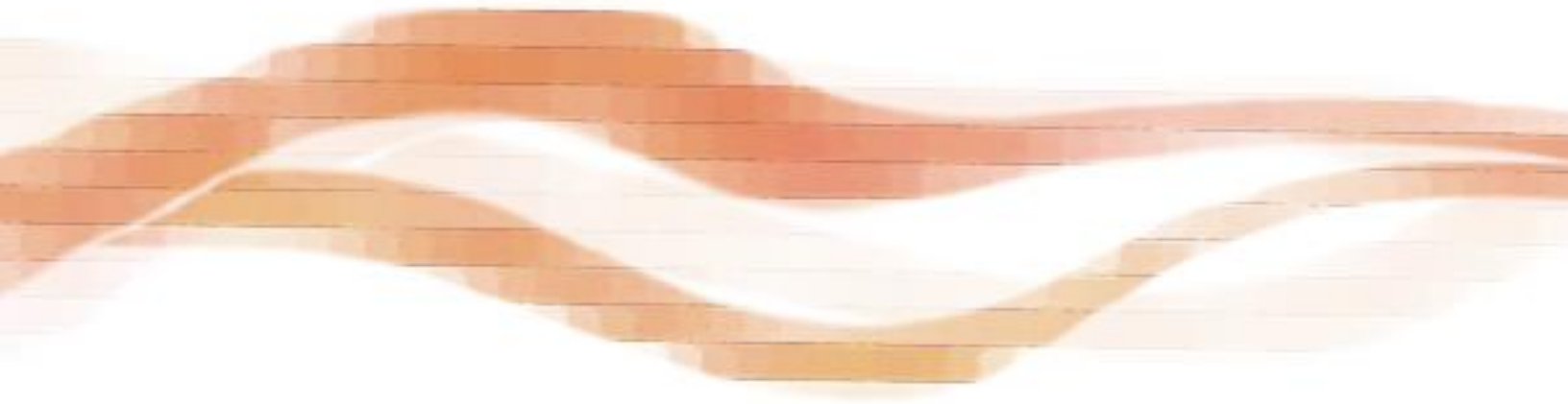
Dynalene Ethylene Glycol Series

engineering guide



DYNALENE

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Contents

Product Overview

This engineering guide provides operating guidelines, product information, and engineering data for the Dynalene ethylene glycol series of heat transfer fluids. Dynalene ethylene glycols are intended for use in secondary heating and cooling applications, burst and freeze protection of pipes, and various deicing and snow melting systems.

Dynalene ethylene glycol coolants are blended with specially formulated Dynalene additive packages depending on your system's specifications. These packages provide superior corrosion protection for steel, brass, copper, and other metals, as well as extend the long-term life of the coolant due to the additive's excellent buffering capacity. This buffer allows the coolant to maintain stable pH levels after years of use by minimizing acidic breakdown and neutralizing contaminants that are present in your system.

Dynalene offers four different ethylene glycol blends, each with its own specific advantages depending on the process it is used in and which metals and materials the fluid will be contacting. These products are Dynalene EG, Dynalene EG-XT, Dynalene EG-V1, and Dynalene Raw EG. All Dynalene ethylene glycol products can be blended to any concentration, sold as a concentrate, or customized based on the requirement of the customer (dye, pH, inhibitor, packaging, etc.).

Dynalene EG Series

Dynalene offers the following four ethylene glycol-based heat transfer fluids:

Dynalene EG -60°F to 250°F

Inhibited ethylene glycol

Dynalene EG is an inhibited technical-grade ethylene glycol-based coolant used in industrial applications. It is blended with Dynalene's PE-1 inhibitor package for pH stability, inhibiting corrosion in steel, brass, copper, and other metals, and reducing thermal breakdown at high temperatures. It is nearly odorless, has moderate acute oral toxicity, and is non-flammable in solutions of up to 80% ethylene glycol. Dynalene EG offers excellent freeze and burst protection down to -60°F while maintaining high heat transfer performance.

Dynalene EG-XT -60°F to 350°F

High temperature inhibited ethylene glycol

Dynalene EG-XT is designed for systems with operating temperatures that exceed those of Dynalene EG. It uses a specially formulated additive package that minimizes thermal breakdown by neutralizing organic acids that are produced when glycols are exposed to high temperatures. Dynalene EG-XT can be used in solar applications, inline heaters, boiler systems, molding/casting, and other processes up to 350°F.

Dynalene EG-V1 -60°F to 194°F

Inhibited ethylene glycol for aluminum systems

Dynalene EG-V1 is designed for systems containing significant amounts of aluminum. Radiators, heat exchangers, and fins that are constructed out of aluminum can be further protected from corrosion by using Dynalene's V1 inhibitor package. Due to its high reserve alkalinity, EG-V1 also offers excellent protection for steel, brass, copper, and other materials of construction.

