

# **DOWCAL™**

**Inhibited glycol-based heat transfer fluids**

**Guide to products and applications**

**DOW**



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# DOWCAL™ Inhibited Glycol-based Fluids

## High performance heat transfer fluids offer sustainable solutions

### Advantages of DOWCAL™ Heat Transfer Fluids

What are DOWCAL™ Heat Transfer Fluids? Ethylene or Propylene glycol-based liquids with our signature corrosion inhibitors for optimum system performance, Dow offers a full range of DOWCAL™ Heat Transfer Fluids to meet your specific system requirements.

#### Long-lasting performance

DOWCAL™ Fluids are also long-lasting and can be operated for many years in properly maintained systems. Their special corrosion inhibitor package supports higher temperature operation compared to alternative technologies.

#### Corrosion protection

DOWCAL™ Fluids are formulated with carefully chosen corrosion inhibitors to provide protection to the metallic parts of process equipment, therefore improving process efficiency and reducing maintenance costs. DOWCAL™ Fluids are very efficient at protecting aluminum.

#### Expert technical support

As a Dow heat transfer fluids customer, you have direct access to our industry leading heat transfer expertise, including our in-depth and highly diversified application experience. Dow heat transfer specialists will help you select the exact fluid you require, then work with you to properly install and optimize fluid operation for best results. Contact us as indicated on the back of this brochure to learn more about our services and to begin working with our experts on your successful heat transfer project.

### Sustainability

#### Safe for use

DOWCAL™ 100E and DOWCAL™ 200E are borate, nitrate and CMR (carcinogenic, mutagenic, and reprotoxic) free.

DOWCAL™ GEO-100 and DOWCAL™ GEO-200 are borate, nitrate, CMR (carcinogenic, mutagenic, and reprotoxic) free and on positive list of LAWA (German Working Group on water issues of the Federal States and the Federal Government represented by the Federal Environment Ministry).

DOWCAL™ N Fluid is approved by the National Sanitation Foundation (NSF). It is suitable as a heat transfer medium for food and beverage plants.



## Selecting the right DOWCAL™ Fluid

DOWCAL™ Fluids are used successfully in a wide range of applications, from renewable energy, HVAC systems and geothermal heat pumps, to chemical, pharmaceutical and food processing. Your choice of fluid will depend both on where it will be used and your operating temperature requirements. Specific properties depending on temperature and concentration can be calculated with Dow's FLUIDFILE™ Software available at [www.dow.com](http://www.dow.com).

|                               | DOWCAL™ 100 | DOWCAL™ 100E | DOWCAL™ 200 | DOWCAL™ 200E | DOWCAL™ GEO-100 | DOWCAL™ GEO-200 | DOWCAL™ N |
|-------------------------------|-------------|--------------|-------------|--------------|-----------------|-----------------|-----------|
| Based on ethylene glycol      | *           | *            |             |              | *               |                 |           |
| Based on propylene glycol     |             |              | *           | *            |                 | *               | *1        |
| Recommended for cooling       | *           | *            | *           | *            | *               | *               | *         |
| Recommended for heating       | *           |              | *           |              |                 |                 |           |
| NSF certified <sup>2</sup>    |             |              |             |              |                 |                 | *         |
| Free from borate <sup>3</sup> |             | *            |             | *            | *               | *               | *         |

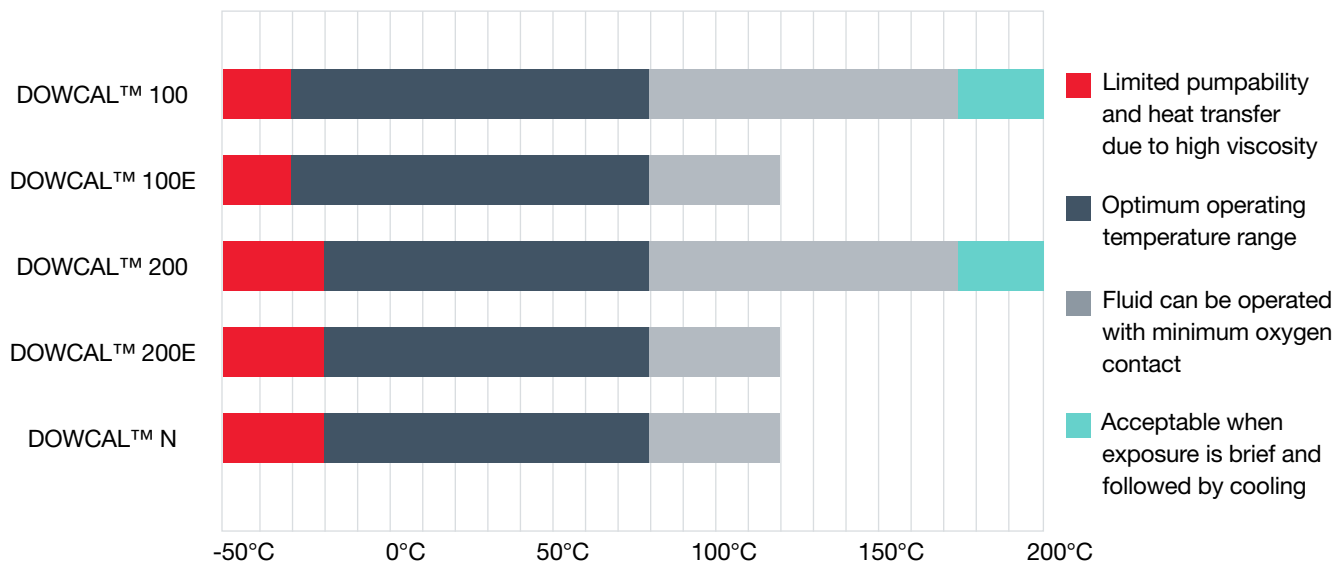
1: Based on high purity propylene glycol USP/EP

2: National Sanitation Foundation

3: DOWCAL™ 100E, 200E, GEO-100, GEO-200, and N grades are borate free, being manufactured without added borate.

These are typical properties, not to be construed as specifications.

DOWCAL™ 100 and DOWCAL™ 200 have recommended operating temperature ranges of -50°C to 175°C while DOWCAL™ 100E, DOWCAL™ 200E and DOWCAL™ N have a recommended range from -50°C to 120°C. Efficiency and operating conditions can differ within those temperature ranges. Refer to the graphic below for guidance.



Note: If operated above 100°C, the fluid needs to be pressurized to avoid evaporation in the system

# Applications and product recommendations

## Construction and infrastructure

| Application process                                                                                                                                                                                                                                                                                                                                                                                                                            | Recommended product(s)                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>Ground source heat pumps:</b> DOWCAL™ Geothermal Fluids are circulated through underground or underwater piping, carrying thermal energy to and from the building. To prevent freezing when the transfer fluid contacts the evaporating refrigerant at sub-zero temperatures, DOWCAL™ Geothermal Fluids can be circulated in the captors/probes.                                                                                            | <b>DOWCAL™ GEO-100</b><br><b>DOWCAL™ GEO-200</b> |
| <b>Solar heating:</b> Active solar thermal systems, such as flat panel collectors, rely on the solar energy to heat-up DOWCAL™ Fluids, which are circulated in an area that requires heat.                                                                                                                                                                                                                                                     | <b>DOWCAL™ 200</b>                               |
| <b>HVAC (Heating Ventilation and Air Conditioning):</b> Modern HVAC systems frequently use a glycol based heat transfer fluid to transport heat and cold from heating and cooling units to the consumers. When designing, installing or operating these water-based HVAC systems, DOWCAL™ Fluids provide the required system protection against freezing and corrosion and provide efficient heat transfer for years with minimal maintenance. | <b>DOWCAL™ 100E</b><br><b>DOWCAL™ 200E</b>       |
| <b>Floor heating:</b> Massive damage can be inflicted on warehouse floors due to frost heaving. This risk is reduced by embedding a grid of tubing in the soil beneath the floor and heating it with DOWCAL™ Fluid.                                                                                                                                                                                                                            | <b>DOWCAL™ 100</b><br><b>DOWCAL™ 200</b>         |
| <b>Snow melting systems:</b> A snow melting system consists of a network of pipes or tubing embedded in concrete or asphalt. A solution of heated DOWCAL™ Fluids and water is circulated through the pipes in order to melt snow and ice from bridges, service areas, roads and sidewalks.                                                                                                                                                     | <b>DOWCAL™ 100</b><br><b>DOWCAL™ 200</b>         |



# Applications and product recommendations

## Industrial

| Application process                                                                                                                                                                                                                                                                                                                                                             | Recommended product(s)                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <p><b>Process chilling, freeze protection and cooling:</b> The chemical and petrochemical industries use secondary cooling for chilling purposes or to remove heat generated during processing. The choice of product depends on the use. DOWCAL™ Fluids are often used for process chilling because they are nonflammable in aqueous solutions and are low in corrosivity.</p> | <p><b>DOWCAL™ 100E</b><br/><b>DOWCAL™ 200E</b></p> |
| <p><b>Process heating:</b> In batch processing environments, such as pharmaceutical batch processing / multipurpose reactors in the pharmaceutical, reactors must be cooled and heated. DOWCAL™ 100 and DOWCAL™ 200 have a wide temperature range making them suitable to be used in both hot and cold loops.</p>                                                               | <p><b>DOWCAL™ 100</b><br/><b>DOWCAL™ 200</b></p>   |
| <p><b>Heat recovery:</b> Many industries operate heat recovery systems to improve the overall thermal efficiency of their processes. In this application, DOWCAL™ Fluids collect waste heat that would otherwise be expelled to the environment and pumps it to places where this thermal energy can be put to use.</p>                                                         | <p><b>DOWCAL™ 100</b><br/><b>DOWCAL™ 200</b></p>   |



# Applications and product recommendations

## Food and beverages

### Facts of food and beverages contact

DOWCAL™ N Fluid is based on propylene glycol which is generally recognized as safe by the United States Food and Drug Administration (FDA) in section 21CFR184.1666 and meets the specifications of the Food Chemicals Codex, 6th edition (2008). It can therefore be used in indirect food application.

In Europe, the ingredients in DOWCAL™ N Fluids are listed in the Commission Regulation (EU) No 1130/2011 concerning food additives authorized for use in foodstuffs intended for human consumption. Propylene glycol (PG) is classified as E1520 in an amendment to European Union Directive 95/2/EC, which regulates human food additives and it is listed in Annex I of the Commission Regulation (EU) No 10/2011 as an authorized monomer and additive for plastic materials and articles intended to come into contact with food.

