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## IceFree™ Anti-Freeze Gel Installation Instructions

### General Description

IceFree™ Anti-Freeze Gel is a specialty, non-freezing gel which is pumped into conduits (around cable) to prevent water ingress and subsequent ice formation. This system protects fiber optic cable from the crushing force of ice expansion when cable is exposed to below freezing temperatures.

IceFree™ is a thick gel with a similar consistency to jell-o gelatin. The high viscosity gel requires special pumping and installation procedures. Please review the following instructions before installing product.

### Material and Equipment Requirements

#### **IceFree™ Antifreeze Gel**

Use the IceFree™ Quantity Calculator to determine the amount needed for the installation.

[http://www.polywater.com/calculators/icefree\\_fill.asp](http://www.polywater.com/calculators/icefree_fill.asp)

#### **IceFree™ Chemical Duct Block (WB-8, WB-86) or Polywater® FST Foam Duct Sealant (FST-250KIT)**

Available from American Polywater Corporation.

#### **IceFree™ Hose Insertion Kit (WH-1)**

The kit creates a quick-connect hose between the pump and gel delivery hose for use with the IceFree™ Chemical Duct Block. Available from American Polywater Corporation.

#### **High-Pressure Grease Pump**

A standard pneumatic grease pump with 50-1 ratio is recommended. Pump must be able to develop 5000 to 7500 psi. ARO and Lincoln manufacture pumps that have worked in the past.

#### **High-Volume Air Compressor (Minimum 180 cfm rating)**

The compressor is used to power the high pressure grease pump. Larger air compressor will increase flow rate.

#### **High-Pressure Hose (Minimum 2500 psi rating)**

Hose should be hard-jacketed 3/8-inch or greater in diameter. Large hoses allow more flow, pumping faster and further. The maximum distance a 3/8-inch hose can pump is about 150 feet.

#### **Follower Plate**

The follower plate, is sourced with grease pump, and sized for either the 55-gallon drum or 5-gallon pail.

## **Innerduct Access**

Access to the site and innerduct may be the most difficult part of the installation. Innerduct access may require cutting into the steel or fiberglass conduit under the bridge, digging to expose innerduct buried in ballast, or from access boxes or manholes. It may be necessary to hang a basket on a boom truck over the bridge railing to get at conduit on the side of or underneath the bridge.

Once the innerduct is accessed, a port is carefully cut into the wall of the innerduct, using caution to avoid damaging existing cable. The minimum hole size is 1 by 6 inches.

## **Pump Set-Up**

Set up pump according to manufacturer instructions. The follower plate is placed on top of the IceFree™ Gel. Use of a follower plate prevents air pocket formation, eliminates cavitations, and scrapes the side of the container for complete removal and usage of the IceFree™ Antifreeze Gel.

## **Determine Pumping Rate**

Mark the installation hose with bright spray paint every 10 feet. This will help during the installation of the IceFree™ Gel.

Before installing the hose, the flow rate of the IceFree™ Gel must be determined, based on the specific pump used in the installation, hose diameter, and length. Measure the time it takes to fill a 1 gallon pail in seconds to calculate innerduct fill rate later. Test the rate two or three times for accuracy. The IceFree™ Gel used in this testing can be placed back into the container for reuse.

## **Blocking the Innerduct**

Prevent IceFree™ Gel from slowly migrating, or from exposure to water pressure by blocking the innerduct ends. Blockage can occur with a chemical or mechanical duct plug.

American Polywater manufactures two chemical duct plugs: Type FST Foam Sealant (FST-250KIT) for use at the exposed end of ducts, and IceFree™ Chemical Duct Block Type WB (WB-8, WB-86) for placement inside an inaccessible innerduct. It is possible to pump the IceFree™ Chemical Duct Block through the insertion hose.

Location and timing of plugging will be determined by actual field situations. If pumping from a manhole or vault, leave about two feet of space for Type FST Foam Sealant as you are inserting the Gel. Clean the innerduct and then follow instructions for the Foam Sealant.

If pumping through a bridge wall or to insert gel to an inaccessible point beyond the frost line, use the IceFree™ Chemical Duct Block Type WB to create a re-enterable plug inside the innerduct. See IceFree™ Chemical Duct Block instructions (Attachment 1).

**Hose Insertion**

A pulling rope and cable pulling lubricant may be needed to help install the hose. Polywater® F or J Lubricant is recommended. Maximum pumping distances for the 5/16-inch hose is about 175 feet.

Push the insertion hose into the innerduct the desired distance. It is very difficult to insert a hose into blocked, breached or crushed innerducts. If there are problems installing the insertion hose, additional innerduct ports may be required.

If the installation is being done during winter, ice may be causing the blockage and a steam hose can be used to help melt the ice and break up ice blockages. Insert the steam hose between the innerduct and the conduit; do not apply steam directly to a cable. Use the insertion hose in the innerduct to help break up the ice.

**Injecting IceFree™ Gel**

Determine the time it will take to fill 10 feet of innerduct, using the pumping rate determined earlier and by calculating the volume of gel required to fill that 10 feet of innerduct.