Dynalene Raw EG -60°F to 250°F

> 99.5% ethylene glycol with no additives

Dynalene offers pure ethylene glycol that is available in technical grade.

Table 1. Typical properties of Dynalene ethylene glycol solutions.

Composition	Ethylene glycol, inhibitors
Color	Clear, light yellow
Odor	Little or none

	Dynalene EG	Dynalene EG-XT	Dynalene EG-V1	Dynalene Raw EG
pH	8.0 – 9.0	8.5 – 10.0	10.0 – 11.0	6.0 – 8.0
Reserve Alkalinity	>10.5 mL	>25.0 mL	>10.5 mL	0 mL
Operating Range	-60 to 250°F	-60 to 350°F	-60 to 194°F	-60 to 250°F
Flash Point	None	None	None	None

Ethylene vs Propylene Glycol

Dynalene offers both ethylene glycol and propylene glycol-based coolants. When choosing which glycol to use, there are a few important factors to consider. Ethylene glycol-based coolants are less viscous than propylene glycol-based coolants, therefore ethylene glycol will provide better heat transfer than propylene glycol across the entire temperature range, as depicted in Figure 1 below. However, when toxicity is a concern, such as with food applications or where contact with drinking water is possible, propylene glycol is used because it has a lower acute oral toxicity compared to ethylene glycol. It is important to identify any toxicity concerns that could be associated with your system prior to installing ethylene glycol.

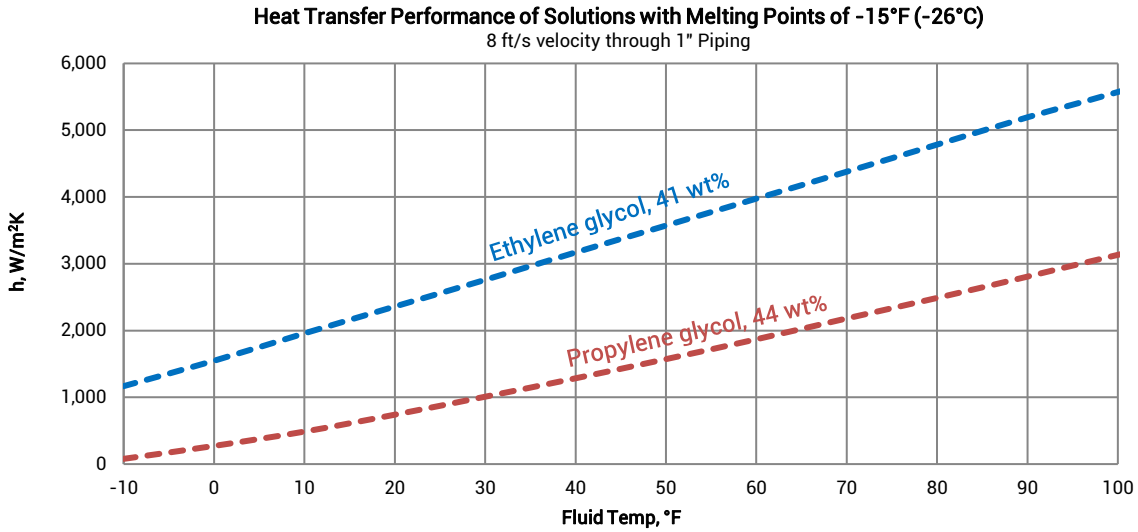

Figure 1. Heat transfer performance comparison of propylene glycol and ethylene glycol solutions.

Freeze and Burst Protection

The concentration of glycol required in the heat transfer fluid depends on the lowest operating temperature of your system and the coldest environmental conditions the fluid will experience. As the temperature of the glycol solution drops below its freezing point, ice crystals begin to form and precipitate out into the fluid. The liquid glycol solution becomes further concentrated with glycol and remains fluid. Ice occupies a larger specific volume than water, and as more slush forms the glycol slurry expands in the system provided there is an expansion reservoir where the slurry can flow into. If an adequate amount of glycol is included in the heat transfer fluid, damage should not occur to system exponents during this expansion. This is important for systems that remain dormant during winter shutdown where there is potential for the temperature to drop below the glycol solution's freezing point. This is known as "burst protection." Table 2 gives Dynalene's recommendations for sufficient burst protection using Dynalene ethylene glycols.

"Freeze protection" is required in closed systems where there is inadequate expansion volume available to accommodate the slush formation. With freeze protection, no ice crystals can be permitted to form and the fluid must be pumped at the lowest operating temperature. Systems that shut down during the winter but need to start up again when the weather is still cold may require freeze protection. For optimal freeze protection, Dynalene recommends a glycol solution that can maintain a freezing point of at least 10°F below the lowest anticipated temperature. See Table 2 for Dynalene ethylene glycol freezing points for various concentrations.