Finally, DOWCAL™ N Fluid is approved by the National Sanitation Foundation (NSF). It is suitable as a heat transfer medium for food and beverage plants.

| Application process                                                                                                                                                                                                                                                                                                                                                    | Recommended product(s) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <p><b>Cooling liquid:</b> DOWCAL™ N Fluid is widely used in the beverage industry to cool products such as beer, wine, milk and juices.</p>                                                                                                                                                                                                                            | DOWCAL™ N              |
| <p><b>Fermentation cooling:</b> Breweries and wineries use DOWCAL™ N Fluid to cool fermentation and wort tanks. The fluid's anti-corrosive properties safeguard the integrity of the piping systems.</p>                                                                                                                                                               |                        |
| <p><b>Packaging of carbonated beverages:</b> DOWCAL™ N Fluid is used prior to bottling to cost-effectively chill and prevent loss of carbonation from carbonated beverages such as sparkling wines, champagne and beer.</p>                                                                                                                                            |                        |
| <p><b>Refrigeration coil defrosting:</b> When moisture from the air condenses on the refrigeration coils of walk-in freezers and chillers, frost build-up can result in loss of refrigeration efficiency. Sprayed directly onto the coils, DOWCAL™ N Fluid will prevent frost formation and, because it is hygroscopic, DOWCAL™ N Fluid also absorbs condensation.</p> |                        |
| <p><b>Immersion Freezing of Wrapped Foods:</b> In the food industry, products sealed in airtight and watertight pouches are immersion-frozen in baths of DOWCAL™ N Fluid. This method is popular because it is fast and efficient while ensuring uniform freezing.</p>                                                                                                 |                        |



# Applications and product recommendations

## Other applications

| Application process                                                                                                                                                                                                                                                                                                                                                                                  | Recommended product(s)                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <p><b>Cooling of electronic systems and components:</b> Liquid cooling is an effective technology in removing heat generated by electronics in established power conversion sectors such as motor drives, wind and solar inverters. Other developing application is on battery cooling.</p>                                                                                                          | <p><b>DOWCAL™ 100E</b><br/> <b>DOWCAL™ 200E</b><br/> <b>DOWCAL™ 100</b><br/> <b>DOWCAL™ 200</b></p> |
| <p><b>Wind turbine systems:</b> There are large and complex power electronics and these systems go through significant thermal stresses and generate heat under load. The components in these converters are cooled with DOWCAL™ Fluid loop.</p>                                                                                                                                                     |                                                                                                     |
| <p><b>Photo-voltaic (PV) inverters:</b> As the inverter works to convert DC power to AC power, it generates heat.</p>                                                                                                                                                                                                                                                                                |                                                                                                     |
| <p><b>DataCenter cooling:</b> DataCenter OEMs want to replace conventional air cooling technology with liquid cooling using DOWCAL™ Heat Transfer Fluids.</p>                                                                                                                                                                                                                                        |                                                                                                     |
| <p><b>Ice skating rinks:</b> Some of the most elite indoor ice arenas depend on DOWCAL™ Fluid to help keep the ice cool and consistent. For ice skating rinks, solutions containing DOWCAL™ Fluids are chilled by refrigeration equipment and then circulated through a network of pipes beneath the rink floor. The cold solution causes a layer of water to freeze into a smooth sheet of ice.</p> |                                                                                                     |



# Corrosion protection capabilities

DOWCAL™ Fluids are made for a very broad range of applications. The specially formulated inhibitor packages of DOWCAL™ Fluids are effective in minimizing corrosion of a wide variety of metals that are used in industrial and residential applications, reducing maintenance costs and extending the life of the process equipment.

These inhibitors minimize corrosion of metals in two ways. First, they passivate the surface of metals, reacting with the surface or forming a layer on the surface to prevent acids from attacking it. Second, the inhibitors in DOWCAL™ Fluids buffer any acids formed as a result of glycol oxidation. All glycols produce organic acids as degradation products. This degradation is accelerated in the presence of oxygen and/or heat. Left in solution, acids lower pH and contribute to corrosion. Properly formulated inhibitors such as those in DOWCAL™ Fluids neutralize these acids and contribute to a long fluid life time. Many commonly available coolants – such as fluids with pure organic acid technology (OAT) – have little ability to buffer these degradation products and therefore need to be changed more frequently.

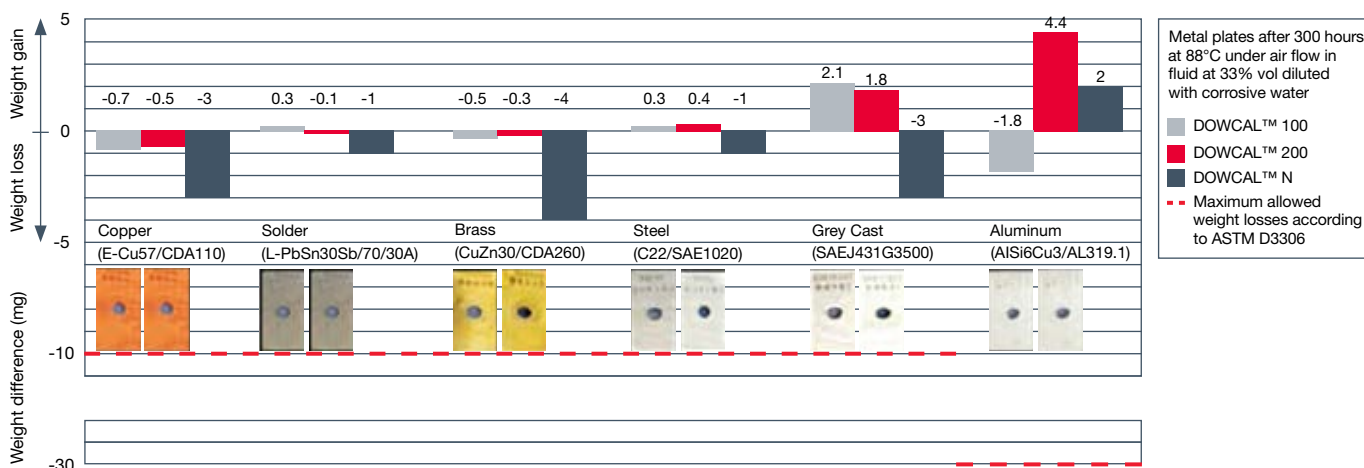
The following data show the comparatively low corrosion of widely used metals caused by DOWCAL™ Fluid/water mixtures. The results were derived from tests performed

according to the widely known ASTM D 1384 corrosion test method and represent the weight loss of metallic plates in milligrams per specimen due to corrosion (ASTM D 1384, 88°C for 2 weeks, glycol concentration 33% by volume, air bubbling, corrosive water contains 100 ppm Cl<sup>-</sup>, 100 ppm SO<sub>4</sub><sup>2-</sup>, 100 ppm HCO<sub>3</sub><sup>-</sup>).

DOWCAL™ Fluids fall well within the generally accepted corrosion limits considered adequate under this test. Rates in excess of 10 mg (30 mg for aluminum) are generally evidence of inadequate corrosion protection.

While the other fluids tested at a concentration of 33% by volume can also perform acceptably, solutions containing lower concentrations of fluid are frequently required. The tables on this page show ASTM D1384 corrosion test results under the same conditions for various coolants at a 20% concentration by volume. For comparison purposes, pure water and uninhibited propylene glycol and ethylene glycol are included. The data shows that the DOWCAL™ Fluids demonstrate effective corrosion protection on all metals while the alternative products were more corrosive to aluminum. The tests also demonstrated that water and uninhibited glycols are highly corrosive, reinforcing the need for inhibited fluid protection.

**Metal Probes Cleaned After ASTM D1384 Corrosion Testing at a Concentration of 33% by Volume**



Corrosion of Cast Aluminum Under Heat-Rejecting Conditions According to ASTM D 4340 at a concentration of 25% by volume Measured at BfB Oil Research S.A., Gembloux, Belgium, 05/2012 and 03/2013

ASTM D1384 Corrosion test Results at 20% Concentration  
by volume Ethylene Glycol (Weight Difference [mg])

|   |            | Non-inhibited ethylene glycol | Automotive coolant, MEG-based | OAT fluid, MEG-based | DOWCAL™ 100 Solution |
|---|------------|-------------------------------|-------------------------------|----------------------|----------------------|
| 1 | Copper     | -19                           | -1.4                          | -0.8                 | -0.6                 |
| 2 | Solder     | -46                           | -1.1                          | -0.8                 | -0.8                 |
| 3 | Brass      | -29                           | -0.4                          | -0.4                 | -0.9                 |
| 4 | Mild steel | -819                          | 0.5                           | 0.7                  | -0.2                 |
| 5 | Cast iron  | -642                          | 1.8                           | 1.6                  | 2.7                  |
| 6 | Aluminum   | -111                          | -10.2                         | -16.0                | 0.1                  |

Typical values, not to be construed as specifications. Users should confirm results by their own tests.



Non-inhibited ethylene glycol

Automotive coolant

OAT fluid

DOWCAL™ 100 Solution

ASTM D1384 Corrosion test Results at 20% Concentration  
by volume Propylene Glycol (Weight Difference [mg])

|   |            | Non-inhibited propylene glycol | Industrial propylene glycol coolant | Alternative OAT fluid | DOWCAL™ 200 Solution |
|---|------------|--------------------------------|-------------------------------------|-----------------------|----------------------|
| 1 | Copper     | -12                            | -0.5                                | -1.3                  | -0.3                 |
| 2 | Solder     | -55                            | -1                                  | -1.8                  | -0.5                 |
| 3 | Brass      | -31                            | -0.7                                | -1.4                  | 0.3                  |
| 4 | Mild steel | -969                           | 0.7                                 | 0.3                   | 0.6                  |
| 5 | Cast iron  | -700                           | 1.5                                 | 0.3                   | 1.3                  |
| 6 | Aluminum   | -150                           | -11.3                               | -22                   | 0.7                  |

Typical values, not to be construed as specifications. Users should confirm results by their own tests.



Non-inhibited Propylene Glycol

Industrial Propylene Glycol Coolant

OAT fluid

DOWCAL™ 200 Solution



# Using DOWCAL™ Fluids

## Material compatibility

### Compatibility with metals, plastics and rubbers

Solutions of DOWCAL™ Fluids are compatible with all metals, with the exception of zinc. The heat transfer fluid can dissolve zinc when hot and should, therefore, not be used in galvanized pipelines.

DOWCAL™ Fluids are compatible with most plastics and rubbers, such that they can be considered industry standards. The following table provides a list of compatible plastics and rubbers together with the materials' maximum recommended temperatures (in some cases the maximum use temperature is for the plastics, regardless of the fluid).

| Materials                            | Ethylene glycol based fluids | Propylene glycol based fluids |
|--------------------------------------|------------------------------|-------------------------------|
| <b>Plastics</b>                      |                              |                               |
| ABS                                  | 66°C                         | 32°C                          |
| Acrylics                             | 32°C                         |                               |
| Chlorinated polymer                  | 110°C                        |                               |
| CPVC                                 | 93°C <sup>a</sup>            | 93°C <sup>b</sup>             |
| Epoxy                                | 143°C                        | 99°C(U) <sup>c</sup>          |
| Fluorocarbons FEP                    | 199°C                        | 199°C                         |
| Fluorocarbons TFE                    | 249°C                        | 249°C                         |
| Noryl                                | 66°C                         |                               |
| Polyamides – Nylon                   | 99°C                         |                               |
| Bisphenol A-Fumurate                 | 110°C                        | 88°C                          |
| Hydrogenated Bisphenol A-Bisphenol A | 104°C                        | 93°C                          |
| Isophthalic                          | 43°C(U) <sup>c</sup>         | 88°C                          |
| Chlorinated polyesters               | 127°C                        | 104°C                         |
| Polystyrenes                         | 77°C                         |                               |
| Polyethylene                         | 71°C                         | 66°C                          |
| Polypropylene                        | 116°C                        | 66°C                          |
| PVC – Type 1                         | 49°C                         | 49°C <sup>d</sup>             |
| PVC – Type 2                         | 49°C                         | 49°C <sup>d</sup>             |
| Polyvinylidene chloride              | 88°C                         |                               |
| Vinylidene fluoride                  | 143°C                        | 138°C                         |
| Vinyl ester                          | 104°C                        | 104°C                         |
| Polymethylmethacrylate (PMMA)        |                              | 70°C                          |

| <b>Rubbers</b>                       |       |      |
|--------------------------------------|-------|------|
| Butyl GR-1                           | 93°C  |      |
| Fluoro Elastomers Viton A            | 182°C | 38°C |
| Fluoro Elastomers KEL-F 3700         | 99°C  |      |
| Hard rubber                          | 93°C  |      |
| Chlorosulfonated polyethylene (CSPE) | 99°C  |      |
| Koroseal                             | 71°C  |      |
| Natural rubber (GRS)                 | 71°C  |      |
| Neoprene GR-M (CR)                   | 77°C  | 32°C |
| Nitrile Buna M (NBR)                 | 88°C  | 32°C |
| NORDEL™ EPDM                         | 154°C |      |
| Polyurethane                         | 38°C  |      |

(a) But only if the solution contains 50% or less of ethylene glycol, according to BF Goodrich  
 (b) But not in a solution containing more than 25% of propylene glycol, according to BF Goodrich  
 (c) When U follows a recommended temperature range, the fluid was found to cause a problem with the plastic above the range, and is therefore unsuitable at higher temperatures  
 (d) The Geon Company, a major manufacturer of PVC resins and compounds, cautions against using PVC above 49°C  
 (e) Tested by Ecofys Netherlands BV, 2008  
 Table Sources: "Corrosion Resistance Tables," Second Edition, Philip A. Schweiter, P.E., 1986 BF Goodrich and The Geon Company  
 These are typical properties, not to be construed as specifications.

