/16 in. (1.6 mm) O.D. PTFE 1 in. (25 mm)
- 1/16 in. (1.6 mm) I.D. x 1/8 in. (3.2 mm) O.D. PTFE 1 1/2 in. (38 mm)
- 1/8 in. (3.2 mm) I.D. x 3/16 in. (4.8 mm) O.D. PTFE 2 in. (51 mm)
- 3/16 in. (4.8 mm) I.D. x 1/4 in. (6 mm) O.D. PTFE 3 in. (76 mm)

- **Heater Leads**
  - One at each end
  - Both at one end
  - Standard lead insulation (UL® Style 1180 CSA white PTFE)
  - 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**
  - Thermocouple (#30 AWG PTFE - Type J)
  - Thermistor (specify) 10KΩ at 72°F (25°C) standard
  - Other temperature sensors size/types (specify)
  - Sense heater element or tube temperature
- **Sensor Lead Exit Direction**
  - Inboard/outboard
- **Temperature Sensor Lead Length**
  - 12 in. (305 mm)
  - Other (specify)

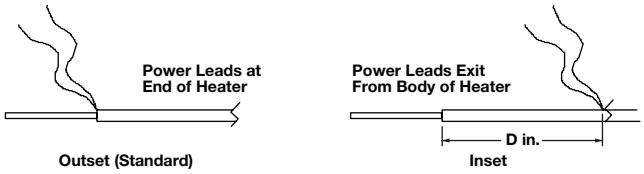
Typical FREEFLEX Layout



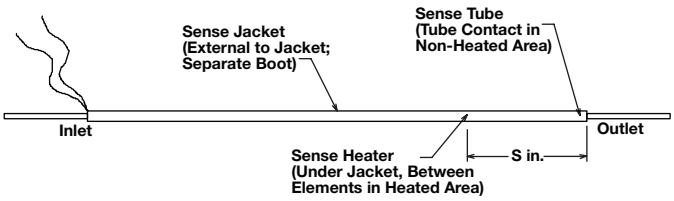
Lead Orientation



Lead Location



Sensor Location/Mounting Description



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1-800-WATLOW2 • www.watlow.com
inquiry@watlow.com

International Technical Sales Offices:

Austria	+43 6244 20129 0	**India**	+91 40 6661 2700	**Mexico**	+52 442 256 2200
China	+86 21 3532 8532	**Italy**	+39 02 458 8841	**Singapore**	+65 6773 9488
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