# Winterization Instructions

Around the world most soiling occurs in the spring, summer, and early fall. However, some may still want to measure soiling or irradiance in the winter months. The Wash Extension utilizes distilled or filtered water to wash the "clean" reference cell on the ARES device, but that water can freeze in the right conditions. In locations that are constantly below freezing temperatures, the Wash Extension must be winterized. There are two options to winterize the Wash Extension:

## Option 1: Add a Propylene Glycol (PG) mixture to the Wash Extension reservoir

To enable automatic cleaning of the ARES reference cell in freezing environments, an anti-freeze solution can be added to the Wash Extension reservoir. Fracsun applies a hydrophobic coating to ARES' clean reference cell, so the solution will not stick to the surface if the array is properly tilted.

Fracsun recommends using a solution of distilled water and DOWFROST propylene glycol-based heat transfer fluid. A solution by volume chart can be viewed below. For example, if the lowest freezing temperature of the location is 11 degrees F, a 1:3 mixture of PG:Water is recommended (25%).

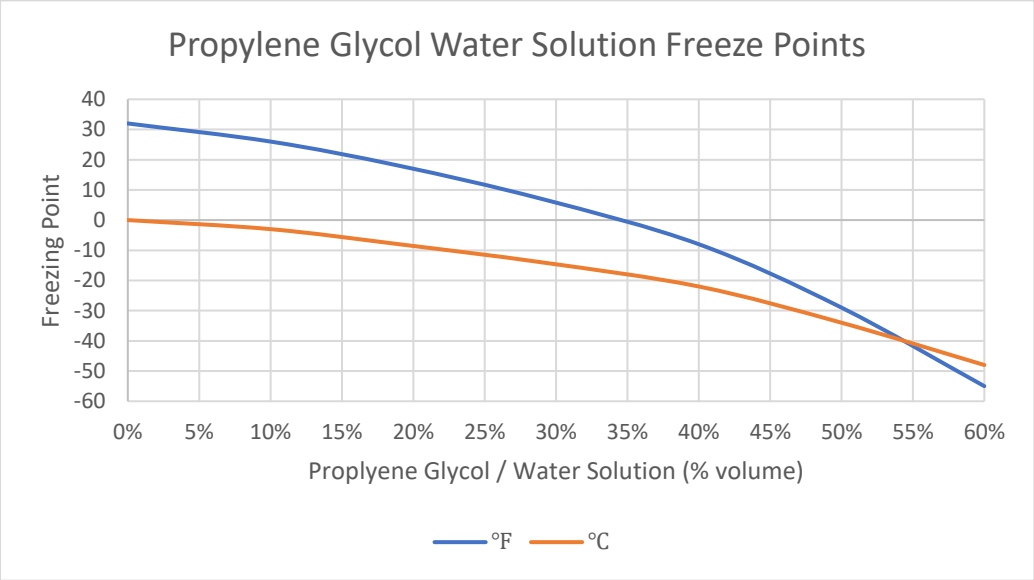
### Mixture and volume

The entire reservoir does not have to be filled to get through the winter. Start with approximately 4 – 8 gallons of the solution, depending on the length of the winter. The default wash duration is 5 seconds, which uses approximately 5oz of solution per spray.

Mix the solution well and run the pump so that the PG solution is in the pump head and flex tubing lines.

### Maximum solution

A 33% solution serves as a practical maximum, considering the rarity of temperatures dropping below 10°F. Omitting an auto-wash on the coldest days of the year is deemed acceptable from a data integrity perspective.



### Upon completion of winter

When the freezing period is over, purge the PG mixture from the reservoir. More details about purging the system can be found below in the section titled “Purge the Wash Extension”.

## Option 2: Manually clean the reference cell on a schedule and purge all water from system

### Purge the Wash Extension

Any residual water left in the pump or lines can freeze. The most important component to purge is the pump head.

- Disconnect the *inlet* side of the water pump in the Wash Extension and press the “CLN NOW” button on the Wash Extension to purge all water from the lines and pump-head. Leave the inlet side disconnected until the last freeze.
- On newer Wash Extension units, the Fracsun team can *remotely* purge the Wash Extension by running the pump until the reservoir is empty. Please reach out to our team for this option.

### Manually cleaning ARES

Use a clean damp microfiber towel to gently wipe away any soiling on the **clean reference cell only**. Do not forcefully scrub the glass, as this repeated practice will lead to scratches. When possible, dampen the microfiber towel with distilled or filtered water and dry with a second clean towel.


If a tougher cleaning agent is required, detergents intended for solar glass (plus filtered water) may be used to clean the cell.

Be careful when performing scheduled cleanings on tracking systems when the clean cell is above the soiled cell. Residual water can flow downward onto the soiled cell.

**Do not clean or touch the “soiled” reference cell at any time unless instructed to do so.**

### Add a routine cleaning schedule to your winter O&M plan

Manually cleaning ARES takes less than 1 minute to perform and should be added to your winter O&M schedule. When manually wiping down the “clean” reference cell, data granularity is determined by the frequency of cleanings.

- **Once per week** or **once every 2 weeks** are acceptable manual cleaning frequencies
- **Once per day** in the morning (or evening) is the absolute best scenario, but is often impossible at unmanned plants.

Random cleanings not based on a schedule are not recommended but can be used to get a single datapoint.