### Fluid dilution requirements

Whenever possible, DOWCAL™ Fluids should be diluted with demineralized or distilled water. DOWCAL™ Fluids can also be mixed with other water within the limits of the following table. Local tap water typically meets these requirements. If water of adequate quality is not available, Dow or Dow's local distributor can supply ready-to-use solutions of DOWCAL™ Fluids.

### Dilution water quality requirements

|                | DOWCAL™ Fluids   |
|----------------|------------------|
| Chloride       | <400 ppm*        |
| Sulphate       | <400 ppm*        |
| Total hardness | <450 ppm (25°dH) |

\*<100 ppm if the system contains aluminum or aluminum alloy components

# Using DOWCAL™ Fluids (continued)

## Fluid handling

### Storage of DOWCAL™ Fluids

DOWCAL™ Fluids require no special climate storage precautions. DOWCAL™ Fluids and fluid solutions should be stored in plastic storage containers rather than metallic containers. Zinc, in particular, is not resistant to undiluted DOWCAL™ Fluids. Therefore, exposure of zinc or zinc coatings to pure DOWCAL™ Fluids should be avoided.

When properly stored, DOWCAL™ Fluids will meet sales specification requirements for a period of at least 24 months from date of production in Dow. Continued storage beyond the designated shelf life does not necessarily make the fluid unsuitable for use. Dow offers a fluid analysis service to evaluate fluid condition after prolonged storage.

### Disposal of solutions of DOWCAL™ Fluids

The primary component of DOWCAL™ Fluids, propylene or ethylene glycol, is readily biodegradable and it is not classified as dangerous to aquatic organisms. However, any disposal practice must be in compliance with all local and national laws and regulations. Do not dump into any sewers, on the ground, or into any body of water.

### Fluid flammability and fire hazards

When mixed with water in concentrations of up to 80%, DOWCAL™ Fluids are nonflammable since they have no measurable flash points. Therefore, they pose no fire hazard in most applications. The following flashpoint and fire point values apply to pure DOWCAL™ Fluids.

#### Fluid flammability

|                          | DOWCAL™ 100 | DOWCAL™ 200 | DOWCAL™ N |
|--------------------------|-------------|-------------|-----------|
| Flash point, °C          | 120         | 101         | 101       |
| Ignition temperature, °C | 435         | 420         | 420       |

## System design

Like all other fluids, solutions containing DOWCAL™ Fluids expand as temperatures increase. Expansion tanks are commonly used in systems containing DOWCAL™ Fluids. Expansion tanks must be sized appropriately. To determine the volume required for expansion, the formula given on this page can be used.

$$\Delta V = \frac{\rho(T_{low}) - \rho(T_{high})}{\rho(T_{high})} \times V$$

where:  $\rho(T_{low})$  = the density at the lowest anticipated temperature

$\rho(T_{high})$  = the density at the highest anticipated temperature

### Preparing new systems for use of DOWCAL™ Fluids

When preparing new equipment for systems using DOWCAL™ heat transfer fluids, it is good practice to remove oil, grease or protective coatings that may have been applied during fabrication, construction or storage following the equipment manufacturer's recommendations. The system should be free of all foreign matter and debris before any cleaning procedure. Chemical cleaning of new systems can be performed with a 1 to 2 wt% solution of water and trisodium phosphate.

After cleaning the system, it must be thoroughly flushed with clean soft water prior to adding DOWCAL™ Fluids. After pressure-testing with water or a solution of DOWCAL™ Fluid, systems should be left in the filled state to avoid pitting at the liquid/air phase boundary. If systems that have been filled with water or a solution of DOWCAL™ Fluid need to be drained and cannot be refilled within a few days, they should be thoroughly rinsed and dried.

### Preparing existing systems for use of DOWCAL™ Fluids

When changing from another heat transfer fluid to a DOWCAL™ Fluid, systems should be carefully cleaned to remove all traces of the previous fluid and any deposits which may be present. To help ensure optimum performance of the DOWCAL™ Fluid, it is very important to remove any corrosion and replace damaged seals before filling the system. When replacing brine solutions, special care should be taken to remove all scale and corrosion deposits that may have built up.

It is particularly important to remove calcium deposits and chlorides. Residual calcium will react with, and deplete, the inhibitors in DOWCAL™ Fluids, reducing the products' corrosion protection capabilities. Chlorides are potentially corrosive to the system if present at high levels. For large or severely corroded systems, it is recommended that a professional cleaning organization be consulted.

When changing from another glycol-based heat transfer fluid, compatibility of the fluid with DOWCAL™ Fluid should be checked. If the fluids are compatible and if the system is still in proper condition, the system can be filled with a DOWCAL™ Fluid.

### Expert technical support

As a Dow heat transfer fluids customer, you have direct access to our industry-leading heat transfer expertise, including our in-depth and highly diversified application experience. Dow heat transfer specialists will help you select the exact fluid you require, then work with you to properly install and optimize fluid operation for best results. Contact us as indicated on the back of this brochure to learn more about our services and to begin working with our experts on your successful heat transfer project.

## Using DOWCAL™ Fluids (continued)

### Fluid analysis recommendations

Experience confirms that DOWCAL™ Fluids can be used in installations for many years. However, the concentration of DOWCAL™ Fluids and the products' functional performance should be checked at intervals of one to two years. Please refer to the back cover of this brochure to find the toll-free number of the Dow Customer Information Group and ask for our fluid analysis procedure.

## Heat transfer fluid selection calculator

FLUIDFILE™ Software is designed to enable fast, efficient evaluation of the properties and performance of Dow heat transfer fluids under your actual system conditions, and in the units of measure you prefer. It makes choosing the right fluid easier and more convenient for both experienced professionals and first-time system designers.

You won't need prior experience with Dow heat transfer fluids to obtain the information you need to select the right fluid. To assist in your fluid decision-making, FLUIDFILE™ Software provides an overview of our fluids line, guidance in choosing a fluid chemistry including application information, plus profiles of the individual fluids. FLUIDFILE™ Software can be accessed from [www.dow.com](http://www.dow.com) website.

### Glycol Based Fluid Calculator

|                                                                                                                                                      | Single temperature and concentration                                                                                                      | Temperature range | Concentration range |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|
| <b>ETHYLENE GLYCOL BASED</b><br><input type="checkbox"/> DOWCAL™ 100<br><input type="checkbox"/> DOWCAL™ 100E                                        | Temperature <input type="range"/> 20 °C                                                                                                   |                   |                     |
| <b>PROPYLENE GLYCOL BASED</b><br><input type="checkbox"/> DOWCAL™ 200<br><input type="checkbox"/> DOWCAL™ 200E<br><input type="checkbox"/> DOWCAL™ N | Concentration <input type="range"/> 35 %                                                                                                  |                   |                     |
| <b>OTHER</b><br><input type="checkbox"/> WATER                                                                                                       | Percent glycol <input checked="" type="radio"/> % Volume fluid <input type="radio"/> % Weight glycol <input type="radio"/> % Weight fluid |                   |                     |
| <b>UNITS</b><br><input type="radio"/> English<br><input checked="" type="radio"/> SI                                                                 | Diameter <input type="range"/> 27.2 mm                                                                                                    |                   |                     |
|                                                                                                                                                      | <input checked="" type="radio"/> Pipe <input type="radio"/> Tube                                                                          |                   |                     |
|                                                                                                                                                      | Volumetric flow: <input type="range"/> 6.28 m³/hour                                                                                       |                   |                     |
|                                                                                                                                                      | Fluid velocity <input type="range"/> 3.00 m/sec                                                                                           |                   |                     |



## Product information for DOWCAL™ 100 Fluid

**DOWCAL™ 100** is an ethylene glycol-based heat transfer fluid used in various industrial applications, highly recommended for heating applications.

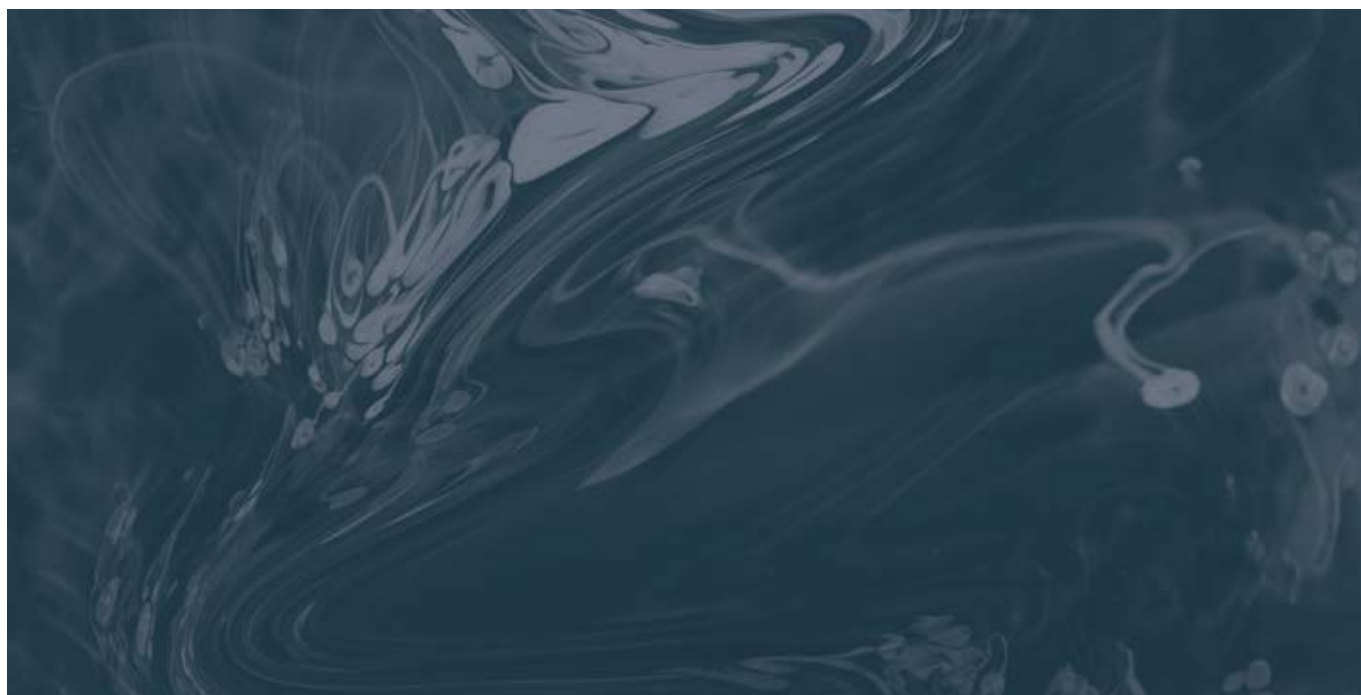
### Key benefits of DOWCAL™ 100

- Improved corrosion protection, in particular for aluminum alloys
- Hard water stability to enable use with local tap water
- Compatible with commonly used elastomers
- Long fluid lifetime, lowering maintenance cost

