

## LFP® Antifreeze+ Agency Listed Solution for Fire Sprinkler Systems

### General Description

LFP® Antifreeze+ is a pre-mixed freeze protection solution designed and listed for use in wet sprinkler systems. The solution is designed for systems subject to freezing temperatures that can cause damage to equipment or impede the proper function of the system. The solution is developed to meet the requirements of UL 2901 for compliance to the 2019 editions of NFPA 13, 13R, 13D, and the 2020 edition of NFPA 25.

LFP® Antifreeze+ remains in a liquid state at temperatures as low as -25°F (-31,7°C). Upon operation of the sprinklers during a fire event, the solution immediately discharges from the sprinklers and is followed by water from the water supply. Use of the solution in sprinkler systems eliminates the delivery delay times associated with dry pipe systems.

#### Allowable Temperature Range

Minimum use temperature:  
-25°F (-31,7°C)

Maximum use temperature:  
150°F (66°C)

#### Fire Performance

LFP® Antifreeze+ is tested for exposure to fire and fire fighting effectiveness.

#### Safe Handling Procedures

LFP® Antifreeze+ is formulated to reduce risks to humans and the environment. Wearing gloves and eye protection is best practice when handling LFP® Antifreeze+. For additional product information and Safety Data Sheet, refer to [www.tyco-fire.com](http://www.tyco-fire.com).

### Typical Properties

#### Appearance

Liquid, colorless

#### Freeze Point

-28.5°F (-33.6°C)

**Note:** Freeze point is the temperature at which crystallization begins.

#### Density

See Table E

#### pH

7-8

#### Conductivity

1200 to 1600 µS/cm

#### Refractive Index

See Table C

#### Specific Gravity

See Table C

#### Viscosity

See Table D, Graphs A and B

#### Pour Point

-28.8°F (-33.8°C)

### Technical Data

#### Approvals

UL and cUL Listed  
UL and cUL Certified  
FBC™ System Compatible

**Note:** FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® pipe and fittings. FBC™, FlowGuard Gold®, BlazeMaster® and Corzan® are licensed trademarks of The Lubrizol Corporation or its affiliates.



### Compatibility

The following materials are compatible with LFP® Antifreeze+:

- Steel piping (not galvanized)
- Brass materials
- Stainless steel piping
- Black steel
- Copper
- Bronze
- Cast iron
- CPVC
- PEX
- EPDM
- Natural rubber
- Nitrile rubber (BUNA-N)
- Styrene-butadiene rubber (SBR)
- Fusion bonded epoxy coated ductile iron
- Butyl rubber

#### NOTICE

For use with other materials, contact Technical Services.

#### IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

## Design Criteria

LFP® Antifreeze+ is a solution specifically tested and listed by UL for use within the strict parameters and requirements in this Technical Data Sheet.

All fire protection systems shall conform to state, local, and NFPA requirements if employing the use of LFP® Antifreeze+.

### Layout and Design

Flow rates, pipe sizing, sprinkler spacing, hanging methods, and system design must be in accordance with NFPA 13, 13R, and 13D. Fire sprinkler systems utilizing LFP® Antifreeze+ shall meet the system size limitations, as shown in Table F.

### NOTICE

*LFP® Antifreeze+ is not listed for use in protecting extra hazard occupancies, flammable liquids, or use with ESFR sprinklers.*

### Hydraulic Calculations

For all systems, the following requirements shall apply:

- The use of the antifreeze solution is limited to the aboveground system piping only except for a limited length of underground piping that connects sections of the aboveground system.
- The viscosity of the antifreeze solution at the lowest anticipated temperature of the system shall be considered in the hydraulic design. Where the system application temperature is between 0°F (-17.8°C) and -25°F (-31.7°C), the curves shown in Graphs A and B may be used to determine the value of viscosity.
- The friction loss shall be determined using the Hazen-Williams formula for water and the Darcy-Weisbach formula to account for the antifreeze solution fluid properties.
- The K-factor of the sprinkler shall be adjusted to account for the density of the antifreeze.