Selecting the Right Concentration

Glycols are generally mixed with water to form solutions to increase the heat transfer performance of the fluid. Water has a lower viscosity, higher thermal conductivity, and higher heat capacity than pure glycol, so solutions with lower glycol concentrations will have superior heat transfer performance than solutions with higher glycol concentrations. However, in situations where low temperature freeze protection is necessary, higher glycol concentrations must be used. To determine what percentage of glycol your application requires for freeze protection, identify the lowest possible temperature the fluid will be exposed to and select a solution with a freezing point 10°F below your lowest anticipated temperature. Table 2 provides Dynalene ethylene glycol freezing points, burst points, boiling points, and specific gravities for various concentrations.

Table 2. Freezing points, burst points, boiling points, and specific gravities of Dynalene ethylene glycol solutions.

Vol% Ethylene Glycol	Wt% Ethylene Glycol	Freezing Point °F	Freezing Point °C	Burst Point °F	Burst Point °C	Boiling Point °F	Specific Gravity (22°C)
0	0	32	0.0	32	0.0	212	1.000
5	5.6	29	-1.7	27	-2.7	213	1.008
10	11.2	26	-3.3	23	-4.9	214	1.020
15	16.6	22	-5.5	17	-8.6	215	1.026
20	22.0	16	-8.5	8	-13.2	216	1.033
21	23.0	15	-8.9	6	-14.3	217	1.035
22	24.1	14	-10.0	4	-15.4	217	1.036
23	25.2	13	-10.5	2	-16.5	218	1.037
24	26.2	11	-11.7	0	-17.6	218	1.039
25	27.3	10	-12.2	-2	-18.8	218	1.040

(Table continued from page 4)

Vol% Ethylene Glycol	Wt% Ethylene Glycol	Freezing Point °F	Freezing Point °C	Burst Point °F	Burst Point °C	Boiling Point °F	Specific Gravity (22°C)
26	28.4	9	-12.8	-4	-20.1	219	1.041
27	29.4	8	-13.3	-6	-21.4	219	1.042
28	30.5	6	-14.4	-9	-22.7	220	1.044
29	31.5	5	-15.0	-11	-24.0	220	1.045
30	32.6	4	-15.6	-14	-25.4	220	1.047
31	33.6	3	-16.1	-16	-26.8	220	1.048
32	34.7	1	-17.2	-20	-28.9	220	1.049
33	35.7	0	-17.8	-25	-31.7	221	1.050
34	36.7	-2	-18.9	-33	-36.1	221	1.052
35	37.7	-3	-19.4	-45	-42.8	221	1.053
36	38.8	-5	-20.6	-60	-51.1	221	1.054
37	39.8	-7	-21.7	-60	-51.1	222	1.056
38	40.8	-9	-22.8	-60	-51.1	222	1.057
39	41.9	-11	-23.9	-60	-51.1	222	1.058
40	42.9	-13	-25.0	-60	-51.1	223	1.060
41	43.9	-15	-26.1	-60	-51.1	223	1.061
42	44.9	-17	-27.2	-60	-51.1	224	1.062
43	46.0	-19	-28.3	-60	-51.1	224	1.064
44	47.0	-21	-29.4	-60	-51.1	224	1.065
45	48.0	-24	-31.1	-60	-51.1	224	1.066
46	49.0	-26	-32.2	-60	-51.1	224	1.068
47	50.0	-29	-33.9	-60	-51.1	225	1.069
48	51.0	-31	-35.0	-60	-51.1	225	1.070
49	52.0	-33	-36.1	-60	-51.1	225	1.072
50	53.0	-36	-37.8	-60	-51.1	226	1.073
51	54.0	-38	-38.9	-60	-51.1	226	1.074
52	55.0	-42	-41.1	-60	-51.1	227	1.076
53	56.0	-44	-42.2	-60	-51.1	227	1.077
54	57.0	-47	-43.9	-60	-51.1	228	1.078
55	57.9	-50	-45.6	-60	-51.1	228	1.081
56	58.9	-52	-46.7	-60	-51.1	229	1.082
57	59.9	-54	-47.8	-60	-51.1	230	1.083
58	60.9	-56	-48.9	-60	-51.1	230	1.084
59	61.9	< -60	< -51.1	-60	-51.1	231	1.085
60	62.8	< -60	< -51.1	-60	-51.1	232	1.086
65	67.9	< -60	< -51.1	-60	-51.1	237	1.093
70	72.4	< -60	< -51.1	-60	-51.1	244	1.100
75	77.2	< -60	< -51.1	-60	-51.1	251	1.106
80	81.8	-52	-46.7			263	1.110
90	91.0	-20	-28.9			290	1.118
100	100	2	-16.7			317	1.127

System Preparation

New Systems

Newly constructed systems typically contain residual amounts of metal debris, machine oil, lubricant, flux, solder, dirt, and other general pipe scale. It is important to remove most films and particulates prior to installing Dynalene ethylene glycol. Unremoved contaminants can degrade the quality of the fluid and metal components over time. Systems should be thoroughly rinsed with either distilled water or soft tap water (see section 'Solution Preparation' regarding the effects of hard water) until the rinse fluid runs clear. It is strongly recommended to not use heavily chlorinated tap water. Dynalene also offers a flushing fluid, DynaFlush, that will remove debris, scale, and residual oils in the system that water cannot remove. DynaFlush will also remove remaining salts and minerals, such as chlorides and sulfates, from the system interior.