### Typical properties of DOWCAL™ 100 Heat Transfer Fluid †

| Properties, test conditions                                                                                             | Units             | Values    |
|-------------------------------------------------------------------------------------------------------------------------|-------------------|-----------|
| <b>Composition:</b> <ul style="list-style-type: none"> <li>• Ethylene glycol</li> <li>• Inhibitors and water</li> </ul> | %wt               | 91<br>9   |
| Color                                                                                                                   |                   | Colorless |
| Density at 20°C                                                                                                         | g/cm <sup>3</sup> | 1.135     |
| pH of solution (50% vol. in water)                                                                                      |                   | 7.6 – 8.2 |
| Reserve alkalinity                                                                                                      | mL (0.1 N HCl)    | 10        |
| Freeze point (50% vol. in water)                                                                                        | °C                | -38       |

† Typical properties not to be construed as specification, complete sales specification is available on request.



# Physical properties of DOWCAL™ 100 Fluid

Typical freezing, boiling points and other properties of DOWCAL™ 100 Fluid †\*

| DOWCAL™ 100<br>%vol | DOWCAL™ 100<br>%wt | Freezing point<br>°C | Refractive index<br>@ 20°C | Boiling point<br>°C @ 1 bara | Density<br>g/cm³ @ 20°C | Dyn. viscosity<br>mPa.s @ 20°C | Kin. viscosity<br>mm²/s @ 20°C |
|---------------------|--------------------|----------------------|----------------------------|------------------------------|-------------------------|--------------------------------|--------------------------------|
| 5.0                 | 5.6                | -2.1                 | 1.3386                     | 100.5                        | 0.983                   | 1.07                           | 1.03                           |
| 10.0                | 11.2               | -4.3                 | 1.3442                     | 101.1                        | 1.001                   | 1.26                           | 1.22                           |
| 15.0                | 16.7               | -6.7                 | 1.3498                     | 101.7                        | 1.016                   | 1.49                           | 1.43                           |
| 20.0                | 22.1               | -9.4                 | 1.3554                     | 102.4                        | 1.029                   | 1.77                           | 1.69                           |
| 21.0                | 23.2               | -10.0                | 1.3565                     | 102.5                        | 1.031                   | 1.83                           | 1.75                           |
| 22.0                | 24.3               | -10.6                | 1.3576                     | 102.7                        | 1.033                   | 1.89                           | 1.81                           |
| 23.0                | 25.3               | -11.3                | 1.3588                     | 102.8                        | 1.036                   | 1.96                           | 1.87                           |
| 24.0                | 26.4               | -11.9                | 1.3599                     | 102.9                        | 1.038                   | 2.03                           | 1.93                           |
| 25.0                | 27.5               | -12.6                | 1.3610                     | 103.1                        | 1.040                   | 2.09                           | 1.99                           |
| 26.0                | 28.5               | -13.2                | 1.3621                     | 103.2                        | 1.042                   | 2.17                           | 2.06                           |
| 27.0                | 29.6               | -14.0                | 1.3632                     | 103.3                        | 1.044                   | 2.24                           | 2.13                           |
| 28.0                | 30.6               | -14.7                | 1.3643                     | 103.5                        | 1.046                   | 2.32                           | 2.20                           |
| 29.0                | 31.7               | -15.4                | 1.3654                     | 103.6                        | 1.048                   | 2.40                           | 2.27                           |
| 30.0                | 32.7               | -16.2                | 1.3665                     | 103.8                        | 1.050                   | 2.48                           | 2.35                           |
| 31.0                | 33.8               | -17.0                | 1.3676                     | 103.9                        | 1.052                   | 2.57                           | 2.43                           |
| 32.0                | 34.8               | -17.8                | 1.3687                     | 104.0                        | 1.053                   | 2.65                           | 2.51                           |
| 33.0                | 35.9               | -18.7                | 1.3698                     | 104.2                        | 1.055                   | 2.75                           | 2.59                           |
| 34.0                | 36.9               | -19.5                | 1.3709                     | 104.3                        | 1.057                   | 2.84                           | 2.68                           |
| 35.0                | 38.0               | -20.4                | 1.3720                     | 104.5                        | 1.059                   | 2.94                           | 2.77                           |
| 36.0                | 39.0               | -21.4                | 1.3731                     | 104.6                        | 1.060                   | 3.04                           | 2.86                           |
| 37.0                | 40.0               | -22.3                | 1.3742                     | 104.8                        | 1.062                   | 3.14                           | 2.96                           |
| 38.0                | 41.0               | -23.3                | 1.3752                     | 104.9                        | 1.064                   | 3.25                           | 3.06                           |
| 39.0                | 42.1               | -24.3                | 1.3763                     | 105.1                        | 1.065                   | 3.36                           | 3.16                           |
| 40.0                | 43.1               | -25.4                | 1.3774                     | 105.2                        | 1.067                   | 3.48                           | 3.27                           |
| 41.0                | 44.1               | -26.4                | 1.3785                     | 105.4                        | 1.068                   | 3.60                           | 3.38                           |
| 42.0                | 45.1               | -27.5                | 1.3796                     | 105.5                        | 1.070                   | 3.72                           | 3.49                           |
| 43.0                | 46.1               | -28.7                | 1.3806                     | 105.7                        | 1.071                   | 3.85                           | 3.60                           |
| 44.0                | 47.2               | -29.9                | 1.3817                     | 105.9                        | 1.073                   | 3.98                           | 3.73                           |
| 45.0                | 48.2               | -31.1                | 1.3828                     | 106.0                        | 1.074                   | 4.12                           | 3.85                           |
| 46.0                | 49.2               | -32.3                | 1.3838                     | 106.2                        | 1.076                   | 4.26                           | 3.98                           |
| 47.0                | 50.2               | -33.6                | 1.3849                     | 106.4                        | 1.077                   | 4.41                           | 4.11                           |
| 48.0                | 51.2               | -34.9                | 1.3859                     | 106.5                        | 1.079                   | 4.56                           | 4.25                           |
| 49.0                | 52.2               | -36.3                | 1.3870                     | 106.7                        | 1.080                   | 4.71                           | 4.39                           |
| 50.0                | 53.2               | -37.7                | 1.3880                     | 106.9                        | 1.081                   | 4.88                           | 4.54                           |
| 51.0                | 54.2               | -39.1                | 1.3891                     | 107.1                        | 1.083                   | 5.04                           | 4.69                           |
| 52.0                | 55.2               | -40.6                | 1.3901                     | 107.3                        | 1.084                   | 5.22                           | 4.85                           |
| 53.0                | 56.2               | -42.1                | 1.3912                     | 107.5                        | 1.085                   | 5.40                           | 5.01                           |
| 54.0                | 57.1               | -43.7                | 1.3922                     | 107.7                        | 1.087                   | 5.58                           | 5.18                           |
| 55.0                | 58.1               | -45.3                | 1.3932                     | 107.9                        | 1.088                   | 5.77                           | 5.35                           |
| 60.0                | 63.0               | <-51                 | 1.3983                     | 109.2                        | 1.094                   | 6.84                           | 6.31                           |
| 65.0                | 67.8               | <-51                 | 1.4033                     | 110.8                        | 1.100                   | 8.10                           | 7.43                           |
| 70.0                | 72.6               | <-51                 | 1.4082                     | 112.8                        | 1.105                   | 9.59                           | 8.76                           |
| 75.0                | 77.3               | <-51                 | 1.4130                     | 115.4                        | 1.111                   | 11.4                           | 10.3                           |
| 80.0                | 82.0               | <-51                 | 1.4176                     | 118.8                        | 1.116                   | 13.4                           | 12.2                           |
| 85.0                | 86.6               | -50.9                | 1.4220                     | 123.2                        | 1.120                   | 15.9                           | 14.4                           |
| 90.0                | 91.1               | -40.8                | 1.4264                     | 128.9                        | 1.125                   | 18.8                           | 16.9                           |
| 95.0                | 95.6               | -34.5                | 1.4305                     | 136.1                        | 1.129                   | 22.3                           | 19.9                           |
| 100.0               | 100.0              | -28.7                | 1.4345                     | 145.1                        | 1.134                   | 26.4                           | 23.5                           |

† Typical properties, not to be construed as specifications.

\* Temperature-dependent physical properties are provided in the FLUIDFILE™ Software.

Generally, for an extended margin of protection you should select a temperature in this table that is at least 3°C lower than the expected lowest ambient temperature. Contact Dow for information and further assistance with specific cases.

## Product information for DOWCAL™ 200 Fluid

**DOWCAL™ 200** is a propylene glycol-based heat transfer fluid for use in a wide range of applications, mainly recommended for heating applications. Low acute toxicity makes DOWCAL™ 200 especially suitable for applications where toxicity is a concern.

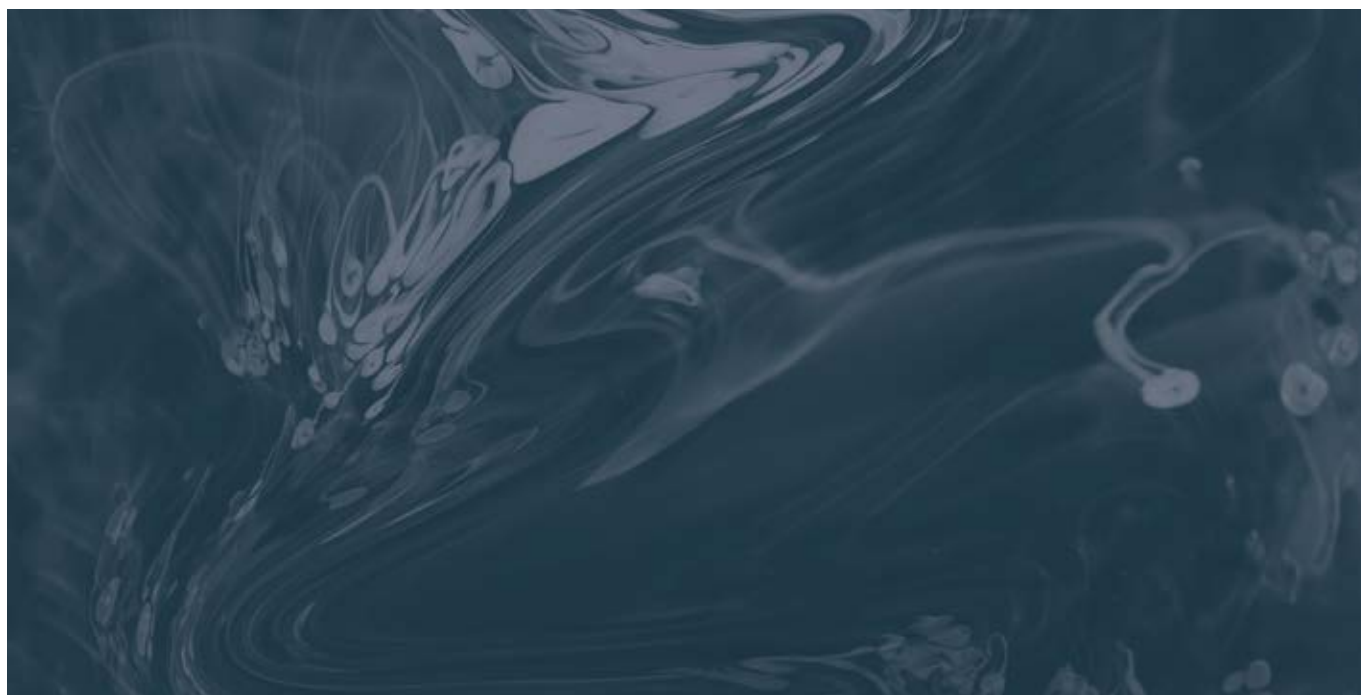
### Key benefits of DOWCAL™ 200

- Improved corrosion protection, in particular for aluminum alloys
- Hard water stability to enable use with local tap water
- Compatible with commonly used elastomers
- Long fluid lifetime, lowering maintenance cost