The flowing pressures are to be based upon a K-factor calculated using the following equation:

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

$K_A$  = sprinkler k-factor discharging the antifreeze solution

$K_W$  = sprinkler K-factor discharging water

$\gamma_A$  = density of the antifreeze solution at the temperature used for testing in lb/ft<sup>3</sup>

Where the use of antifreeze in accordance with the listing requires the hydraulic design to be based on the dry system hydraulic design criteria, the hydraulic calculations are to be performed in accordance with the applicable NFPA Standard dry system design even though the system is filled with antifreeze. The following guidelines show the dry system design criteria:

1. All applicable design area increases shall apply, such as:
  - 30 percent increase for dry systems.
  - 30 percent increase for sloped ceiling applications.
2. Where using QR sprinklers, the QR reduction in design area shall not apply.
3. Where a system is being designed using specific application attic or concealed space sprinklers, the dry system hydraulic design criteria in the manufacturers installation instructions shall be used.

The friction loss coefficient (c-factor or c values) for a wet system is permitted to be used for the dry system hydraulic calculation using antifreeze. It is not required to use the c-factor for the dry system.

**Note:** See Table E for density in lb/ft<sup>3</sup>.

### Minimum Design Pressure

For system design, a minimum operating pressure of 20 psi must be used at the most hydraulically remote sprinkler. This is an additional requirement for the hydraulic calculations. Also, the minimum operating pressure of the sprinklers must be at least the required pressure for the sprinklers used.

### Fluid Sampling Valve Connection

The riser must be installed in an area not subject to freezing with a minimum temperature of 40°F (4°C). A fluid sampling valve connection must be located at the top of each system riser. The sampling valves should be located for ease of access to the valve by contractors.

The sampling connection will facilitate implementing the service requirements outlined in the Care and Maintenance

section.

### Fluid Contraction and Expansion

Fluids expand and contract when exposed to changes in temperatures, resulting in changes in fluid density. Thermal expansion shall be taken into account when designing or retrofitting a sprinkler system that will use LFP® Antifreeze+ by use of an expansion tank. Table A shows the thermal expansion or contraction of the solution at different temperatures in sprinkler system volumes, using the equation for sizing the expansion chamber due to thermal expansion in NFPA 13.

These values and the NFPA 13, 13R, and 13D Standards for the Installation of Sprinkler Systems can be used by the installer to determine the proper expansion or contraction arrangement of a sprinkler system containing LFP® Antifreeze+.

### Expansion Example

A sprinkler system containing 50 gal (189 L) of LFP® Antifreeze+ is subjected to an environmental temperature of 0°F (-18°C) in the winter months and an increase of system temperature to 100°F (38°C) in the summer months, or a temperature change of 100°F (38°C). This results in fluid expansion of approximately 1.1 gal (4.2 L).

### Contraction Example

A sprinkler system containing 300 gal (1136 L) of LFP® Antifreeze+ is subjected to an environmental temperature of 70°F (21°C) with a later decrease in system temperature to -10°F (-23°C), or a temperature change of 80°F (27°C). This results in a fluid contraction of approximately 5.0 gal (18.9 L).

### Expansion Tank

Reference NFPA 13 for guidance on the addition of expansion tanks in new and existing systems. Vessel sizing should be based on the anticipated operating conditions the system will experience and the corresponding expansion values in Table A.

An expansion tank is highly recommended for all systems (including existing). Without an expansion tank there is potential for water to enter the system which can alter the performance of LFP® Antifreeze+.

Reference NFPA 13, System Requirements of Antifreeze Systems for alternate methods.