An effective procedure for cleaning new systems is as follows:

1. Rinse with water for at least 1 hour, or until a sample of rinse water is free of debris. If significant amounts of particulates remain, drain water, charge with fresh water, and repeat until most contaminants are removed.
2. Rinse with DynaFlush for at least 1 hour, then drain.
3. Rinse with distilled or deionized water for at least 1 hour, then drain.
4. (Optionally) Purge the existing system with compressed air or an inert gas such as nitrogen, until there is no more fluid leaving the system. Build up a small amount of pressure with the purging gas, then disrupt to zero pressure several times until all residual fluid is removed. This is also an ideal time to check for system leaks using a soapy solution applied to joints and fittings.
5. Install Dynalene ethylene glycol.

If the exact volume of the system is unknown, fresh water can be metered or measured into the system until it is full. In most cases, the cleaning and rinsing procedure can result in a hold up of water in places like heat exchangers, reservoirs, pump housings, elbows, etc. Thus, after initially installing Dynalene ethylene glycol, the concentration may be slightly diluted. Concentration can be checked on-site using a handheld refractometer or hydrometer (see Table 2 for density) and can be adjusted using Dynalene Raw EG. After circulation it is recommended to send a fluid sample to Dynalene to check for concentration, inhibitor amount, and other chemical analysis if needed.

Dynalene ethylene glycols should remain free of debris throughout the operational life of the liquid. Entrained sediment and other solid contaminants accelerate erosion and corrosion, lowering the threshold velocities at which erosion begins to occur. In the case of very low velocities, sediment is deposited in high fouling areas (tubes, tank bottoms, etc.) and may increase localized corrosion. An appropriately sized in-line strainer assembly using a perforation size (1/32") or smaller is recommended to be installed directly in the flow of fluid to allow the most effective particulate removal from the fluid. Providing filtration down to approximately 5 microns nominal, combined with an in-line strainer as a pre-filter, is the best method of conditioning Dynalene ethylene glycols. Strainer/filtration equipment that bypasses the main system can be installed for systems that cannot be interrupted to change filter cartridges.

Retrofitting Systems

Existing systems may contain rust, scale, and debris which must be removed and cleaned before installing Dynalene ethylene glycols. If the previous heat transfer fluid was either glycol or aqueous-based, several rinses with water should remove almost all residual heat transfer fluid. Dynalene recommends testing the previous heat transfer fluid used in the system in order to determine the best method of cleaning. Small amounts of clean, non-ionic flush water that remain in the system are acceptable if free from contaminants. Performing analytical tests on the flush water to detect traces of residual heat transfer fluid is the recommended method of determining the effectiveness of

the procedure. Flush water that may be contaminated should be disposed in accordance with local, state and federal regulations.

The following methods are useful for removing residual heat transfer fluids before installing Dynalene ethylene glycols:

1 **System Evacuation**
System evacuation is usually performed for volatile heat transfer fluids. Residual fluid is removed by creating a vacuum, usually more than 28”Hg within the existing system. As the vacuum within the system increases, the boiling point of the residual liquid will decrease resulting in evaporation. The intent is to evaporate the residual liquid completely by lowering its boiling point to below the internal temperature of the system.

2 **Air and Inert Gas Evaporation**
For volatile heat transfer fluids, evaporation using air or inert gas may be another method of removing residual fluid from an existing piping system. This is performed by allowing warm compressed air or nitrogen to enter the existing system and flow through the wetted areas, including low points. The intent is to evaporate the residual fluid and allow the effluent to exit the system at a point that is generally opposite to the inlet air or inert gas connection.

3 **Dilution**
Dilution of residual fluid can be performed in conjunction with the system evacuation or evaporation methods. Dilution of the residual fluid can be performed by selecting a dilution solvent that is miscible with the residual fluid and has a high vapor pressure.

After diluting the residual fluid with the solvent, drain and follow either step 1 or 2.

If corrosion is severe, an acid wash followed by a neutralization with DynaFlush will remove scale and rust and prep the system before installing Dynalene ethylene glycols. Consult a Dynalene representative regarding this flushing procedure.