### Typical properties of DOWCAL™ 200 Heat Transfer Fluid †

| Properties, test conditions                                                                                              | Units               | Values    |
|--------------------------------------------------------------------------------------------------------------------------|---------------------|-----------|
| <b>Composition:</b> <ul style="list-style-type: none"> <li>• Propylene glycol</li> <li>• Inhibitors and water</li> </ul> | %wt                 | 92<br>8   |
| Color                                                                                                                    |                     | Colorless |
| Density at 20°C                                                                                                          | g/cm <sup>3</sup>   | 1.050     |
| pH of solution                                                                                                           | (50% vol. in water) | 7.2 – 7.6 |
| Reserve alkalinity                                                                                                       | mL (0.1 N HCl)      | 10        |
| Freeze point (50% vol. in water)                                                                                         | °C                  | -33       |

† Typical properties not to be construed as specification, complete sales specification is available on request.



# Physical properties of DOWCAL™ 200 Fluid

Typical freezing, boiling points and other properties of DOWCAL™ 200 Fluid †\*

| DOWCAL™ 200<br>%vol | DOWCAL™ 200<br>%wt | Freezing point<br>°C | Refractive index<br>@ 20°C | Boiling point<br>°C @ 1 bara | Density<br>g/cm³ @ 20°C | Dyn. viscosity<br>mPa.s @ 20°C | Kin. viscosity<br>mm²/s @ 20°C |
|---------------------|--------------------|----------------------|----------------------------|------------------------------|-------------------------|--------------------------------|--------------------------------|
| 5.0                 | 5.3                | -1.6                 | 1.3391                     | 100                          | 1.006                   | 1.36                           | 1.95                           |
| 10.0                | 10.5               | -3.3                 | 1.3452                     | 100                          | 1.011                   | 1.62                           | 1.66                           |
| 15.0                | 15.8               | -5.3                 | 1.3513                     | 101                          | 1.015                   | 1.93                           | 1.81                           |
| 20.0                | 20.9               | -7.5                 | 1.3573                     | 101                          | 1.020                   | 2.30                           | 2.11                           |
| 21.0                | 22.0               | -8.0                 | 1.3585                     | 101                          | 1.021                   | 2.39                           | 2.18                           |
| 22.0                | 23.0               | -8.5                 | 1.3597                     | 101                          | 1.022                   | 2.48                           | 2.26                           |
| 23.0                | 24.0               | -9.1                 | 1.3609                     | 101                          | 1.022                   | 2.57                           | 2.34                           |
| 24.0                | 25.1               | -9.6                 | 1.3621                     | 102                          | 1.023                   | 2.66                           | 2.42                           |
| 25.0                | 26.1               | -10.2                | 1.3633                     | 102                          | 1.024                   | 2.76                           | 2.51                           |
| 26.0                | 27.1               | -10.8                | 1.3645                     | 102                          | 1.025                   | 2.87                           | 2.61                           |
| 27.0                | 28.2               | -11.4                | 1.3657                     | 102                          | 1.026                   | 2.97                           | 2.71                           |
| 28.0                | 29.2               | -12.1                | 1.3669                     | 102                          | 1.027                   | 3.09                           | 2.81                           |
| 29.0                | 30.2               | -12.7                | 1.3681                     | 102                          | 1.028                   | 3.20                           | 2.92                           |
| 30.0                | 31.2               | -13.4                | 1.3693                     | 102                          | 1.029                   | 3.33                           | 3.04                           |
| 31.0                | 32.3               | -14.1                | 1.3704                     | 102                          | 1.030                   | 3.45                           | 3.16                           |
| 32.0                | 33.3               | -14.8                | 1.3716                     | 102                          | 1.031                   | 3.58                           | 3.29                           |
| 33.0                | 34.3               | -15.6                | 1.3728                     | 102                          | 1.032                   | 3.72                           | 3.42                           |
| 34.0                | 35.3               | -16.4                | 1.3739                     | 102                          | 1.033                   | 3.87                           | 3.56                           |
| 35.0                | 36.3               | -17.2                | 1.3751                     | 102                          | 1.034                   | 4.02                           | 3.70                           |
| 36.0                | 37.4               | -18.0                | 1.3762                     | 103                          | 1.035                   | 4.17                           | 3.85                           |
| 37.0                | 38.4               | -18.9                | 1.3774                     | 103                          | 1.036                   | 4.34                           | 4.01                           |
| 38.0                | 39.4               | -19.8                | 1.3785                     | 103                          | 1.037                   | 4.51                           | 4.17                           |
| 39.0                | 40.4               | -20.7                | 1.3797                     | 103                          | 1.038                   | 4.68                           | 4.35                           |
| 40.0                | 41.4               | -21.7                | 1.3808                     | 103                          | 1.039                   | 4.87                           | 4.53                           |
| 41.0                | 42.4               | -22.7                | 1.3820                     | 103                          | 1.039                   | 5.06                           | 4.71                           |
| 42.0                | 43.4               | -23.7                | 1.3831                     | 103                          | 1.040                   | 5.26                           | 4.91                           |
| 43.0                | 44.4               | -24.8                | 1.3842                     | 103                          | 1.041                   | 5.47                           | 5.12                           |
| 44.0                | 45.4               | -25.8                | 1.3853                     | 103                          | 1.042                   | 5.69                           | 5.33                           |
| 45.0                | 46.4               | -27.0                | 1.3864                     | 103                          | 1.043                   | 5.92                           | 5.55                           |
| 46.0                | 47.5               | -28.1                | 1.3875                     | 104                          | 1.044                   | 6.16                           | 5.79                           |
| 47.0                | 48.5               | -29.3                | 1.3886                     | 104                          | 1.045                   | 6.40                           | 6.03                           |
| 48.0                | 49.5               | -30.5                | 1.3897                     | 104                          | 1.046                   | 6.66                           | 6.29                           |
| 49.0                | 50.5               | -31.8                | 1.3908                     | 104                          | 1.047                   | 6.93                           | 6.55                           |
| 50.0                | 51.5               | -33.1                | 1.3919                     | 104                          | 1.048                   | 7.22                           | 6.83                           |
| 51.0                | 52.5               | -34.5                | 1.3930                     | 105                          | 1.048                   | 7.51                           | 7.12                           |
| 52.0                | 53.5               | -35.9                | 1.3941                     | 105                          | 1.049                   | 7.82                           | 7.42                           |
| 53.0                | 54.4               | -37.3                | 1.3951                     | 105                          | 1.050                   | 8.14                           | 7.74                           |
| 54.0                | 55.4               | -38.7                | 1.3962                     | 105                          | 1.051                   | 8.48                           | 8.07                           |
| 55.0                | 56.4               | -40.3                | 1.3973                     | 105                          | 1.052                   | 8.83                           | 8.41                           |
| 60.0                | 61.4               | -48.5                | 1.4024                     | 107                          | 1.056                   | 10.8                           | 10.4                           |
| 65.0                | 66.3               | <-51                 | 1.4074                     | 108                          | 1.059                   | 13.3                           | 12.8                           |
| 70.0                | 71.2               | <-51                 | 1.4122                     | 109                          | 1.062                   | 16.5                           | 15.8                           |
| 75.0                | 76.1               | <-51                 | 1.4168                     | 111                          | 1.064                   | 20.4                           | 19.5                           |
| 80.0                | 80.9               | <-51                 | 1.4212                     | 113                          | 1.066                   | 25.4                           | 24.1                           |
| 85.0                | 85.7               | <-51                 | 1.4253                     | 116                          | 1.066                   | 31.6                           | 29.8                           |
| 90.0                | 90.5               | <-51                 | 1.4291                     | 121                          | 1.065                   | 39.5                           | 36.9                           |
| 95.0                | 95.3               | <-51                 | 1.4327                     | 129                          | 1.062                   | 49.5                           | 45.7                           |
| 100.0               | 100.0              | <-51                 | 1.4360                     | 142                          | 1.057                   | 62.3                           | 56.5                           |

† Typical properties, not to be construed as specifications.

\* Temperature-dependent physical properties are provided in the FLUIDFILE™ Software.

Generally, for an extended margin of protection you should select a temperature in this table that is at least 3°C lower than the expected lowest ambient temperature. Contact Dow for information and further assistance with specific cases.

## Product information for DOWCAL™ 100E Fluid

DOWCAL™ 100E is an ethylene glycol-based heat transfer fluid especially suitable for use in cooling applications such as pharmaceutical and specialty chemical industry.