Initial Fluid Volume gal (L)	Temperature Change							
	20°F (-7°C)	40°F (4°C)	60°F (16°C)	80°F (27°C)	100°F (38°C)	120°F (49°C)	140°F (60°C)	160°F (71°C)
	Approximate Fluid Expansion/Contraction gal (L)							
25 (95)	0,1 (0,4)	0,2 (0,8)	0,3 (1,1)	0,4 (1,5)	0,5 (1,9)	0,6 (2,3)	0,7 (2,6)	0,9 (3,4)
50 (189)	0,2 (0,8)	0,4 (1,5)	0,6 (2,3)	0,8 (3,0)	1,1 (4,2)	1,3 (4,9)	1,5 (5,7)	1,7 (6,4)
75 (284)	0,3 (1,1)	0,6 (2,3)	0,9 (3,4)	1,3 (4,9)	1,6 (6,1)	1,9 (7,2)	2,2 (8,3)	2,6 (9,8)
100 (379)	0,4 (1,5)	0,8 (3,0)	1,3 (4,9)	1,7 (6,4)	2,1 (7,9)	2,5 (9,5)	3,0 (11,4)	3,4 (12,9)
150 (568)	0,6 (2,3)	1,3 (4,9)	1,9 (7,2)	2,5 (9,5)	3,2 (12,1)	3,8 (14,4)	4,5 (17,0)	5,1 (19,3)
200 (757)	0,8 (3,0)	1,7 (6,4)	2,5 (9,5)	3,4 (12,9)	4,2 (15,9)	5,1 (19,3)	6,0 (22,7)	6,8 (25,7)
250 (946)	1,0 (3,8)	2,1 (7,9)	3,1 (11,7)	4,2 (15,9)	5,3 (20,1)	6,4 (24,2)	7,5 (28,4)	8,6 (32,6)
300 (1136)	1,2 (4,5)	2,5 (9,5)	3,8 (14,4)	5,0 (18,9)	6,3 (23,8)	7,6 (28,8)	8,9 (33,7)	10,3 (39,0)

**NOTES**

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

**TABLE A**  
**LFP® 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**

- Values are approximate.

**TABLE B**  
**LFP® ANTIFREEZE+ PIPE FILL**

Concentration of LFP® Antifreeze+ %	Specific Gravity at 77°F (25°C)	Refractive Index at 77°F (25°C)
100	1.1465 to 1.1535	1.4065 to 1.4095

**TABLE C**  
**ACCEPTABLE PROPERTY RANGES OF LFP® ANTIFREEZE+ FOR MINIMUM USE TEMPERATURE -25°F (-31,7°C)**

Temperature °F (°C)	Viscosity Centipoise
-25 (-31,7)	335.9
38,5 (3,6)	19.6
70 (21,1)	8.9
117,9 (47,7)	4.1
150 (65,6)	3.0