Solution Preparation

Good quality water must be used if diluting Dynalene EG. Dynalene recommends using distilled or deionized water to maximize the performance of the fluid and system, but in cases where distilled or deionized water cannot be used, tap water is also acceptable provided it meets minimum standards for purity. Hard minerals and salts in dilution water can increase metal corrosion, cause formation of scale and deposits, interfere with inhibitor protection, and clog system components. In areas where only very hard water is available and where total hardness is above 100 ppm, Dynalene offers prediluted solutions of Dynalene EG. Chloride and sulfate content in dilution water should each be below 25 ppm to minimize corrosion potential.

If mixing on-site, a handheld refractometer or hydrometer can be used to check the Dynalene EG concentration. Concentration can be adjusted after circulating in your system using undiluted Dynalene EG. Dynalene offers handheld refractometers and hydrometers at dynalene.com.

Dynalene EG solutions can be mixed either by weight or volume using the conversions in Table 2. Determine the total system volume, either from design calculations or metering in water until it is observed the system is full. Drain the water and load in the correct amount of glycol solution. After circulation, check the glycol concentration to determine if there needs to be any adjustment.

General Installation Guidelines

The following recommendations are provided to assist the Dynalene ethylene glycol fluid installer in achieving a simple and safe installation. Always refer to component manufacturer's installation guidelines when initially setting up your system.

1 **Consult with Dynalene**
Every system is different. Dynalene recommends talking to one of the Dynalene experts for specific system needs.

2 **The Manual**
Prior to purchasing Dynalene ethylene glycols, review and understand all of the information contained in this manual

3 **Presence of Air Bubbles in the Fluid**
It is always recommended to eliminate the presence of air bubbles in your system to prevent foaming, corrosion, and pump cavitation. Bleeder valves and air separators can be used to remove air bubbles during circulation.

4 **Maximum Surface Temperature**
Surface temperature of heat source components in systems using Dynalene EG, EG-V1, or Raw EG should not exceed 300°F (400°F for Dynalene EG-XT). Fluid velocity should be maintained between 4 to 8 ft/sec to reduce overheating of the heater walls.

5 **Using Electric Resistance Heaters**
In-line electric resistance heaters used in Dynalene ethylene glycol systems should not exceed a maximum watt density of 45 W/in^2 with a minimum fluid velocity of 6 to 8 ft/sec. Watt density not exceeding 30 W/in^2 is recommended for direct tank immersion electric resistance heater applications.

Ensure electrical connections are properly contained and kept away from splash or spill areas. If there is a thermal contact between the cold surface and electrical connection, there may be condensation resulting in short circuiting.

6 **Materials of Construction**
Steel, brass, bronze, copper, cast iron, and most plastic piping materials are acceptable. Galvanized steel is not recommended with inhibited Dynalene ethylene glycols as the zinc coating will react with the inhibitors in the fluid, causing precipitation (and depletion) of the inhibitor and removal of the protective zinc surface. If there is a significant amount of aluminum in the system, Dynalene EG-V1 should be used. Valves and fittings can also be made of bronze, brass, steel, or cast iron.

Any plastic that is compatible with uninhibited ethylene glycol can be used with Dynalene EG throughout the material's operating range. Plastics such as PEX, HDPP, HDPE, LDPE, EPDM, Buna-N, Viton, and PTFE are acceptable for use. Please contact Dynalene about using Dynalene EG with PVC or CPVC.

As in all systems using different metals, galvanic corrosion can occur if dissimilar metals are near or contacting each other. To prevent galvanic corrosion it is important to monitor the Dynalene EG inhibitor concentration over the life of the fluid.

7 **Pump Equipment**
Centrifugal pumps are commonly used with Dynalene ethylene glycols. Gear, reciprocating, and other positive displacement pumps are also acceptable. Steel, brass, bronze, copper, cast iron, and most plastic piping materials used in pump equipment are acceptable. The same mechanical seals and packing used for water may be used with Dynalene ethylene glycols, however it is always recommended to consult the seal, packing, and pump manufacturers regarding high (above 150°F) or low (below 32°F) operating temperatures.

8 Volumetric Expansion

Volumetric expansion and/or contraction of Dynalene ethylene glycols must be taken into consideration when calculating the overall fluid volume within the entire system. For systems with large temperature ranges, consider using an expansion tank. Refer to the volumetric expansion in Table 3.

Table 3. Volumetric expansion, in %, of Dynalene ethylene glycol solutions vs temperature.

