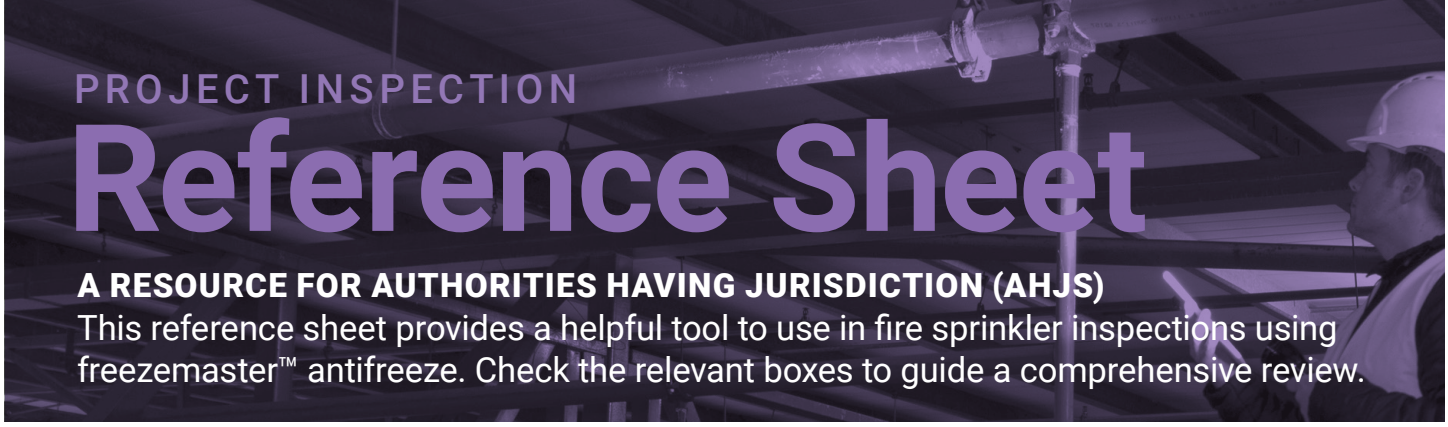

PROJECT INSPECTION

Reference Sheet

A RESOURCE FOR AUTHORITIES HAVING JURISDICTION (AHJS)

This reference sheet provides a helpful tool to use in fire sprinkler inspections using freezemaster™ antifreeze. Check the relevant boxes to guide a comprehensive review.

freezemaster™ antifreeze is UL listed factory premixed antifreeze designed for use in wet fire sprinkler systems. Meeting the requirements of UL 2901, it complies with all editions of NFPA 13, 13R, 13D, and 25. It is the only antifreeze listed for use in galvanized piping systems.

I. Where Can freezemaster™ Antifreeze Be Used?

A. TYPES OF PROJECTS

Listed and certified by Underwriters Laboratories (UL & C-UL) for use in:

☐ **Light hazard occupancies as defined in NFPA 13**

☐ **Residential occupancies**
- Up to four stories in height (NFPA 13R)
- One- and two-family dwellings and manufactured homes (NFPA 13D)

☐ **Ordinary hazard installations**
- Group 1: Combustibility of materials present is low and the quantity is moderate, with no stockpiles of combustible material exceeding 8 feet (2.4 meters). Fire would release moderate rates of heat
- Group 2: Spaces where the quantity and combustibility of contents are moderate to high, and which may have stockpiles of materials up to 12 feet high (3.7 meters) that could release moderate rates of heat release if ignited

☐ **Type of project**
- New construction
- Existing system maintance /refill
- Retrofit

B. ALLOWABLE TEMPERATURE RANGE

- Temperature range within -12°F (-24.4°C) and 150°F (65.6°C)
- Area subject to freezing temperatures or otherwise permitted by the AHJ

C. FIRE PERFORMANCE

- Fire protection system using freezemaster™ antifreeze conforms to local, state and NFPA requirements

D. COMPATIBILITY

Fire protection system made of any of the following materials (tested per UL 2901 for compatibility with freezemaster™antifreeze):
- Steel piping
- Galvanized steel piping
- Brass materials
- Stainless steel piping
- Black steel
- Copper
- Bronze
- Cast iron
- Fusion-bonded epoxy coated ductile iron
- CPVC
- PEX
- EPDM
- Butyl rubber
- Natural rubber
- Nitrile rubber (NBR)
- Styrene-butadiene rubber (SBR)

Important: freezemaster™ antifreeze is the only antifreeze listed for use with galvanized piping systems.

