



UL 515A FIRE SPRINKLER FREEZE PROTECTION SYSTEM

INSTALLATION AND DESIGN GUIDE





UL 515A Fire Sprinkler Freeze Protection System

1 UL 515A FIRE SPRINKLER FREEZE PROTECTION SYSTEM COMPONENTS

A complete UL 515A fire sprinkler freeze protection system that is suitable for use with the following components:

1. Electric heat trace control panel
 - a. Ref. TCM2-FX
 - i. TCM2-FX is certified for fire suppression system supply piping and branch lines.
 - b. TCM2-FX alarm contacts must be connected to any fire detection alarm system monitoring
 - c. Please refer to the Installation, Start-Up, Operating and Maintenance Control Drawing- TCM2-FX Control Panel, PN80520, for detailed ratings and additional information..
 - i. Model: TCM2-1-M252/2R-240-I-P3-0-1-2
 - ii. Model: TCM2-1-M252/2R-240-I-PC3-0-1-2
2. Electric heat tracing cables
 - a. Ref. FLX Series Cables as listed below.
 - i. 3-FLX-1, 5-FLX-1, 8-FLX-1, 10-FLX-1
 - ii. 3-FLX-2, 5-FLX-2, 8-FLX-2, 10-FLX-2
 1. Refer to Thermon FLX Spec Sheet for power output
 - b. Electric Heat Tracing cables shall be installed on branch lines that have sprinkler heads.
 - i. Minimum allowable distance between the heat trace cable and sprinkler head fitting is 1 inch
 - c. Intended for use with Schedule 40 metal piping.
 - d. Minimum ambient temperature for trace heating cable installation -40°F (-40°C)
 - e. See Heat Trace Design Guide for methodology for determining heat loss of the system
 - i. Note: methodology for determining heat loss in guide is consistent with or more stringent than those described in IEEE 515 and 515.1
3. Power connection kit
4. Temperature sensors
 - a. Ref. RTD sensor
 - b. No less than 2 Temperature sensors shall be provided for each heating circuit.
 - i. The temperature sensor utilized for the High-Temperature Limiter shall be located near the sprinkler head of the longest, vertical upward projecting sprig (sprig up). Locate the Temperature sensor 180° from the heat trace cable.
5. Splice kit
6. Cable end and power termination seals
 - a. Ref. ET-6C, TBX-3LC
7. Attachment tape
 - a. 12" intervals or as required by code or specifications
8. Electric heat tracing label (Peel and Stick Label)
 - a. 10' intervals or as required by code or specification
9. Thermal insulation, sealed exterior non-combustible cover with metal cladding.
 - a. Insulation shall be properly oversized to compensate for additional spaced needed for heat trace

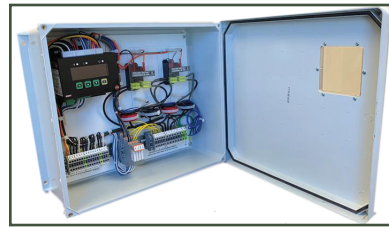


Figure 1: TCM2-FX panel

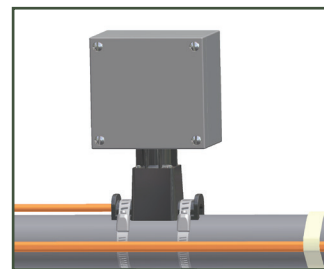


Figure 2: PCA Kit

2 INSULATION REQUIREMENTS

1. The thermal insulation used for the supply piping and branch lines shall be non-combustible and protected with a sealed exterior non-combustible cover that will maintain its integrity when exposed to water discharge.
2. Insulation to be installed in compliance with the requirements of NFPA 13 so that the thermal insulation over the trace heating does not unacceptably obstruct the sprinkler or cover the wrench boss.
3. For upright sprinklers:
 - a. Sprigs are typically 1 in. iron pipe size (IPS) with 0.5 in. thick thermal insulation. The insulation may be oversized to accommodate the heating cable installation, resulting in no greater than 3 in. outer diameter (for example, 1 in IPS sprig, insulated with 1.25 in IPS diameter, 0.5 in thick insulation, OD = 2.7 in.)
 - b. System installation details of upright sprinkler systems shall specify sprig height and/or arm over distance to overcome spray pattern obstruction. See IEEE Std 515.1 – 2022 Figure 14 for non-obstructing insulation design.
4. See chart for recommended minimum fiberglass insulation thickness to balance the heat loss of the system. Please contact Thermon regarding other insulation options available.