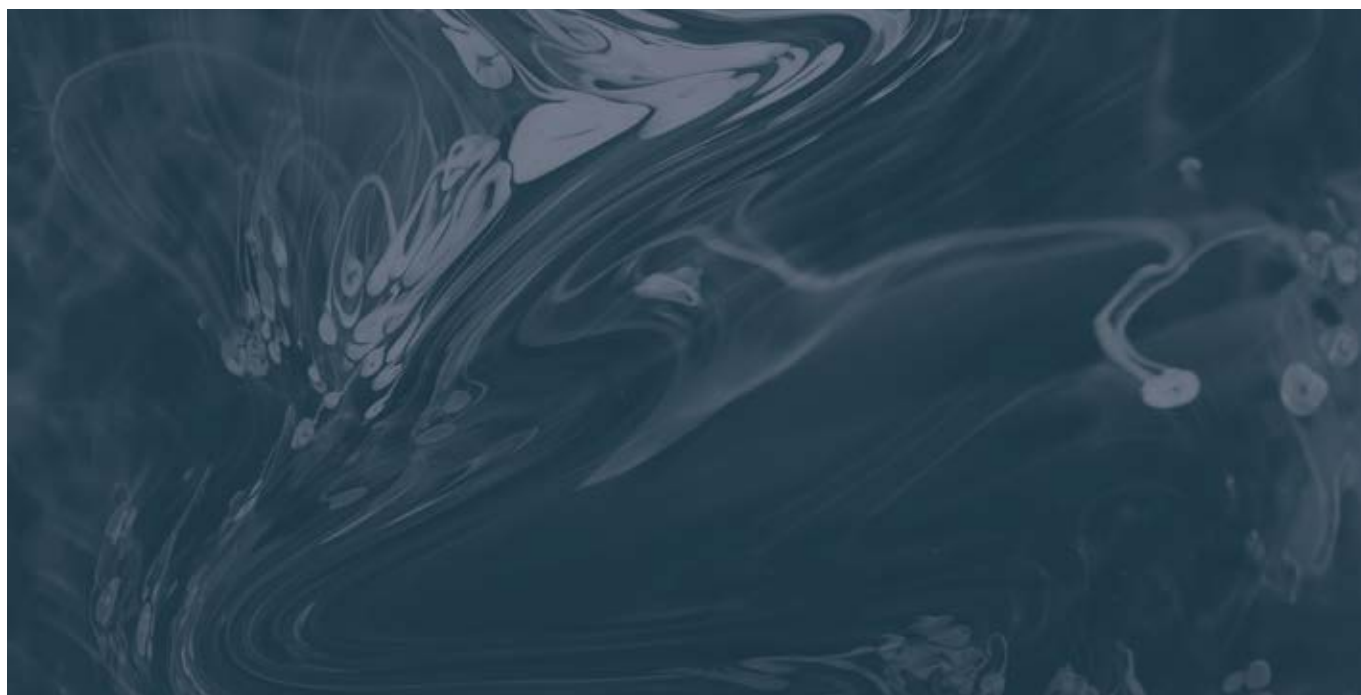
### Key benefits of DOWCAL™ 100E

- Improved corrosion protection, in particular for aluminum alloys
- Suitable for cooling, chilling and freeze protection
- Hard water stability to enable use with local tap water
- Compatible with commonly used elastomers
- Long fluid lifetime, lowering maintenance cost
- Free of borate and nitrate

### Typical properties of DOWCAL™ 100E Heat Transfer Fluid †

| Properties, test conditions                                                                                              | Units               | Values    |
|--------------------------------------------------------------------------------------------------------------------------|---------------------|-----------|
| <b>Composition:</b> <ul style="list-style-type: none"> <li>• Propylene glycol</li> <li>• Inhibitors and water</li> </ul> | %wt                 | 94<br>6   |
| Color                                                                                                                    |                     | Colorless |
| Density at 20°C                                                                                                          | g/cm <sup>3</sup>   | 1.114     |
| pH of solution                                                                                                           | (50% vol. in water) | 8.0 – 8.8 |
| Reserve alkalinity                                                                                                       | mL (0.1 N HCl)      | 9.5       |
| Freeze point (50% vol. in water)                                                                                         | °C                  | -37       |

† Typical properties not to be construed as specification, complete sales specification is available on request.



# Physical properties of DOWCAL™ 100E Fluid

Typical freezing, boiling points and other properties of DOWCAL™ 100E Fluid †\*

| DOWCAL™ 100E<br>%vol | DOWCAL™ 100E<br>%wt | Freezing point<br>°C | Refractive index<br>@ 20°C | Boiling point<br>°C @ 1 bara | Density<br>g/cm³ @ 20°C | Dyn. viscosity<br>mPa.s @ 20°C | Kin. viscosity<br>mm²/s @ 20°C |
|----------------------|---------------------|----------------------|----------------------------|------------------------------|-------------------------|--------------------------------|--------------------------------|
| 5.0                  | 5.6                 | -1.6                 | 1.3389                     | 101                          | 1.003                   | 1.23                           | 1.23                           |
| 10.0                 | 11.0                | -3.6                 | 1.3443                     | 101                          | 1.012                   | 1.40                           | 1.38                           |
| 15.0                 | 16.4                | -6.1                 | 1.3498                     | 102                          | 1.020                   | 1.59                           | 1.56                           |
| 20.0                 | 21.7                | -9.0                 | 1.3551                     | 102                          | 1.028                   | 1.82                           | 1.77                           |
| 21.0                 | 22.7                | -9.7                 | 1.3562                     | 103                          | 1.030                   | 1.87                           | 1.81                           |
| 22.0                 | 23.8                | -10.3                | 1.3573                     | 103                          | 1.032                   | 1.92                           | 1.86                           |
| 23.0                 | 24.8                | -11.0                | 1.3583                     | 103                          | 1.033                   | 1.97                           | 1.91                           |
| 24.0                 | 25.9                | -11.7                | 1.3594                     | 103                          | 1.035                   | 2.02                           | 1.96                           |
| 25.0                 | 26.9                | -12.5                | 1.3605                     | 103                          | 1.036                   | 2.08                           | 2.01                           |
| 26.0                 | 27.9                | -13.2                | 1.3615                     | 103                          | 1.038                   | 2.14                           | 2.06                           |
| 27.0                 | 29.0                | -14.0                | 1.3626                     | 103                          | 1.039                   | 2.19                           | 2.11                           |
| 28.0                 | 30.0                | -14.8                | 1.3637                     | 103                          | 1.040                   | 2.25                           | 2.17                           |
| 29.0                 | 31.0                | -15.6                | 1.3647                     | 104                          | 1.042                   | 2.32                           | 2.22                           |
| 30.0                 | 32.0                | -16.4                | 1.3658                     | 104                          | 1.043                   | 2.38                           | 2.28                           |
| 31.0                 | 33.1                | -17.2                | 1.3668                     | 104                          | 1.045                   | 2.45                           | 2.34                           |
| 32.0                 | 34.1                | -18.1                | 1.3679                     | 104                          | 1.046                   | 2.52                           | 2.41                           |
| 33.0                 | 35.1                | -19.0                | 1.3689                     | 104                          | 1.048                   | 2.59                           | 2.47                           |
| 34.0                 | 36.1                | -19.9                | 1.3699                     | 104                          | 1.049                   | 2.66                           | 2.54                           |
| 35.0                 | 37.1                | -20.8                | 1.3710                     | 104                          | 1.050                   | 2.74                           | 2.61                           |
| 36.0                 | 38.1                | -21.7                | 1.3720                     | 105                          | 1.052                   | 2.82                           | 2.68                           |
| 37.0                 | 39.1                | -22.7                | 1.3731                     | 105                          | 1.053                   | 2.90                           | 2.75                           |
| 38.0                 | 40.1                | -23.7                | 1.3741                     | 105                          | 1.054                   | 2.98                           | 2.83                           |
| 39.0                 | 41.1                | -24.7                | 1.3751                     | 105                          | 1.056                   | 3.06                           | 2.90                           |
| 40.0                 | 42.1                | -25.7                | 1.3761                     | 105                          | 1.057                   | 3.15                           | 2.98                           |
| 41.0                 | 43.1                | -26.7                | 1.3772                     | 105                          | 1.058                   | 3.24                           | 3.07                           |
| 42.0                 | 44.1                | -27.8                | 1.3782                     | 106                          | 1.059                   | 3.34                           | 3.15                           |
| 43.0                 | 45.1                | -28.9                | 1.3792                     | 106                          | 1.061                   | 3.44                           | 3.24                           |
| 44.0                 | 46.1                | -30.0                | 1.3802                     | 106                          | 1.062                   | 3.54                           | 3.33                           |
| 45.0                 | 47.1                | -31.1                | 1.3812                     | 106                          | 1.063                   | 3.64                           | 3.43                           |
| 46.0                 | 48.0                | -32.2                | 1.3823                     | 106                          | 1.064                   | 3.75                           | 3.52                           |
| 47.0                 | 49.0                | -33.4                | 1.3833                     | 106                          | 1.066                   | 3.86                           | 3.62                           |
| 48.0                 | 50.0                | -34.6                | 1.3843                     | 107                          | 1.067                   | 3.98                           | 3.73                           |
| 49.0                 | 51.0                | -35.8                | 1.3853                     | 107                          | 1.068                   | 4.10                           | 3.83                           |
| 50.0                 | 52.0                | -37.0                | 1.3863                     | 107                          | 1.069                   | 4.22                           | 3.95                           |
| 51.0                 | 52.9                | -38.2                | 1.3873                     | 107                          | 1.070                   | 4.35                           | 4.06                           |
| 52.0                 | 53.9                | -39.5                | 1.3883                     | 107                          | 1.072                   | 4.48                           | 4.18                           |
| 53.0                 | 54.9                | -40.8                | 1.3893                     | 108                          | 1.073                   | 4.62                           | 4.30                           |
| 54.0                 | 55.9                | -42.1                | 1.3902                     | 108                          | 1.074                   | 4.76                           | 4.43                           |
| 55.0                 | 56.8                | -43.4                | 1.3912                     | 108                          | 1.075                   | 4.90                           | 4.56                           |
| 60.0                 | 61.7                | -50.3                | 1.3961                     | 109                          | 1.081                   | 5.72                           | 5.29                           |
| 65.0                 | 66.5                | <-51                 | 1.4009                     | 111                          | 1.086                   | 6.70                           | 6.17                           |
| 70.0                 | 71.3                | <-51                 | 1.4056                     | 113                          | 1.091                   | 7.88                           | 7.22                           |
| 75.0                 | 76.0                | <-51                 | 1.4130                     | 115                          | 1.096                   | 9.33                           | 8.51                           |
| 80.0                 | 80.8                | <-51                 | 1.4148                     | 119                          | 1.101                   | 11.1                           | 10.1                           |
| 85.0                 | 85.6                | -50.9                | 1.4192                     | 123                          | 1.106                   | 13.4                           | 12.1                           |
| 90.0                 | 90.3                | -40.8                | 1.4236                     | 129                          | 1.111                   | 16.3                           | 14.7                           |
| 95.0                 | 95.1                | -34.5                | 1.4278                     | 136                          | 1.115                   | 20.2                           | 18.1                           |
| 100.0                | 100.0               | -28.7                | 1.4319                     | 145                          | 1.119                   | 25.7                           | 22.9                           |

† Typical properties, not to be construed as specifications.

\* Temperature-dependent physical properties are provided in the FLUIDFILE™ Software.

Generally, for an extended margin of protection you should select a temperature in this table that is at least 3°C lower than the expected lowest ambient temperature. Contact Dow for information and further assistance with specific cases.

## Product information DOWCAL™ 200E Fluid

**DOWCAL™ 200E** is a propylene glycol-based heat transfer fluid for use in a wide range of applications, including HVAC (Heating, Ventilation & Air Conditioning), freeze protection and other industrial usage. Low acute toxicity makes DOWCAL™ 200E especially suitable for applications where toxicity is a concern.