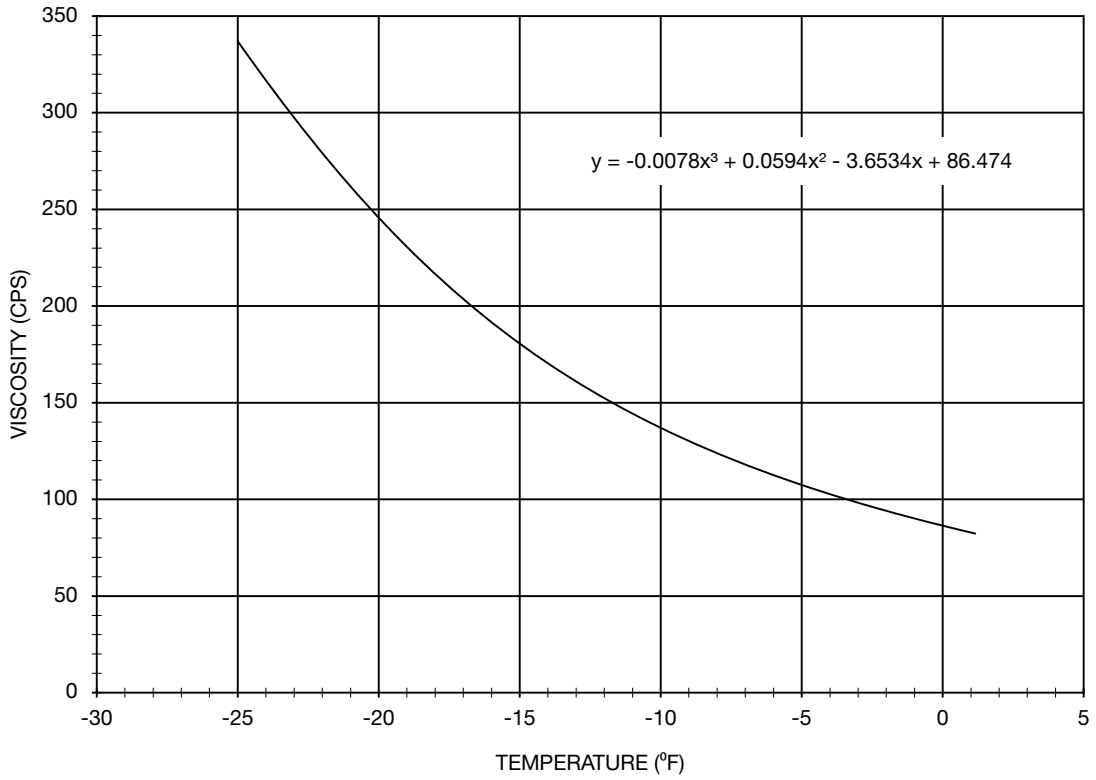
**TABLE D**  
**LFP® ANTIFREEZE+ VISCOSITY ACROSS TEMPERATURE RANGES**

Temperature °F (°C)	Density		
	lb/gal	kg/m <sup>3</sup>	lb/ft <sup>3</sup> *
-25 (-31,7)	9.76	1169.0	73.0
0.0 (-17,8)	9.71	1163.4	72.6
77 (25)	9.55	1144.2	71.4
150 (65,6)	9.42	1129.2	70.5

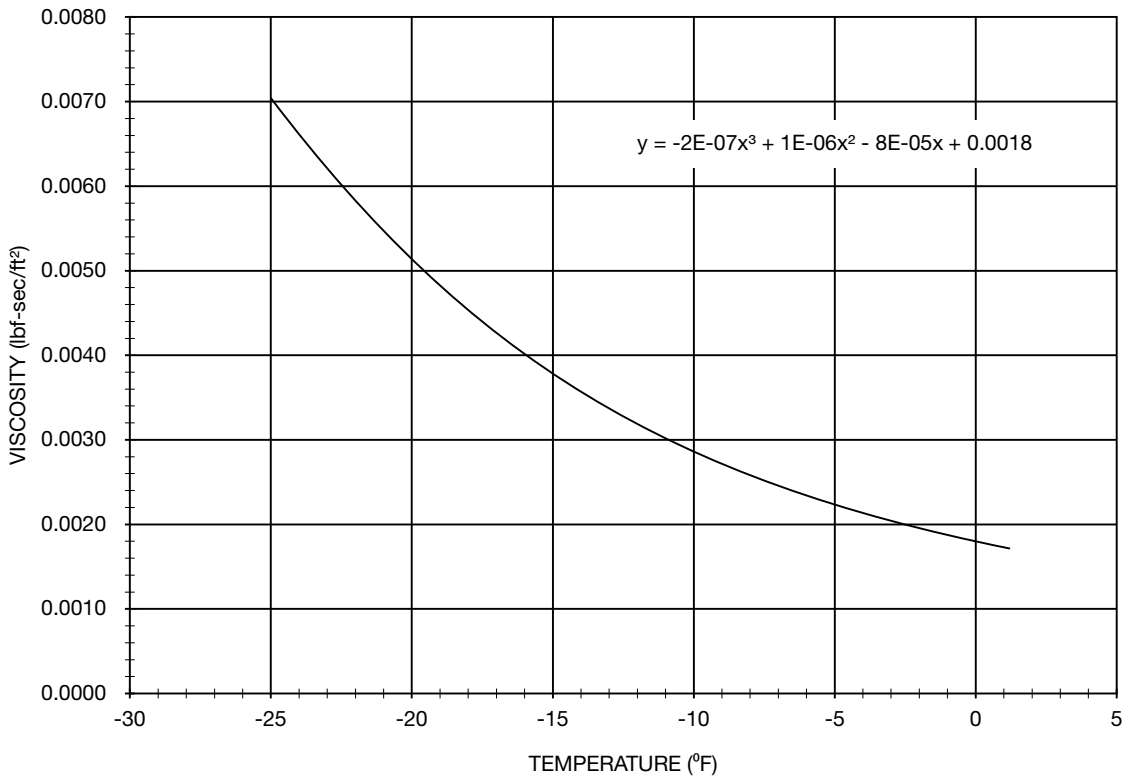
**NOTES**

- \* This column is used in the k-factor equation provided in the Hydraulic Calculations section.