Insulation Thickness mm (in)	Pipe Size DN (NPS)	Low Ambient Temperature				
		-12°C (+10°F)	-18°C (0°F)	-23°C (-10°F)	-29°C (-20°F)	-40°C (-40°F)
13 (½)	15 (½")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	20 (¾")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	25 (1")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	32 (1¼")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	40 (1½")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	50 (2")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	65 (2½")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
25 (1)	80 (3")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	100 (4")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	150 (6")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	200 (8")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	250 (10")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	300 (12")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	350 (14")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
38 (1½)	≤ 25 (1")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	32 (1¼")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	40 (1½")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
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	65 (2½")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	80 (3")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	100 (4")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
50 (2)	150 (6")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	200 (8")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
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	300 (12")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	350 (14")	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX	One Pass 3-FLX
	≤ 25 (1")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX
	32 (1¼")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX
40 (1½")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	
50 (2")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	
65 (2½")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	
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300 (12")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	
350 (14")	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	One Pass 5-FLX	
≤ 25 (1")	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	
32 (1¼")	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	
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300 (12")	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	
350 (14")	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	One Pass 8-FLX	
≤ 25 (1")	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	
32 (1¼")	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	
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300 (12")	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	
350 (14")	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	One Pass 10-FLX	

- One Pass 3-FLX
- One Pass 5-FLX
- One Pass 8-FLX
- One Pass 10-FLX
- Contact Thermon



Figure 3: FLX heat trace cable

Notes

1. Intended for indoor use only.
2. Intended for supply piping and branch line including sprinkler heads.
3. The design and monitoring of trace heating systems for fire sprinkler systems shall be in accordance with IEEE 515.1
4. Minimum sprinkler temperature rating is 68°C. (155°F)
5. If back up power is being provided for the building electrical systems, it shall also provide backup power supply for the trace heating system.
6. All sprinkler systems that are provided with trace heat in shall be properly grounded.
7. Trace heating systems for fire sprinkler systems shall be permanently connected to the power supply.
8. Ambient temperature control is not required if each branch line has line sensing thermal control.
9. A line sensing electronic controller is necessary when ambient control is not applicable
10. Line sensing electronic controller is necessary to satisfy monitoring level requirements.



3 PRE-INSTALLATION

3.1 Upon receiving the trace heater

1. Verify that the correct type has been received.
 - a. Including the correct nominal power output and voltage level
 - i. All flexible trace heaters are printed with the catalogue number, voltage rating, and power output (in W/m or W/ft).
2. Visually inspect cable for any damage incurred during shipment.
3. Perform the Insulation Resistance (IR) test described in this document.
 - a. To confirm the trace heater's electrical integrity.
4. Store the trace heater in a dry location.

3.2 Before installing system

1. Be sure all piping and equipment to be traced have been completely installed and pressure tested.
2. Ensure that all surface areas where the trace heater is to be installed are reasonably clean
 - a. Remove any dirt, rust, and scale with a wire brush.
 - b. Remove oil and grease films with a suitable solvent.
3. De-energize power sources before installation.
4. Keep ends of trace heaters and kit components dry before and during installation

3.3 Insulation Resistance (IR) testing.

The Insulation Resistance (IR) test establishes the electrical integrity of the trace heater. The IR test should be performed with a megger capable of delivering a voltage of at least 500 Vdc. It is strongly recommended that polymeric insulated trace heaters should be tested at 2500 Vdc.

1. Prepare the conductors of the trace heater according to the instructions accompanying the power and end termination kit(s) provided with the system.
2. Connect the megger's positive lead to the cable's bus wires,
 - a. shorted together.
3. Connect the megger's negative lead to the metallic braid.
4. Set the megger test voltage to at least 500 Vdc.
5. Energize the megger for 60 seconds.
6. Readings of at least 20 MΩ are acceptable.
 - a. Readings below 20 MΩ usually indicate that the electrical insulation of the trace heater has been compromised.
 - i. Check the trace heater for signs of physical damage between the braid and the heating element. Small cuts or scuff marks on the outer jacket will not affect the megger reading unless there is penetration through the braid and dielectric insulation jacket.

4 INSTALLATION

4.1 Initial freeze protection trace heater installation

Trace heaters will be installed first. Then, additional splice, power, and temperature sensor kits will be installed.

1. Begin installing the trace heater at the proposed end-of-circuit location,
 - a. If provided, follow the guidance in the isometric system diagrams.
2. Lay out the trace heater on the pipe, at the 4 or 8 o'clock position, securing it tightly against the pipe with attachment tape. Wrap bands of tape around the trace heater and pipe at intervals of 12" (30 cm) or less, keeping the trace heater in close contact with the pipe.
3. If accessibility is a problem, the trace heater may be installed at the 10 or 2 o'clock position.
4. A continuous covering of aluminium foil tape may also be required under special circumstances, including:
 - a. Design requirements dictate the use of aluminium tape.
5. Allow extra length of trace heater for power connections, splices, and any in-line heat sinks, such as valves, flanges, and supports.
 - a. Trace heater installation along inline heat sinks are described in below section.
6. Install temperature sensors at least 90° away from trace heater locations.