Note: freezemaster™ antifreeze is FBC™ System Compatible certified, which indicates this product has been tested and is monitored on an ongoing basis to ensure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® piping systems and products made with TempRite® Technology.

PROJECT INSPECTION

Reference Sheet

A RESOURCE FOR AUTHORITIES HAVING JURISDICTION (AHJS)

II. Typical Properties

- Appearance: blue liquid (see note)
- Freeze point: -15°F (-26.1°C)
- Pour point: -22.4°F (-30.2°C)
- Burst point: -58°F (-50°C)
- Refractive index and Specific Gravity: See Table A
- Viscosity: See Table B
- Density: See Table C
- pH: 7 – 8
- Conductivity: 4500 – 5500 µS/cm

Note: freezemaster™ antifreeze may become slightly discolored due to exposure to higher temperatures and sunlight. This does not affect its performance.

Table A

Acceptable Property Ranges of freezemaster™ Antifreeze for a Minimum Use Temperature: -12°F (-24.4°C)

Concentration of freezemaster™ Antifreeze %	Specific Gravity at 68°F (20°C)	Refractive Index at 68°F (20°C)
100	1.087 – 1.093	1.388 – 1.392

Table B

freezemaster™ Antifreeze Viscosity Across Temperature Ranges

Temperature °F (°C)	Viscosity, Centipoise
-12 (-24.4)	104
-10 (-23.3)	91
-5 (-20.6)	72
0 (-17.7)	55
5 (-15)	43
10 (-12.2)	36
15 (-9.4)	30
20 (-6.7)	25
25 (-3.9)	21
30 (-1.1)	19
35 (1.7)	16
40 (4.4)	13
45 (7.2)	11
50 (10)	9
55 (12.8)	8
60 (15.6)	7
68 (20)	6
150 (65.6)	2

Table C

freezemaster™ Antifreeze Density

Temperature °F (°C)	Density		
	lb/gal	kg/m³	lb/ft³*
-12 (-24.4)	9.3	1115.3	69.6
-10 (-23.3)	9.3	1114.6	69.6
-5 (-20.6)	9.3	1112.9	69.5
0 (-17.7)	9.3	1111.2	69.4
5 (-15)	9.3	1109.5	69.3
10 (-12.2)	9.2	1107.8	69.2
15 (-9.4)	9.2	1106.2	69.1
20 (-6.7)	9.2	1104.5	69
25 (-3.9)	9.2	1102.8	68.8
30 (-1.1)	9.2	1101.1	68.7
35 (1.7)	9.2	1099.4	68.6
40 (4.4)	9.2	1097.7	68.5
45 (7.2)	9.1	1096	68.4
50 (10)	9.1	1094.4	68.3
55 (12.8)	9.1	1092.7	68.2
60 (15.6)	9.1	1091	68.1
68 (20)	9.1	1088.3	67.9
104 (40)	9	1076.2	67.2
150 (65.6)	8.9	1060.6	66.2

Note: This column is used in the K-factor equation provided in the Hydraulic Calculations section.

PROJECT INSPECTION

Reference Sheet

A RESOURCE FOR AUTHORITIES HAVING JURISDICTION (AHJS)

III. Design Requirements

- Flow rates, pipe sizing, sprinkler spacing, hanging methods and system design conform with NPFA 13, 13R and 13D
- Not used in extra hazard occupancies
- While listed antifreezes have volume maximums, systems can be split into several unique systems as long as each system's volume does not exceed the volume limitation specified in the listing for that occupancy.