**TABLE E**  
**LFP® ANTIFREEZE+ DENSITY**



**GRAPH A**  
**LFP® ANTIFREEZE+**  
**VISCOSITY (CPS) VS. TEMPERATURE (°F)**



**GRAPH B**  
**LFP® ANTIFREEZE+**  
**VISCOSITY (LBF-SEC/FT²) VS. TEMPERATURE (°F)**

Temperature Range	Application	Maximum Volume of Antifreeze in Sprinkler System
-25°F to 150°F (-32°C to 66°C)	NFPA 13D*	≤500 gal; in accordance with NFPA 13D design criteria
	NFPA 13R – Residential Only (including corridors, garages that serve only a single dwelling unit, and compartmented Ordinary Hazard areas ≤500 sq ft)*  <b>Note:</b> Where NFPA 13R requires the use of NFPA 13 design criteria, refer to the NFPA 13 applications and volume limitations.	≤500 gal; in accordance with NFPA 13R design criteria  <b>Note:</b> Where NFPA 13 design criteria is required in areas of an NFPA 13R Occupancy, such as an attic, common and large garages, or a clubhouse; use the applicable volume limitation for the hazard area for NFPA 13.
	NFPA 13 - Light Hazard*	≤200 gal; in accordance with NFPA 13 design criteria  or  >200 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 though the system is filled with antifreeze
	NFPA 13 - Ordinary Hazard Groups 1 & 2*	40 gal; in accordance with NFPA 13 design criteria
	NFPA 13 – Storage*	40 gal; in accordance with NFPA 13 design criteria

**NOTES**

\*The antifreeze solution is intended to be installed in accordance with the manufacturer's instructions. The use of the antifreeze solution is limited to the above ground system piping only, except for a limited length of underground piping that connects sections of the above ground system. The viscosity of the antifreeze solution at use temperatures shall be considered in the hydraulic design for all systems using antifreeze. For systems greater than 40 gal (151 L), pipe sizing shall be determined using both the Darcy-Weisbach and Hazen-Williams approved hydraulic calculations. Because of the density of antifreeze, the K-factor shall be adjusted and the friction loss shall be considered in the system design.

**TABLE F**  
**LFP® ANTIFREEZE+ LISTINGS LIMITATIONS**

## Installation

**NOTICE**

*LFP® Antifreeze+ is pre-mixed at the factory per NFPA 13, 13R, 13D. Do not dilute LFP® Antifreeze+ with water. Diluting with water or other constituents in the field can adversely impact the properties and performance of the solution. The functional life of the solution may be impacted by the end use environmental conditions. It is recommended to only use antifreeze in closed systems as oxygen can contribute to an increased rate of corrosion.*

**New Systems**

Use the following guidelines when preparing a new sprinkler system for LFP® Antifreeze+ installation:

1. The system shall be installed with materials as indicated in the compatibility list.
2. Verify the required backflow prevention and cross connection control is in accordance with state and local requirements.
3. The system shall be outfitted with air vent valve(s) and fluid sampling valve connections as required by the applicable NFPA standard.
4. The system should be determined to be airtight prior to introducing LFP® Antifreeze into the system to prevent loss or spillage of product.

5. A pressure test shall be conducted in accordance with the applicable NFPA standard. This pressure test may be performed with water or LFP® Antifreeze. It is recommended that systems with drops be tested with LFP® Antifreeze to prevent the accumulation of water in the drops.
6. For systems hydrostatically tested with water, the system must be drained after the test in accordance with the applicable NFPA standard.

**NOTICE**

*Storing or carrying the antifreeze solution in any container other than the original may introduce contaminants and reduce the functional life of the solution.*

7. It is recommended that prior to filling the system with LFP® Antifreeze, the antifreeze is tested to verify that the specific gravity or refractive index is within the ranges specified in Table C. If the antifreeze solution is from a new, unopened factory container, this test verification is not required. If the solution is discolored or the container has dirt present, contact Customer Services.
8. Fill the system with LFP® Antifreeze+. The use of a pump with a backflow preventer and pressure capabilities to get the sys-

tem to the supply pressure is recommended. For LFP® Antifreeze+ to work correctly, purge as much air as possible from the system. Accelerated corrosion may occur where air pockets exist in the system.

9. After filling the system with LFP® Antifreeze+, test the system to verify the solution has not been diluted. Take samples of the solution from a high and low point in the system. The test results from the samples shall be the same before and after installation for the installation to be successful.