Temp	% Volumetric Expansion								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
-30									-2.53
-20							-2.20	-2.26	-2.33
-10							-1.99	-2.04	-2.10
0					-1.66	-1.71	-1.77	-1.82	-1.86
10			-1.35	-1.40	-1.45	-1.50	-1.55	-1.58	-1.63
20	-1.05	-1.10	-1.16	-1.19	-1.23	-1.26	-1.31	-1.33	-1.37
30	-0.85	-0.89	-0.94	-0.97	-1.00	-1.03	-1.06	-1.08	-1.12
40	-0.65	-0.69	-0.73	-0.74	-0.76	-0.79	-0.81	-0.82	-0.84
50	-0.45	-0.46	-0.49	-0.50	-0.52	-0.53	-0.55	-0.57	-0.61
60	-0.23	-0.25	-0.26	-0.26	-0.25	-0.27	-0.28	-0.28	-0.29
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80	0.25	0.26	0.26	0.27	0.28	0.28	0.28	0.29	0.29
90	0.49	0.51	0.52	0.54	0.57	0.58	0.58	0.59	0.60
100	0.74	0.77	0.79	0.83	0.85	0.88	0.89	0.91	0.92
120	1.28	1.33	1.38	1.43	1.47	1.50	1.52	1.55	1.57
140	1.87	1.93	1.99	2.05	2.11	2.15	2.20	2.24	2.27
160	2.49	2.58	2.64	2.73	2.80	2.85	2.91	2.95	2.99
180	3.14	3.25	3.34	3.44	3.52	3.58	3.64	3.69	3.74
200	3.83	3.95	4.07	4.18	4.27	4.34	4.41	4.49	4.54
220	4.58	4.71	4.83	4.95	5.06	5.14	5.22	5.29	5.36

9 Reservoir Tank

Purging and eliminating air from the headspace above the Dynalene ethylene glycol in the reservoir tank is recommended. Return fluid piping should enter a storage tank below the Dynalene ethylene glycol fluid surface to prevent foaming, air entrapment, and bubbles. Air bubbles can contribute to the damaging effects such as erosion, corrosion, and loss of heat transfer.

10 Pressure Relief Valve Considerations

Pressure relief valves should be cleaned of residue to prevent clogging or sticking if Dynalene ethylene glycol is released through the valve.

Valve Sizing: Relief valve sizing depends on whether the valve is located to relieve liquid or vapor from Dynalene ethylene glycols. Regarding liquid, the relief valves should be sized using the Dynalene ethylene glycol liquid properties to permit sufficient liquid volumetric flow to match or exceed the maximum possible pressure building volume rate increase in the system. If the relief temperature is above the fluid saturated vapor temperature for the discharge pressure, flashing will occur and relief valve must be sized for two-phase flow. Dynalene vapor is primarily water (steam). The latent heat of water should be used to calculate flashing.

11 Dynalene Ethylene Glycol Quality Check

Dynalene recommends a sample to be sent to Dynalene for a quality inspection immediately after system startup. Sample intervals will be based on the results of that inspection and the customer's needs. Sample kits are available from Dynalene which contain a sample bottle and label, sampling instructions, MSDS, and shipping documentation to return the sample to Dynalene for testing. Often residual flushing water left in the system can dilute the Dynalene ethylene glycol fluid, in which case Dynalene will recommend how to readjust the concentration. Representative samples of Dynalene ethylene glycol should be obtained from an active liquid stream.

If the samples cannot be obtained from an active liquid stream at room temperature, locate a collection container that is clean, and its materials of construction are compatible with Dynalene ethylene glycols. Obtain a sample from an area within the active system and allow the liquid to achieve room temperature before packaging.

Vapor Pressure

Vapor pressure is a critical property to be considered when calculating Net Positive Suction Head (NPSH). It is important to provide sufficient head pressure above the pump to prevent local boiling and cavitation in the pump when operating at higher temperatures. Refer to the pump specifications and determine the necessary head pressure your pump requires. Glycols have higher boiling points and lower vapor pressures than those of pure water, and higher glycol concentrations will result in lower vapor pressures. The vapor pressures for Dynalene ethylene glycol are given in Table 4. It is recommended to be used in airtight systems when operating at elevated temperatures to maintain liquid phase.

Table 4. Vapor pressures of Dynalene ethylene glycol solutions.

Temp	Vapor Pressure, psia								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
100	0.9	0.9	0.8						
110	1.2	1.2	1.1	1.1	1.0				
120	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.2	1.1
130	2.0	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.5
140	2.7	2.6	2.5	2.5	2.4	2.3	2.2	2.1	2.0
150	3.5	3.4	3.3	3.2	3.1	3.1	2.8	2.6	2.6
160	4.4	4.3	4.2	4.1	3.9	3.8	3.6	3.5	3.3
170	5.6	5.5	5.3	5.2	5.0	4.8	4.6	4.4	4.2
180	7.0	6.6	6.2	6.3	6.3	6.1	5.8	5.6	5.3

(Table continued from page 10)

