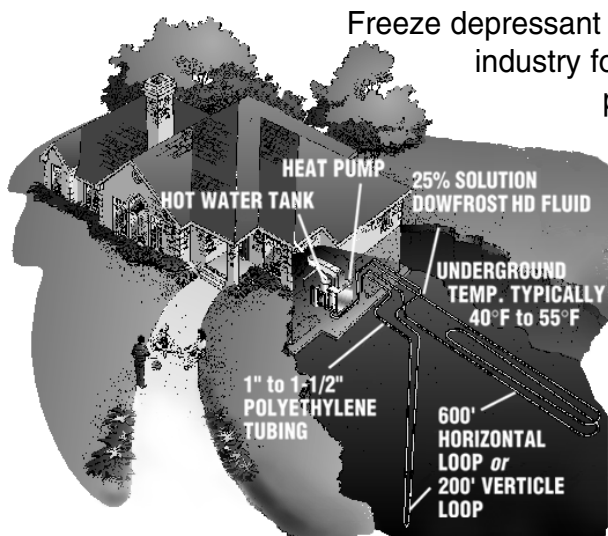




# DOWFROST HD Heat Transfer Fluid

## For Use in Ground Source Heat Pumps



Typical Ground Source Heat Pump System

Freeze depressant fluids (antifreezes) have been widely used in the HVAC industry for many years. As HVAC applications have diversified, performance requirements for heat transfer fluids have become more specific. This guide discusses key performance criteria that should be considered when selecting fluids for use in ground source heat pump (GSHP) applications, and examines the performance of DOWFROST\* HD industrially inhibited propylene glycol versus those criteria.

The GSHP industry recognizes the need for an antifreeze or freeze depressant in most installations, however, industry standards for fluid performance in ground source heat pump applications do not currently exist. Historically, fluid decisions have been based on three performance considerations: antifreeze/freeze point depressant capability, heat transfer efficiency, and initial cost to fill the system.

Over the many years Dow has been supplying heat transfer fluids to the HVAC industry, it has become increasingly clear that a more sophisticated evaluation is needed when selecting fluids for use in ground source heat pumps if system performance is to be optimized and long-term costs minimized. A thorough evaluation requires careful consideration to several key selection criteria.

First and foremost, because this application calls for underground installation of fluids, utmost consideration must be placed on environmental and handling implications.

Additionally, while heat transfer efficiency is crucial, fluid selections should also consider longer term issues, such as protecting equipment from loss and/or failure due to corrosion.

An "ideal" fluid for use in GSHP would exhibit the following performance characteristics:

- Minimal Regulatory Considerations
- Low Toxicity and Flammability
- Efficient Heat Transfer
- Corrosion Protection
- Proven Utility
- Total Cost

To date, no single fluid is known to exhibit optimum performance in each of the key selection criterion. Table 1 compares performance characteristics of DOWFROST HD and methanol (selected as the basis for comparison) versus key performance criteria.

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## A Word About Performance Criterion: What You Should Consider When Selecting a Fluid

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### Regulatory Considerations

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This criterion is high priority because potential leaks could lead to contamination (of both the soil and water supplies). The fluid must be low in toxicity to wildlife, readily biodegradable, and not listed or characterized as hazardous material subject to RCRA regulation (e.g., the flash point must be greater than 140°F).

DOWFROST HD fluid satisfies all these requirements. However, methanol is highly toxic, with a flash point of 54°F and subject to RCRA regulation even when diluted to 20% by volume concentration. This low flash point causes methanol to be characterized as a hazardous waste upon disposal.

### Toxicity and Flammability

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In the interest of fire safety, the fluid selected should not have a low flash point (<140°F), and should be low in acute oral toxicity to humans.

DOWFROST HD is very low in acute oral toxicity, and its primary ingredient (>94% propylene glycol) is an FDA approved food additive. By comparison, methanol is characterized as relatively high in both acute oral and inhalation toxicity. And, due to its low flash point, extra safety precautions should be taken during installation and system operations to guard against fire and protect both the health and safety of those involved.

### Efficient Heat Transfer

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At the concentration required for typical (25°F) freeze protection, the fluid is not likely to be the limiting factor in heat transfer efficiency for the overall system. Though the heat transfer coefficient of methanol is somewhat better than that of DOWFROST HD, in the great majority of GSHP applications, the limiting factor is the heat transfer of the earth/piping or the refrigerant in the evaporator. Therefore, slight differences in fluid heat transfer efficiency do not impact the overall system's heat transfer. It is possible (even likely) that changing from methanol to DOWFROST HD fluid will have no measurable impact on overall system heat transfer efficiency, even though the individual fluid coefficients differ.

### Corrosion Protection

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In order to ensure the long-term success of the system and its equipment, the fluid must pass ASTM D-1384 corrosion evaluation, and should provide 20-year corrosion protection for heat pump systems without any required maintenance during that period.

DOWFROST HD provides corrosion protection well within the recommended guidelines for typical metals, and can provide 20+ years of worry-free protection. However, when methanol is used, the fluid is often installed without, or with improper, corrosion inhibitors. This could lead to serious corrosion problems and equipment failure.

### Proven Utility

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The product selected should have demonstrated utility for all above criteria for similar HVAC freeze protection situations. The DOWFROST HD formulation has demonstrated its effectiveness for corrosion protection, heat transfer, human safety, and environmental protection in typical HVAC applications over decades of use in the industry.

### Total Cost

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Cost evaluation should consider the long-term system maintenance and replacement costs, total pumping costs, and initial installation costs. Comparisons which simply look at initial purchase price of the fluid may skew the long-term system economics by ignoring other factors such as maintenance and replacement costs of fluid and equipment.

**Table 2: Residential Total Monthly Cost Comparison  
(Modeled After a Typical 3 Ton Application)**

	Methanol, 2 ft/sec.		DOWFROST HD, 2 ft/sec.	
	In Ground	In Heat Pump	In Ground	In Heat Pump
Fluid Heat Transfer Coefficient	204	695	120	465
System Heat Transfer Coefficient	5.5	107	5.4	95
Pressure Drop/100 ft <sup>2</sup>	1.1	21.5	1.38	26.5
Pump Horsepower (Per 2000 ft in ground/10 ft in heat pump)	.100	.0096	.124	.011
Electric Pump Cost per Kilowatt	\$ .08	\$ .08	\$ .08	\$ .08
<b>Total Monthly Electric Cost</b>		<b>\$2.39</b>		<b>\$2.95</b>

**Typical Physical Properties of DOWFROST HD**

Composition (% by weight)	
Glycol	94.0
Inhibitors & Water	6.0
Color	Bright yellow
Specific Gravity (at 60/60°F)	1.053 - 1.063
pH of Solution (50% glycol)	9.5 - 10.5
Reserve Alkylinity (min.)	15.0 ml

If you would like additional product information or specific engineering or operating assistance, call Dow toll free: 1-800-447-4369

***For further information, call...***

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