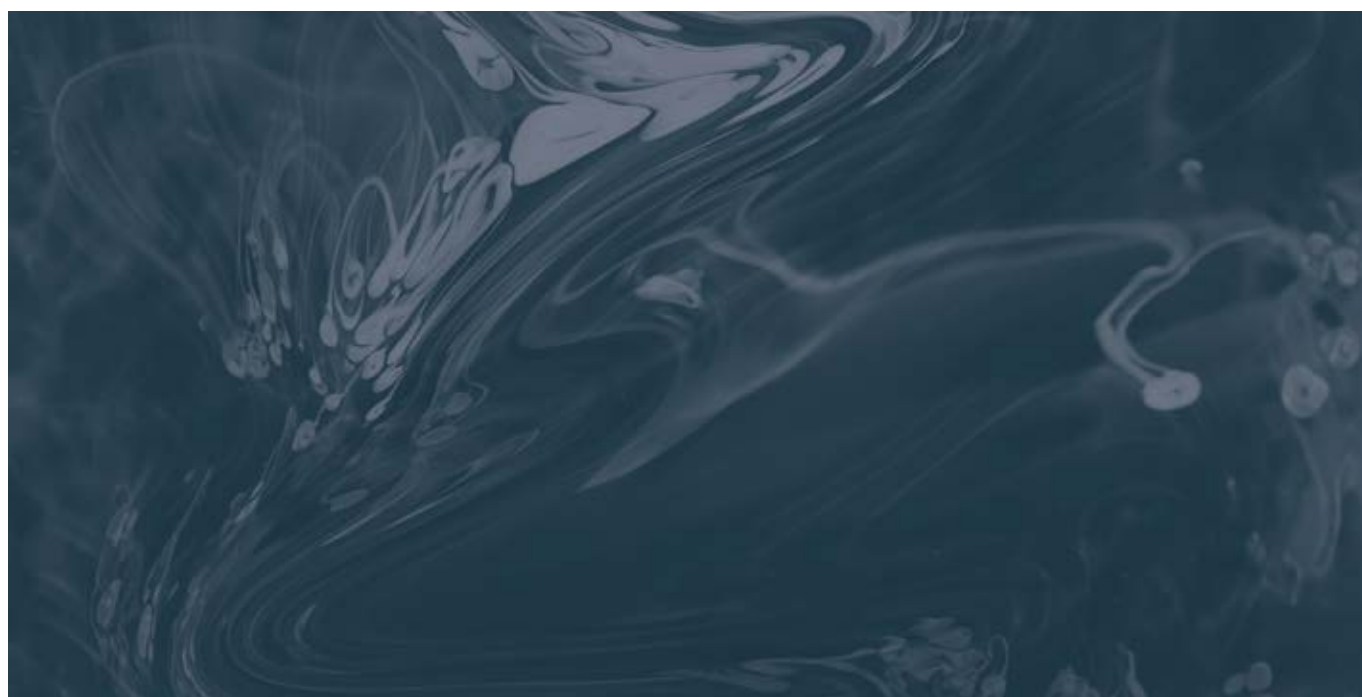
### Key benefits of DOWCAL™ 200E

- Improved corrosion protection, in particular for aluminum alloys
- Hard water stability to enable use with local tap water
- Compatible with commonly used elastomers
- Long fluid lifetime, lowering maintenance cost
- Free of borate and nitrate

### Typical properties of DOWCAL™ 200E Heat Transfer Fluid †

| Properties, test conditions                                                                                              | Units               | Values    |
|--------------------------------------------------------------------------------------------------------------------------|---------------------|-----------|
| <b>Composition:</b> <ul style="list-style-type: none"> <li>• Propylene glycol</li> <li>• Inhibitors and water</li> </ul> | %wt                 | 94<br>6   |
| Color                                                                                                                    |                     | Colorless |
| Density at 20°C                                                                                                          | g/cm <sup>3</sup>   | 1.043     |
| pH of solution                                                                                                           | (50% vol. in water) | 7.7 – 8.5 |
| Reserve alkalinity                                                                                                       | mL (0.1 N HCl)      | 9.0       |
| Freeze point (50% vol. in water)                                                                                         | °C                  | -32       |

† Typical properties not to be construed as specification, complete sales specification is available on request.



# Physical properties of DOWCAL™ 200E Fluid

Typical freezing, boiling points and other properties of DOWCAL™ 200E Fluid †\*

| DOWCAL™ 200E<br>%vol | DOWCAL™ 200E<br>%wt | Freezing point<br>°C | Refractive index<br>@ 20°C | Boiling point<br>°C @ 1 bara | Density<br>g/cm³ @ 20°C | Dyn. viscosity<br>mPa.s @ 20°C | Kin. viscosity<br>mm²/s @ 20°C |
|----------------------|---------------------|----------------------|----------------------------|------------------------------|-------------------------|--------------------------------|--------------------------------|
| 5.0                  | 5.2                 | -1.2                 | 1.3392                     | 100                          | 0.998                   | 1.25                           | 1.26                           |
| 10.0                 | 10.4                | -2.8                 | 1.3451                     | 100                          | 1.005                   | 1.51                           | 1.50                           |
| 15.0                 | 15.5                | -4.7                 | 1.3510                     | 101                          | 1.011                   | 1.82                           | 1.80                           |
| 20.0                 | 20.5                | -7.0                 | 1.3568                     | 101                          | 1.016                   | 2.19                           | 2.15                           |
| 21.0                 | 21.5                | -7.5                 | 1.3580                     | 101                          | 1.017                   | 2.27                           | 2.23                           |
| 22.0                 | 22.5                | -8.0                 | 1.3591                     | 101                          | 1.019                   | 2.36                           | 2.31                           |
| 23.0                 | 23.5                | -8.6                 | 1.3603                     | 102                          | 1.020                   | 2.45                           | 2.40                           |
| 24.0                 | 24.5                | -9.2                 | 1.3614                     | 102                          | 1.021                   | 2.54                           | 2.49                           |
| 25.0                 | 25.5                | -9.8                 | 1.3626                     | 102                          | 1.022                   | 2.64                           | 2.58                           |
| 26.0                 | 26.5                | -10.4                | 1.3637                     | 102                          | 1.022                   | 2.74                           | 5.68                           |
| 27.0                 | 27.5                | -11.0                | 1.3649                     | 102                          | 1.023                   | 2.84                           | 2.77                           |
| 28.0                 | 28.5                | -11.7                | 1.3661                     | 102                          | 1.024                   | 2.95                           | 2.88                           |
| 29.0                 | 29.5                | -12.4                | 1.3672                     | 102                          | 1.025                   | 3.06                           | 2.98                           |
| 30.0                 | 30.5                | -13.0                | 1.3683                     | 102                          | 1.026                   | 3.18                           | 3.09                           |
| 31.0                 | 31.5                | -13.8                | 1.3695                     | 102                          | 1.027                   | 3.30                           | 3.21                           |
| 32.0                 | 32.5                | -14.5                | 1.3706                     | 102                          | 1.028                   | 3.42                           | 3.33                           |
| 33.0                 | 33.4                | -15.3                | 1.3718                     | 102                          | 1.029                   | 3.55                           | 3.45                           |
| 34.0                 | 34.4                | -16.1                | 1.3729                     | 102                          | 1.030                   | 3.69                           | 3.58                           |
| 35.0                 | 35.4                | -16.9                | 1.3740                     | 102                          | 1.030                   | 3.83                           | 3.71                           |
| 36.0                 | 36.4                | -17.7                | 1.3751                     | 103                          | 1.031                   | 3.97                           | 3.85                           |
| 37.0                 | 37.4                | -18.6                | 1.3763                     | 103                          | 1.032                   | 4.12                           | 4.00                           |
| 38.0                 | 38.4                | -19.4                | 1.3774                     | 103                          | 1.033                   | 4.28                           | 4.15                           |
| 39.0                 | 39.3                | -20.4                | 1.3785                     | 103                          | 1.033                   | 4.45                           | 4.30                           |
| 40.0                 | 40.3                | -21.3                | 1.3796                     | 103                          | 1.034                   | 4.62                           | 4.46                           |
| 41.0                 | 41.3                | -22.2                | 1.3807                     | 103                          | 1.035                   | 4.79                           | 4.63                           |
| 42.0                 | 42.3                | -23.2                | 1.3818                     | 103                          | 1.036                   | 4.98                           | 4.80                           |
| 43.0                 | 43.3                | -24.2                | 1.3829                     | 103                          | 1.036                   | 5.17                           | 4.99                           |
| 44.0                 | 44.2                | -25.3                | 1.3840                     | 103                          | 1.037                   | 5.36                           | 5.17                           |
| 45.0                 | 45.2                | -26.3                | 1.3851                     | 103                          | 1.038                   | 5.57                           | 5.37                           |
| 46.0                 | 46.2                | -27.4                | 1.3862                     | 104                          | 1.038                   | 5.78                           | 5.57                           |
| 47.0                 | 47.2                | -28.5                | 1.3873                     | 104                          | 1.039                   | 6.01                           | 5.78                           |
| 48.0                 | 48.2                | -29.7                | 1.3883                     | 104                          | 1.039                   | 6.24                           | 6.00                           |
| 49.0                 | 49.1                | -30.8                | 1.3894                     | 104                          | 1.040                   | 6.48                           | 6.23                           |
| 50.0                 | 50.1                | -32.0                | 1.3905                     | 104                          | 1.040                   | 6.73                           | 6.47                           |
| 51.0                 | 51.1                | -33.3                | 1.3915                     | 105                          | 1.041                   | 6.99                           | 6.71                           |
| 52.0                 | 52.1                | -34.5                | 1.3926                     | 105                          | 1.041                   | 7.26                           | 6.97                           |
| 53.0                 | 53.0                | -35.8                | 1.3936                     | 105                          | 1.042                   | 7.54                           | 7.23                           |
| 54.0                 | 54.0                | -37.1                | 1.3947                     | 105                          | 1.042                   | 7.83                           | 7.51                           |
| 55.0                 | 55.0                | -38.5                | 1.3957                     | 105                          | 1.043                   | 8.13                           | 7.80                           |
| 60.0                 | 59.9                | -45.6                | 1.4008                     | 107                          | 1.045                   | 9.84                           | 9.42                           |
| 65.0                 | 64.8                | <-51                 | 1.4057                     | 108                          | 1.047                   | 11.9                           | 11.4                           |
| 70.0                 | 69.7                | <-51                 | 1.4104                     | 109                          | 1.048                   | 14.5                           | 13.9                           |
| 75.0                 | 74.6                | <-51                 | 1.4150                     | 111                          | 1.049                   | 17.7                           | 16.9                           |
| 80.0                 | 79.6                | <-51                 | 1.4193                     | 113                          | 1.049                   | 21.8                           | 20.7                           |
| 85.0                 | 84.6                | <-51                 | 1.4234                     | 116                          | 1.048                   | 27.0                           | 25.7                           |
| 90.0                 | 89.7                | <-51                 | 1.4272                     | 121                          | 1.047                   | 34.1                           | 32.6                           |
| 95.0                 | 94.8                | <-51                 | 1.4308                     | 129                          | 1.045                   | 45.1                           | 43.1                           |
| 100.0                | 100.0               | <-51                 | 1.4340                     | 142                          | 1.042                   | 68.9                           | 66.1                           |

† Typical properties, not to be construed as specifications.

\* Temperature-dependent physical properties are provided in the FLUIDFILE™ Software.

Generally, for an extended margin of protection you should select a temperature in this table that is at least 3°C lower than the expected lowest ambient temperature. Contact Dow for information and further assistance with specific cases.

## Product information for DOWCAL™ N Fluid

**DOWCAL™ N** is a propylene glycol-based fluid that is low in acute oral toxicity and widely used to depress freeze points in food and beverage processing and in other applications. It features a specially formulated corrosion inhibitor package.