Temp	Vapor Pressure, psia								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
190	8.7	8.5	8.3	8.1	7.8	7.5	7.2	6.9	6.6
200	10.8	10.6	10.3	10.0	9.7	9.7	9.0	8.2	8.2
210	13.2	12.9	12.6	12.2	11.8	11.4	11.0	10.5	10.0
220	16.4	15.9	15.3	14.9	14.4	13.9	13.4	12.9	12.3
230	19.4	19.0	18.5	18.0	17.5	16.9	16.2	15.6	14.9
240	23.3	22.8	22.3	21.7	21.0	20.3	19.5	18.7	17.9
250	27.9	26.6	26.6	25.9	25.1	25.1	23.3	21.4	21.4
260	33.1	32.4	31.6	30.7	29.8	28.8	27.7	26.6	25.4
270	39.1	38.2	37.3	36.3	35.2	34.0	32.8	31.5	30.1
280	46.0	45.0	43.9	42.7	41.4	40.0	38.5	36.9	35.3
290	53.8	52.6	51.3	49.9	48.4	46.7	45.0	43.2	41.3
300	62.6	61.2	59.7	58.0	56.3	56.3	52.4	48.1	48.1
310	72.6	70.9	69.2	67.2	65.2	63.0	60.7	60.7	55.7
320	83.7	81.8	79.8	77.5	75.2	72.6	69.9	67.1	64.3
330	96.2	94.0	91.7	89.1	86.4	83.4	80.3	77.1	73.8
340	110.2	107.6	105.0	102.0	98.9	95.4	91.8	88.1	84.4
350	125.7	122.7	119.7	116.2	112.7	108.7	104.6	100.4	96.2

Metals Compatibility

Dynalene ethylene glycols are compatible with the following metals when used in a closed, airtight system:

- Aluminum*
- Cast Steel
- Monel
- Brass
- Copper
- Nickel
- Bronze
- Hastelloy
- Stainless Steel
- Carbon Steel
- Inconel
- Tantalum
- Cast Iron
- Incoloy 825
- Titanium

**Contact Dynalene when utilizing aluminum as a wetted material of construction. Call 1-877-244-5525 or email at info@dynalene.com*

Caution: Do not use magnesium, zinc, zinc-plated, or galvanized metals in the heat transfer loop containing inhibited Dynalene ethylene glycols. Zinc coatings can interfere with the inhibitor mechanism, precipitating out of solution, reducing inhibitor concentration, and removing the protective zinc plating. These metals are acceptable to use as support framing, electrical conduit, and structural components.

Gasket & Polymer Compatibility

Any plastic that is compatible with uninhibited ethylene glycol can be used with Dynalene ethylene glycols throughout the material's operating range. For compatibility of Dynalene ethylene glycols with gasket and polymer materials, refer to the table below.

Table 5. Gasket and polymer compatibility with Dynalene ethylene glycol.

Material	Compatibility
Nitrile / NBR	Excellent to 150°F, Good above 150°F
Hydrogenated Nitrile / HNBR	Excellent
Ethylene Propylene / EP, EPDM	Excellent
Chloroprene / CR (Neoprene)	Fair
Isobutylene / IIR (Latex)	Good
Synthetic Isoprene / IR (Latex)	Good / Excellent
Natural Isoprene / NR (Natural Rubber)	Good / Excellent
Fluorocarbon / FKM (Viton)	Good to 100°F, Fair / Poor over 100°F
Chemraz Kalrez / FFKM	Excellent
PTEF / FEP (Teflon)	Excellent
Gylon Style 3500, 3504, 3510	Excellent
Nylon / Polyamide	Fair
Polyvinyl Chloride / PVC	Fair
Polyethylene	Excellent
Polypropylene	Excellent
Epoxy	Good / Excellent
Graphite	Excellent

If you would like to use another material not listed in the above table, please contact Dynalene at 1-877-244-5525 or email info@dynalene.com.

Packing & Shipping

Dynalene ethylene glycols are available in 5-gallon pails, 55-gallon drums, 265-gallon totes, and bulk tankers.

Please refer to the MSDS for additional shipping information.

Shelf Life

Dynalene ethylene glycols will remain stable for a period of at least five years if:

1. It is stored in the original unopened container
2. The storage area temperature does not exceed 100°F (37°C)

Dynalene Ethylene Glycol Properties: Viscosity

Viscosities of Dynalene ethylene glycol solutions vs. temperature are given in Table 6.

Table 6. Viscosities of Dynalene ethylene glycol solutions.