A. MAXIMUM VOLUME OF ANTIFREEZE IN SPRINKLER SYSTEM

NFPA 13D

- <500 gal, in accordance with NFPA design criteria

NFPA 13R

- <500 gal, in accordance with NFPA design criteria

Note: Where NPFA 13 design criteria is required, such as an attic, garages or clubhouses, use the applicable volume limitation for the hazard area for NFPA 13.

NFPA 13 – Light Hazard

- <200 gal, in accordance with NFPA design criteria

OR

- >200 gal to <500 gal using NPFA 13 dry system hydraulic criteria, where system hydraulics are designed as a dry system even though the system is filled with antifreeze

NFPA 13 – Ordinary Hazard Groups 1 & 2

- ≤40 gal; in accordance with NFPA 13 design criteria

OR

- >40 gal to ≤500 gal; in accordance with NFPA 13 using the dry system hydraulic design criteria, where the system hydraulics are designed as a dry system even

NFPA 13 – Storage

- <40 gal, in accordance with NFPA design criteria

Note: Section 5.3.4.4.1 of the 2023 Edition of NFPA 25 permits the use of a listed antifreeze outside of its listing as long as it meets the proper temperature specifications. Reference the section and the annex for more information.

B. HYDRAULIC CALCULATIONS

- Use of antifreeze solution limited to aboveground system piping, except for limited length of underground pipe that connect sections of the above-ground system.
- Design considers viscosity of antifreeze solution at the lowest anticipated temperature
- Friction loss determined using Hazen-Williams formula for water and Darcy-Weisbach formula to account for antifreeze solution fluid properties.
- K-factor of the sprinkler adjusted to account for density of antifreeze
- Flowing pressures based on a K-factor using the following formula:

$$K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$$

K_A = Sprinkler K-factor discharging the antifreeze solution

K_W = Sprinkler K-factor discharging water

γ_A = Density of the antifreeze solution at the temperature used for testing, lbs./ft3

For hydraulic designs based on dry system criteria

- Applicable design area increases applied, such as:
  - 30% increase for dry systems
  - 30% increase for sloped ceiling applications
- QR reduction in design area applied if QR sprinklers used
- Manufacturer's installation instructions used if systems designed using attic or concealed space sprinklers

C. MINIMUM DESIGN PRESSURE

- Pressure meets minimum required pressure for the sprinklers used
- While freezemaster antifreeze does not, note that some listed antifreezes have minimum operating pressure requirements of 20 psi at the furthest sprinkler head. Always reference the product's technical data sheet.

Reference Sheet

A RESOURCE FOR AUTHORITIES HAVING JURISDICTION (AHJS)

D. FLUID SAMPLING VALVE CONNECTION

- Riser installed in area not subject to freezing with minimum temperature of 40°F (4°C)
- Valve connection located at top of each system and provides easy access for contractors

E. FLUID CONTRACTION AND EXPANSION

- Expansion must be accounted for in the design to accommodate changes in fluid density caused by changes in temperature. (See Table D for expansion/ contraction at different temperatures.)
- An expansion tank is not required but is highly recommended by Lubrizol. Reference NFPA 13 for proper expansion tank installation guidelines and alternate methods to account for expansion.
- Vessel sizing based on anticipated operating conditions

Table D

freezemaster™ Antifreeze Approximate Fluid Expansion/ Contraction in Gallons (and Liters)