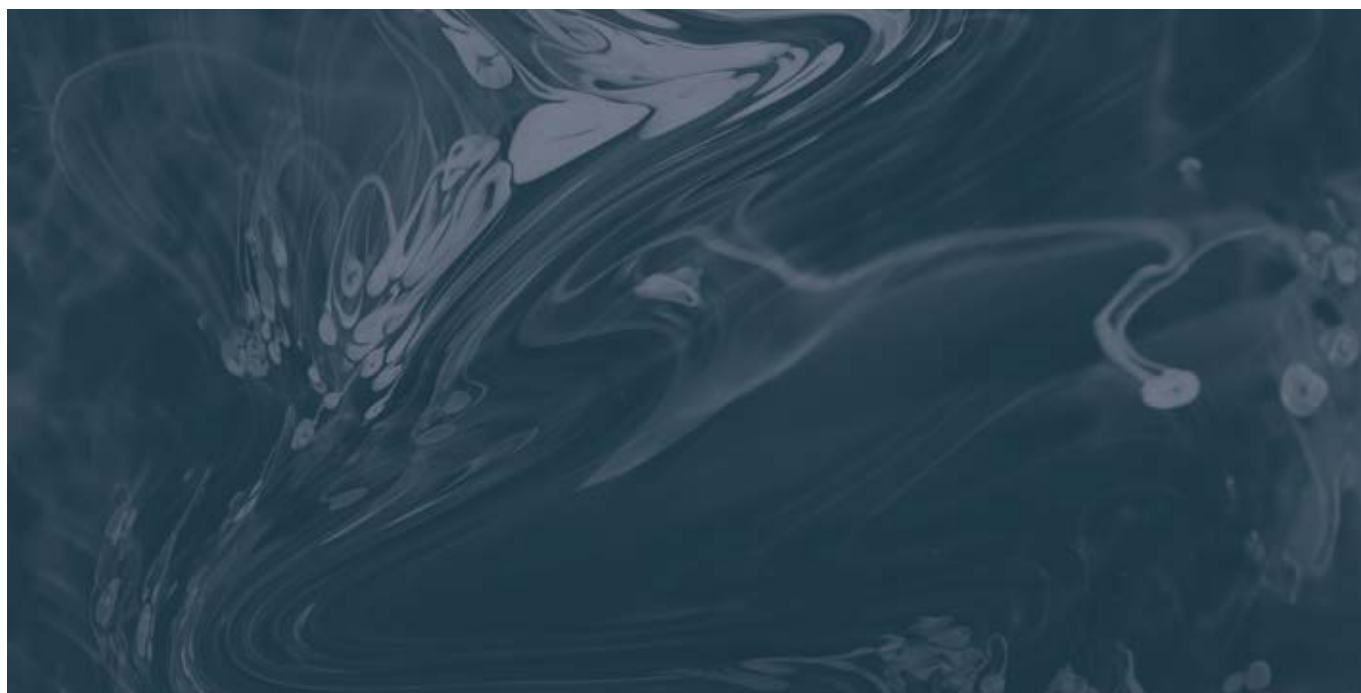
### Key benefits of DOWCAL™ N

- Better freeze protection
- Approved by the National Sanitation Foundation (NSF)
- Compatible with commonly used elastomers
- Long fluid life and low maintenance costs
- Greater cost-effectiveness
- Low acute oral toxicity

### Typical properties of DOWCAL™ N Heat Transfer Fluid †

| Properties, test conditions                                                                                              | Units               | Values      |
|--------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|
| <b>Composition:</b> <ul style="list-style-type: none"> <li>• Propylene glycol</li> <li>• Inhibitors and water</li> </ul> | %wt                 | 95.5<br>4.5 |
| Color                                                                                                                    |                     | Colorless   |
| Density at 20°C                                                                                                          | g/cm <sup>3</sup>   | 1.050       |
| pH of solution                                                                                                           | (50% vol. in water) | 9.5 – 10.5  |
| Reserve alkalinity                                                                                                       | mL (0.1 N HCl)      | 9           |
| Freeze point (50% vol. in water)                                                                                         | °C                  | -31         |

† Typical properties not to be construed as specification, complete sales specification is available on request.



# Physical properties of DOWCAL™ N Fluid

Typical freezing, boiling points and other properties of DOWCAL™ N Fluid †\*

| DOWCAL™ N<br>%vol | DOWCAL™ N<br>%wt | Freezing point<br>°C | Refractive index<br>@ 20°C | Boiling point<br>°C @ 1 bara | Density<br>g/cm³ @ 20°C | Dyn. viscosity<br>mPa.s @ 20°C | Kin. viscosity<br>mm²/s @ 20°C |
|-------------------|------------------|----------------------|----------------------------|------------------------------|-------------------------|--------------------------------|--------------------------------|
| 5.0               | 5.2              | -1.6                 | 1.3383                     | 100                          | 1.004                   | 1.2                            | 1.2                            |
| 10.0              | 10.5             | -3.3                 | 1.3438                     | 100                          | 1.009                   | 1.4                            | 1.4                            |
| 15.1              | 15.7             | -5.1                 | 1.3495                     | 100                          | 1.014                   | 1.6                            | 1.6                            |
| 20.3              | 20.9             | -7.1                 | 1.3555                     | 101                          | 1.020                   | 2.0                            | 2.0                            |
| 21.3              | 22.0             | -7.6                 | 1.3567                     | 101                          | 1.021                   | 2.0                            | 2.0                            |
| 22.4              | 23.0             | -8.0                 | 1.3579                     | 101                          | 1.022                   | 2.1                            | 2.1                            |
| 23.4              | 24.1             | -8.6                 | 1.3591                     | 101                          | 1.023                   | 2.2                            | 2.2                            |
| 24.5              | 25.1             | -9.1                 | 1.3603                     | 101                          | 1.023                   | 2.3                            | 2.2                            |
| 25.5              | 26.2             | -9.6                 | 1.3615                     | 101                          | 1.024                   | 2.4                            | 2.3                            |
| 26.5              | 27.2             | -10.2                | 1.3627                     | 101                          | 1.025                   | 2.5                            | 2.4                            |
| 27.6              | 28.3             | -10.8                | 1.3639                     | 101                          | 1.026                   | 2.6                            | 2.5                            |
| 28.6              | 29.3             | -11.4                | 1.3651                     | 102                          | 1.027                   | 2.7                            | 2.6                            |
| 29.7              | 30.4             | -12.0                | 1.3663                     | 102                          | 1.028                   | 2.9                            | 2.8                            |
| 30.7              | 31.4             | -12.7                | 1.3675                     | 102                          | 1.029                   | 3.0                            | 2.9                            |
| 31.8              | 32.5             | -13.4                | 1.3687                     | 102                          | 1.030                   | 3.1                            | 3.0                            |
| 32.8              | 33.5             | -14.1                | 1.3698                     | 102                          | 1.031                   | 3.3                            | 3.2                            |
| 33.9              | 34.6             | -14.8                | 1.3710                     | 102                          | 1.032                   | 3.4                            | 3.3                            |
| 35.0              | 35.6             | -15.6                | 1.3721                     | 102                          | 1.032                   | 3.5                            | 3.4                            |
| 36.0              | 36.6             | -16.4                | 1.3733                     | 103                          | 1.033                   | 3.7                            | 3.6                            |
| 37.1              | 37.7             | -17.3                | 1.3744                     | 103                          | 1.034                   | 3.9                            | 3.8                            |
| 38.2              | 38.7             | -18.2                | 1.3756                     | 103                          | 1.035                   | 4.0                            | 3.9                            |
| 39.2              | 39.8             | -19.1                | 1.3767                     | 103                          | 1.036                   | 4.2                            | 4.1                            |
| 40.3              | 40.8             | -20.1                | 1.3779                     | 103                          | 1.036                   | 4.4                            | 4.2                            |
| 41.4              | 41.9             | -21.1                | 1.3790                     | 104                          | 1.037                   | 4.5                            | 4.3                            |
| 42.4              | 42.9             | -22.1                | 1.3802                     | 104                          | 1.038                   | 4.7                            | 4.5                            |
| 43.5              | 44.0             | -23.2                | 1.3813                     | 104                          | 1.039                   | 4.8                            | 4.6                            |
| 44.5              | 45.0             | -24.3                | 1.3825                     | 104                          | 1.039                   | 5.0                            | 4.8                            |
| 45.7              | 46.1             | -25.5                | 1.3836                     | 104                          | 1.040                   | 5.2                            | 5.0                            |
| 46.7              | 47.1             | -26.7                | 1.3847                     | 104                          | 1.041                   | 5.4                            | 5.2                            |
| 47.8              | 48.2             | -27.9                | 1.3858                     | 104                          | 1.041                   | 5.6                            | 5.4                            |
| 48.9              | 49.2             | -29.3                | 1.3870                     | 104                          | 1.042                   | 5.8                            | 5.6                            |
| 50.0              | 50.3             | -30.6                | 1.3881                     | 105                          | 1.043                   | 6.1                            | 5.8                            |
| 51.1              | 51.3             | -32.1                | 1.3892                     | 105                          | 1.043                   | 6.3                            | 6.0                            |
| 52.2              | 52.4             | -33.5                | 1.3903                     | 106                          | 1.044                   | 6.6                            | 6.3                            |
| 53.2              | 53.4             | -35.0                | 1.3914                     | 106                          | 1.045                   | 6.9                            | 6.6                            |
| 54.3              | 54.5             | -36.6                | 1.3924                     | 106                          | 1.045                   | 7.2                            | 6.9                            |
| 55.4              | 55.5             | -38.2                | 1.3935                     | 106                          | 1.046                   | 7.6                            | 7.3                            |
| 60.6              | 60.7             | -47.1                | 1.3987                     | 107                          | 1.048                   | 9.3                            | 8.9                            |
| 61.7              | 61.8             | -49.0                | 1.3998                     | 107                          | 1.049                   | 9.7                            | 9.2                            |
| 62.7              | 62.8             | -51.0                | 1.4008                     | 107                          | 1.049                   | 10.0                           | 9.5                            |
| 68.0              | 68.1             | -51.0                | 1.4058                     | 108                          | 1.052                   | 11.7                           | 11.1                           |
| 73.2              | 73.3             | -51.0                | 1.4104                     | 110                          | 1.054                   | 14.2                           | 13.5                           |
| 78.4              | 78.5             | -51.0                | 1.4150                     | 114                          | 1.055                   | 17.1                           | 16.2                           |
| 83.6              | 83.8             | -51.0                | 1.4193                     | 118                          | 1.054                   | 21.2                           | 20.1                           |
| 88.9              | 89.0             | -51.0                | 1.4235                     | 125                          | 1.053                   | 26.0                           | 24.7                           |
| 94.1              | 94.2             | -51.0                | 1.4275                     | 132                          | 1.052                   | 33.4                           | 31.7                           |
| 100.0             | 100.0            | -51.0                | 1.4320                     | 165                          | 1.051                   | 35.7                           | 34.0                           |

† Typical properties, not to be construed as specifications.

\* Temperature-dependent physical properties are provided in the FLUIDFILE™ Software.

Generally, for an extended margin of protection you should select a temperature in this table that is at least 3°C lower than the expected lowest ambient temperature. Contact Dow for information and further assistance with specific cases.

# DOWCAL™ Fluids

## Inhibited glycol-based heat transfer fluids

Guide to products and application



Seek Together™

### About Dow

Dow (NYSE: DOW) combines global breadth; asset integration and scale; focused innovation and materials science expertise; leading business positions; and environmental, social and governance (ESG) leadership to achieve profitable growth and deliver a sustainable future. The Company's ambition is to become the most innovative, customer centric, inclusive and sustainable materials science company in the world. Dow's portfolio of plastics, industrial intermediates, coatings and silicones businesses delivers a broad range of differentiated, science-based products and solutions for its customers in high-growth market segments, such as packaging, infrastructure, mobility and consumer applications. Dow operates 104 manufacturing sites in 31 countries and employs approximately 35,700 people. Dow delivered sales of approximately \$55 billion in 2021. References to Dow or the Company mean Dow Inc. and its subsidiaries. For more information, please visit [www.dow.com](http://www.dow.com) or follow [@DowNewsroom](https://twitter.com/DowNewsroom) on Twitter.

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