The general volume calculation follows:

$$\text{Gallons} = \frac{\left(\frac{ID}{2}\right)^2 \pi \ell - \left(\frac{OD}{2}\right)^2 \pi \ell}{231 \text{ cubic inches/gallon}}$$

Where: = *ID* = Inside Diameter of Innerduct in Inches  
           = *ℓ* = Length in Inches  
           = *OD* = Outside Diameter of Cable in Inches

The same formula solved for 10 feet of innerduct,

$$\text{Gallons per 10 Feet Innerduct} = 1.63 \left[ \left(\frac{ID}{2}\right)^2 - \left(\frac{OD}{2}\right)^2 \right]$$

**Gallons Per 10 feet**

Duct Size	Cable Size			
	1/2"	5/8"	3/4"	1"
1"	0.3	0.3	0.2	NA
1 1/4"	0.5	0.5	0.4	0.3
2"	1.5	1.5	1.4	1.2
3"	3.6	3.5	3.4	3.3
4"	6.4	6.4	6.3	6.1

To determine the time it will take to fill 10 feet of innerduct:

$$\text{Fill Time for 10 feet of Innerduct, Minutes} = \frac{\text{Innerduct Volume, Gallons}}{\text{Pumping Rate, Gallons per Minute}}$$

Begin pumping the IceFree™ Gel into the innerduct. Keep time and continuously pull out the installation hose as the conduit is filled. Do this in increments of 5 feet or less. You should feel the hose get easier to pull as the hose is coming out of the gel. If the hose gets stuck, stop pumping and free the hose before continuing. Most crews will clean the hose with a dry rag and roll it onto the hose reel as it exits the innerduct. As the hose is get closer to the end, it should push itself out. Leave two to three feet of the duct end unfilled to allow room for the duct block. Both ends of the installation must be blocked.

Note: If there is water in the innerduct, the IceFree™ Gel will displace it. The displaced water may collect in an enclosed area and may need to be removed or diverted.

### **Sealing the Innerduct**

After the IceFree™ Gel is inserted and the hose removed, the innerduct should be resealed. This is commonly done by splitting a piece of innerduct (next diameter size larger works easiest) and putting it over the port. If the IceFree™ Gel access point is at a manhole or access box, use a mechanical or Type FST Foam Duct Seal.

## IceFree™ Chemical Duct Block Instructions

Use IceFree™ Chemical Duct Block when the conduit ends are inaccessible.

- (1) Each IceFree™ Hose Insertion Kit (WH-1) consists of the following:
  - 3 \* 1/2-inch ID hoses (length 48 inches) with 1/2-inch male connectors installed
  - 3 \* 1/2-inch male-to-male short nipples
  - 3 \* 1/2-inch female-to-female couplers
  - 2 \* 1/2-inch straight-through couplers(female)
  - 1 \* Pressure relief tee and valve assembly
  - 1 \* Roll Teflon® tape

Use these components to make an easily accessible quick-connect hose between the pump and the gel delivery hose, which may be replaced after loading with IceFree™ Chemical Duct Block. Use a male nipple on each end of the insertion hose to avoid losing the o-ring gasket on the female coupler when cleaning the hose.

- (2) After inserting gel delivery hose to proper location, mix one bottle of IceFree™ Chemical Duct Block. Add Part B—liquid to Part A—powder. Put cap on and shake for 15 seconds, until well mixed. The mixture will become very liquid.
- (3) Take spare insertion hose with quick-connects attached and slide neck of bottle over male quick-connect nipple.
- (4) Squeeze bottle while holding slightly elevated; keep close eye on to other end of hose to see when IceFree™ Chemical Duct Block reaches other end.
- (5) When IceFree™ Block reaches other end, put thumb over to prevent escape, but allow air to escape as needed. Squeeze entire bottle into hose until hose is full or bottle is empty.
- (6) Taking care not to spill any IceFree™ Block from hose, quick connect into delivery system between pump and gel delivery hose. Also, connect pressure relief valve assembly between pump and insertion hose.
- (7) Begin pumping as usual.
- (8) When done pumping, open pressure relief valve so it is easy to disconnect Duct Block Hose.
- (9) Clean spare hose to be ready for next use. Keep free of dirt and contaminants.

**(Instructions for “Duct Block Mixing at High Temperatures” Follows)**

<b>Conduit Size</b>	<b>Number IceFree™ Block</b>
<2 inches / 50 mm	1 WB-8
3 inches / 37.5 mm	2 WB-8
4 inches / 100 mm	4 WB-8

## **Duct Block Mixing at High Temperatures**

Field reports have indicated accelerated setup of IceFree™ Duct Block during warm weather. Laboratory tests at 120°F have confirmed this problem.

At 120°F the duct block sets up in less than 30 seconds. This rapid setup causes problems for field personnel because they do not have sufficient time to transfer the duct block to the insertion hose.

The following is recommended:

- (1) In warm weather, store the duct block in an ice cooler during the day.
- (2) Don't mix the duct block until insertion hose is ready to be filled. Be quick when transferring.