Initial Fluid Volume		Temperature Change															
		20°F (11.1°C)		40°F (22.2°C)		60°F (33.3°C)		80°F (44.4°C)		100°F (55.6°C)		120°F (66.7°C)		140°F (77.8°C)		160°F (88.9°C)	
		Approximate Fluid Expansion/Contraction in Gallons (and Litres)															
gal	(L)	gal	(L)	gal	(L)	gal	(L)	gal	(L)	gal	(L)	gal	(L)	gal	(L)	gal	(L)
25	(95)	0.2	(0.6)	0.3	(1.3)	0.5	(1.9)	0.7	(2.5)	0.8	(3.2)	1.0	(3.8)	1.2	(4.4)	1.3	(5.1)
50	(189)	0.3	(1.3)	0.7	(2.5)	1.0	(3.8)	1.3	(5.0)	1.7	(6.3)	2.0	(7.6)	2.3	(8.8)	2.7	(10.1)
75	(284)	0.5	(1.9)	1.0	(3.8)	1.5	(5.7)	2.0	(7.6)	2.5	(9.5)	3.0	(11.3)	3.5	(13.2)	4.0	(15.1)
100	(379)	0.7	(2.5)	1.3	(5.0)	2.0	(7.6)	2.7	(10.1)	3.3	(12.6)	4.0	(15.1)	4.7	(17.7)	5.3	(20.2)
150	(568)	1.0	(3.8)	2.0	(7.6)	3.0	(11.3)	4.0	(15.1)	5.0	(18.9)	6.0	(22.7)	7.0	(26.5)	8.0	(30.3)
200	(757)	1.3	(5.0)	2.7	(10.1)	4.0	(15.1)	5.3	(20.2)	6.7	(25.2)	8.0	(30.2)	9.3	(35.3)	10.7	(40.3)
250	(946)	1.7	(6.3)	3.3	(12.6)	5.0	(18.9)	6.7	(25.2)	8.3	(31.5)	10.0	(37.8)	11.7	(44.1)	13.3	(50.4)
300	(1136)	2.0	(7.6)	4.0	(15.1)	6.0	(22.7)	8.0	(30.3)	10.0	(37.8)	12.0	(45.4)	14.0	(53.0)	16.0	(60.5)

Table E

freezemaster™ Antifreeze Expansion

Tubing Size	Approximate Gallons of Fluid/100 ft			
	Steel Schedule 40 Pipe	PEX Tube	CPVC Pipe	Copper Pipe Type L
1/2 in.	–	1	–	1.5
3/4 in.	–	2	3.5	2.5
1 in.	4.5	3	5	4.5
1 1/4 in.	8	4.5	8	6.5
1 1/2 in.	11	6.5	10.5	9.5
2 in.	17.5	11	16.5	16.0
2 1/2 in.	25	–	24.0	25
3 in.	38.5	–	35.5	–
4 in.	66.5	–	–	–

Notes:

- Interpolation and extrapolation can be calculated for values outside temperatures and volumes listed in Table E.
- For examples on calculating fluid expansion and contraction, see the sections titled Expansion Example and Contraction Example, respectively.

PROJECT INSPECTION

Reference Sheet

A RESOURCE FOR AUTHORITIES HAVING JURISDICTION (AHJS)

IV. Installation

A. NEW SYSTEMS

- Installed with compatible materials listed above
- Backflow prevention is in accordance with state and local requirements
- System outfitted with air vent valves and fluid sampling valve connections as required by NFPA
- System airtight prior to introducing antifreeze to prevent leaks and spillage
- Pressure test performed with antifreeze in accordance with applicable NFPA standard
- For systems hydrostatically tested with water, system drained after the test in accordance with NFPA standards
- As much air purged from the system as possible
- Antifreeze tested to verify the specific gravity is within the ranges cited in Table A
- Antifreeze tested to ensure it has not been diluted

B. EXISTING SYSTEMS

- Sprinklers free of mechanical damage, corrosion or evidence of leaking
- Backflow prevention and cross connection control is in accordance with state and local requirements
- System airtight prior to introducing freezemaster™ antifreeze to prevent leaks and spillage
- Air vents present to reduce oxygen in system
- Antifreeze tested to verify the specific gravity is within the ranges cited in Table A
- Antifreeze tested to ensure it has not been diluted

C. SYSTEM TAG

- System tag present on an antifreeze system main valve identifying:
  - Type and manufacturer of the antifreeze solution used
  - Volume of antifreeze used
  - Percent concentration by volume

Note: With freezemaster™ antifreeze, the percent concentration by volume will be 100% because it is a premixed solution. A tag for inspection, testing and maintenance can also be hung at the system riser to record annual testing data. Tag design is available on freezemaster.com.

FOR MORE INFORMATION, VISIT FREEZEMASTER.COM

freezemaster™ ANTIFREEZE