CAUTION: Do not exceed the trace heater's specified minimum bend radius. Refer to product's specification sheets for the minimum bend radius of a specific trace heater type.

4.1.1 Installation of trace heater on elbows, pipe supports, and flanges.

1. Elbows
 - a. Locate the trace heater on the outside radius of the elbow. Secure the trace heater to the pipe with attachment tape on each side of the elbow.
2. Pipe supports.
 - a. For uninsulated pipe supports, allow twice the length of the support, plus an additional 40cm of trace heater. Install the trace heater in a loop. Insulated pipe supports do not require additional length of trace heater.
3. Flanges
 - a. Loop the trace heater around the pipe on each side of, and adjacent to, the flange. Be sure to keep the trace heater in close contact with the flange, throughout the length of the bend.

4.1.2 Installation of trace heater on valves and pumps

1. Valves, pumps, and other miscellaneous equipment require additional passes of trace heater to offset the increased heat loss that occurs at these sites.
2. Install the trace heaters using a looping technique. Allowing the valve or pump to be removed for required service and maintenance.
3. Keep the trace heater in close contact with the pipe and heat sink areas, to compensate, for additional heat loss.



4 INSTALLATION, continued

4.1.3 Installation of trace heater on branch line with sprinkler heads

1. Install the trace heater starting at the base of the branch line starting from the base of the branch line, traveling up the branch line, turning back and exiting at the base of the branch line.

4.2 Completing the trace heater installation

1. Secure the end of circuit termination kit and work back toward the power supply.
2. Keep the trace heater in secure contact with the pipe, using bands of attachment tape at least every 30 cm or as specified by relevant standards.
3. Secure any required temperature sensors to the pipe using attachment tape.
4. Complete any required splice connections in accordance with the installation instruction provided with the splice kit.
5. Install any power connection kits in accordance with the detailed installation instruction provided with the kit.
6. Connect the metallic shielding of the trace heater to a suitable earthing / ground terminal.
7. Before completing the power connections. Perform an Insulation Resistance (*IR) test.
 - a. The recorded values shall not be less than 20 MΩ.
8. Install any control panel in accordance with the detailed installation instruction provided with the panel.

4.2.1 Installing thermal insulation

Properly installed and well-maintained thermal insulation is critical, to the performance of the trace heating system. Without proper insulation, heat losses are generally too high to be offset by a conventional heat tracing system.

1. Properly insulate all heat sinks; including pipe supports, hangers, glandes, and in most cases, valve bonnets.
2. Install a protective vapor barrier over the insulation,
 - a. regardless of the type or thickness of insulation used, the vapor barrier protection protects the insulation from moisture intrusion and physical damage and ensures the proper performance of the trace heating system.
3. Seal all penetrations around the vapor barrier.

4.2.2 After installing thermal insulation

The presence of trace heaters shall be made evident by posting caution signs or marking at appropriate locations and/or at frequent intervals along the circuit.

1. Apply the provided peel and stick “electric heat tracing – caution” labels along the pipe, on the outermost surface of the thermal insulation or vapor barrier,
 - a. at intervals of 3m or less.
2. Apply the caution labels at any other appropriate location,
 - a. such as valves.

5 POST INSTALLATION

5.1 Final Inspection

1. After installing the thermal insulation and vapor barrier, but before energizing the circuit, repeat the IR test to verify that the trace heater has not been damaged during installation.
2. Ensure that all junction boxes, temperature controllers, cable glands, etc., are properly secured.
3. Force the circuit on and energize the circuit at the rated voltage.
4. After 5 minutes, measure the voltage, current, pipe temperature, and ambient temperature.
5. verify its settings to ensure that the maximum surface temperature does not exceed the system temperature rating.

6 TCM2-FX SETTINGS

To ensure the proper operation of the TCM2-FX system, please ensure that the settings below are set as such.

Settings	Circuit 1 (Ck1)	Circuit 2 (Ck2)
Maintain Temperature		38°C
Bandwidth (control Band)		4°C
High Temp trip		48°C
High temp alarm		43°C
Low temp alarm		2°C
Heater enables	Enabled	Enabled
Heater control	ON/OFF MEC	ON/OFF MEC
height temp trip	ON	ON
Alarm on	All Alarms	All Alarms
Alarm output NRM	ON	ON
Auto self-test	2Hr.	2Hr.



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