**Existing Systems**

Use the following guidelines when preparing an existing sprinkler system for LFP® Antifreeze+ installation:

1. Inspect all sprinklers for mechanical damage, corrosion, and evidence of leakage. If any of these conditions are present, replace the sprinkler per NFPA 25.
2. Verify the required backflow prevention and cross connection control is in accordance with state and local requirements.
3. The system should be air-tight to prevent leakage. Air vents are recommended to reduce the oxygen in the system.

4. Drain the existing antifreeze from the system in accordance with NFPA 25.
5. It is recommended that prior to filling the system with LFP® Antifreeze, the antifreeze is tested to verify that the specific gravity or refractive index is within the ranges specified in Table C. If the antifreeze solution is from a new, unopened factory container, this test verification is not required. If the solution is discolored or the container has dirt present, contact Customer Services.

#### **NOTICE**

*Storing or carrying the antifreeze solution in any container other than the original may introduce contaminants and reduce the functional life of the solution.*

6. Fill the system with LFP® Antifreeze. Avoid the use of contaminated hoses and equipment that have come into contact with fluids other than LFP® Antifreeze or water. The use of a pump with a back-flow preventer and pressure capabilities to get the system to the supply pressure is recommended. For LFP® Antifreeze to work correctly, purge as much air as possible from the system. Accelerated corrosion may occur where air pockets exist in the system.
7. After filling the system with LFP® Antifreeze, test the system to verify the solution has not been diluted by measuring the specific gravity or refractive index. Take samples of the solution from a high and low point in the system.
8. If the specific gravity or refractive index is not within the allowable range, drain the system and repeat the steps or add LFP® Antifreeze to displace the non-compliant antifreeze and achieve the required purity. Repeat the required tests to verify the specific gravity or refractive index is within the acceptable range. Repeat this process until the specific gravity or refractive index is within the acceptable range.

#### **System Tag**

A system tag must be present on an antifreeze system main valve identifying the following:

- Type and manufacturer of the antifreeze solution used
- Volume of antifreeze used
- Percent concentration by volume of antifreeze used

If using LFP® Antifreeze+, the percent concentration by volume would be 100% since it is a pre-mixed solu-

tion. 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 [www.tyco-fire.com](http://www.tyco-fire.com).

#### **Storage**

Store the product in original container and at a temperature between 40°F (4,4°C) minimum and 90°F (32,2°C) maximum. Do not mix the product with other liquids. Eye and hand protection are recommended when handling the antifreeze solution.

## **Care and Maintenance**

The sprinkler system owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable NFPA standards, in addition to the standards of any authority having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

It is recommended that automatic sprinkler antifreeze systems be inspected, tested, and maintained by a qualified inspection, testing, and maintenance service.

#### **Fluid Test**

At least once a year, an inspection, testing, and maintenance service shall take a measurement of the specific gravity or refractive index of the fluid in the LFP® Antifreeze+ system. The fluid must be replaced if either property deviates from that originally supplied within the allowed tolerance, as specified in Table C.

A detailed description of an appropriate hydrometer or refractometer can be found in the sections titled Using a Hydrometer and Using a Refractometer, respectively. A recommended hydrometer, refractometer and accessories are available for purchase, as listed in the Ordering Procedure section.

It is required to have test equipment calibrated annually to reduce the risk of incorrect test results. Two test methods are acceptable per NFPA 25, and either may be used to verify that the antifreeze is within the specification limits.

#### **Using a Hydrometer**

1. Ensure that your hydrometer measures specific gravity. The range of specific gravity measurements should cover the acceptable specific gravity range listed in Table C and the hydrometer should have increments of at most 0.002.

2. Ensure the main supply valve is closed prior to taking a sample to test. If the valve is open, supply water will be pulled into the system when the first sample is removed from the system. Test separate samples from the top of each system and at the bottom of each system, or otherwise required by applicable NFPA standards. If the most remote portion of the system or the interface with the wet pipe system is not near the top or the bottom of the system, additional samples must be checked.

3. Discharge a 1/2 gal (2 L) of fluid from the fluid sampling valve connection. Collect and seal the sample in a clean and dry 3/4 gal (3 L) or larger container. Allow the sample to warm until it reaches the minimum temperature in Table C.

4. Once the solution reaches the minimum temperature, fill the 500 ml calibrated cylinder with the solution and gently insert the hydrometer into the cylinder to allow it to float. Fluid may be added to the cylinder until the hydrometer is floating. Note the specific gravity as shown on the hydrometer. Check the temperature using an appropriate thermometer.

5. Verify the specific gravity falls within the acceptable range listed in Table C. If the test results for all the samples are within the acceptable ranges, the inspection is complete.

6. If the test results from any of the samples fall outside of the acceptable ranges, drain out the system, and pump in new LFP® Antifreeze+. Take samples and test again. If the samples continue to fall outside of the acceptable specifications, then the system shall be emptied and vacuumed clean of any remaining fluid. Recharge the system per the Existing Systems section of the Installation section. If the samples fall within the acceptable range, top off the system to replace the liquid removed for the samples.

#### **Using a Refractometer**

1. Ensure that your refractometer is temperature compensating and that it measures refractive index. The range of refractive index measurements should cover the acceptable refractive index range listed in Table C and the refractometer should have increments of at most 0.0001.

2. Ensure the main supply valve is closed prior to taking a sample to test. If the valve is open, supply water will be pulled into the system when the first sample is removed

from the system. Test separate samples from the top of each system and at the bottom of each system, or otherwise required by applicable NFPA standards. If the most remote portion of the system or the interface with the wet pipe system is not near the top or the bottom of the system, additional samples must be checked.

3. Discharge a 1/2 gal (2 L) of fluid from the fluid sampling valve connection. Collect and seal the sample in a clean and dry 3/4 gal (3 L) or larger container.
4. To measure the refractive index, use a digital refractometer that is temperature compensating. Fill the well in the refractometer with solution and shut the cover. Note the refractive index as shown on the refractometer.
5. Verify the refractive index falls within the acceptable range listed in Table C. If the test results for all the samples are within the acceptable ranges, the inspection is complete.
6. If the test results from any of the samples fall outside of the acceptable ranges, drain out the system, and pump in new LFP® Antifreeze+. Take samples and test again. If the samples continue to fall outside of the acceptable specifications, then the system shall be emptied and vacuumed clean of any remaining fluid. Recharge the system per the Existing Systems section of the Installation section. If the samples fall within the acceptable range, top off the system to replace the liquid removed for the samples.

#### **NOTICE**

*Contaminants or other foreign materials within a sprinkler system may adversely impact the properties and performance of LFP® Antifreeze+. See the Installation section for instructions on flushing and recharging the system if the solution falls outside of the acceptable range since the last inspection.*

#### **NOTICE**

*Use of LFP® Antifreeze+ shall be in conformance with all state and local health and environmental regulations for the location where it is installed. If a small amount of antifreeze solution is spilled, absorbent towels are recommended to clean up spill. Towels used to clean up spill can be disposed of in the garbage. Use caution following a spill as the floor may remain slippery in the area of the spill. Consult with a local waste water treatment plant or council for information on procedures to follow for the disposal of large amounts of waste water.*

#### **Disposal**

Any disposal of LFP® Antifreeze+ shall be in conformance with all federal, state, and local waste regulations. Refer to the LFP® Antifreeze+ Safety Data Sheet for more details.

## **Limited Warranty**

For warranty terms and conditions, visit [www.tyco-fire.com](http://www.tyco-fire.com).

# Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

## LFP® Antifreeze+

Specify: LFP® Antifreeze+, (specify net contents), P/N (specify):

Pallet of 5 gal (19 L) pails,  
36 per pallet . . . . . 54033  
Pallet of 30 gal (114 L) drums,  
5 per pallet . . . . . 54034

**Note:** *Minimum order quantity is 1 pallet of 36 pails or 5 drums. Smaller quantities may be purchased through a Johnson Controls authorized distributor.*

## Testing Instruments

Recommended instruments for testing LFP® Antifreeze+ for installation or maintenance can be purchased through FISHER SCIENTIFIC, using the following part numbers:

Hydrometer . . . . . 13202421  
Graduated Cylinder . . . . . 115822  
Thermometer . . . . . 13201647  
Refractometer . . . . . 12561346