Temp	Viscosity, cP								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
-30									89.7
-20							40.4	50.5	60.5
-10							27.3	34.7	42.1
0					13.8	16.6	19.3	24.7	30.1
10			6.83	8.47	10.1	12.2	14.3	18.2	22.1
20	3.90	4.64	5.38	6.56	7.74	9.32	10.9	13.8	16.6
30	3.14	3.74	4.33	5.21	6.09	7.29	8.48	10.6	12.7
40	2.59	3.07	3.54	4.23	4.91	5.84	6.77	8.34	9.90
50	2.18	2.57	2.95	3.50	4.04	4.77	5.50	6.68	7.85
60	1.86	2.18	2.49	2.94	3.38	3.97	4.55	5.44	6.33
70	1.61	1.87	2.13	2.50	2.87	3.34	3.81	4.49	5.17
80	1.41	1.63	1.84	2.15	2.46	2.85	3.23	3.76	4.28
90	1.24	1.42	1.60	1.87	2.13	2.45	2.76	3.17	3.58
100	1.11	1.26	1.41	1.64	1.87	2.13	2.39	2.71	3.03
120	0.90	1.01	1.11	1.29	1.46	1.64	1.82	2.03	2.23
140	0.74	0.82	0.90	1.04	1.17	1.30	1.43	1.56	1.69
160	0.63	0.69	0.75	0.85	0.95	1.05	1.15	1.24	1.32
180	0.54	0.59	0.63	0.71	0.79	0.87	0.94	1.00	1.06
200	0.47	0.51	0.54	0.61	0.67	0.73	0.78	0.82	0.86
220	0.41	0.44	0.46	0.52	0.57	0.62	0.66	0.69	0.72

1 cP= 0.001 Pa·s

Dynalene Ethylene Glycol Properties: Thermal Conductivity

Thermal conductivities of Dynalene ethylene glycol solutions vs. temperature are given in Table 7.

Table 7. Thermal conductivities of Dynalene ethylene glycol solutions.

Temp	Thermal Conductivity, BTU/hr·ft·°F								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
-30									0.178
-20							0.193	0.187	0.181
-10							0.197	0.191	0.184
0					0.216	0.208	0.200	0.193	0.186
10			0.238	0.229	0.220	0.212	0.204	0.197	0.189
20	0.264	0.254	0.243	0.234	0.224	0.216	0.207	0.199	0.191
30	0.269	0.258	0.247	0.237	0.227	0.219	0.210	0.202	0.194
40	0.274	0.263	0.251	0.241	0.231	0.222	0.212	0.204	0.196
50	0.279	0.267	0.255	0.245	0.234	0.225	0.215	0.207	0.198
60	0.284	0.272	0.259	0.248	0.237	0.228	0.218	0.209	0.200
70	0.288	0.276	0.263	0.252	0.240	0.230	0.220	0.211	0.202
80	0.292	0.279	0.266	0.255	0.243	0.233	0.223	0.214	0.204
90	0.296	0.283	0.269	0.258	0.246	0.236	0.225	0.216	0.206
100	0.299	0.286	0.272	0.260	0.248	0.238	0.227	0.218	0.208
120	0.305	0.291	0.277	0.265	0.253	0.242	0.230	0.220	0.210
140	0.311	0.297	0.282	0.269	0.256	0.245	0.233	0.223	0.213
160	0.315	0.300	0.285	0.272	0.259	0.248	0.236	0.226	0.215
180	0.318	0.303	0.288	0.275	0.262	0.250	0.238	0.228	0.217
200	0.320	0.305	0.290	0.277	0.263	0.252	0.240	0.229	0.218
220	0.321	0.306	0.291	0.278	0.265	0.253	0.240	0.230	0.219

1 Btu/hr·ft·°F = 1.73 W/mK

Dynalene Ethylene Glycol Properties: Specific Heat

Specific heats of Dynalene ethylene glycol solutions vs. temperature are given in Table 8.

Table 8. Specific heats of Dynalene ethylene glycol solutions.

Temp	Specific Heat, BTU/lb·°F								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
-30									0.669
-20							0.730	0.702	0.674
-10							0.735	0.708	0.680
0					0.792	0.766	0.740	0.713	0.686
10			0.845	0.821	0.796	0.771	0.745	0.719	0.692
20	0.894	0.871	0.848	0.825	0.801	0.776	0.751	0.725	0.698
30	0.897	0.875	0.852	0.829	0.805	0.781	0.756	0.730	0.704
40	0.900	0.878	0.856	0.833	0.810	0.786	0.761	0.736	0.710
50	0.903	0.882	0.860	0.837	0.814	0.790	0.766	0.741	0.716
60	0.907	0.886	0.864	0.842	0.819	0.796	0.772	0.747	0.722
70	0.910	0.889	0.868	0.846	0.824	0.801	0.777	0.753	0.728
80	0.913	0.892	0.871	0.850	0.828	0.805	0.782	0.758	0.734
90	0.916	0.896	0.875	0.854	0.833	0.807	0.781	0.761	0.740
100	0.919	0.899	0.879	0.858	0.837	0.815	0.793	0.770	0.746
120	0.925	0.906	0.887	0.867	0.846	0.825	0.803	0.780	0.757
140	0.931	0.913	0.895	0.875	0.855	0.835	0.814	0.792	0.769
160	0.938	0.920	0.902	0.884	0.865	0.845	0.824	0.803	0.781
180	0.944	0.927	0.910	0.892	0.874	0.855	0.835	0.814	0.793
200	0.950	0.934	0.918	0.901	0.883	0.864	0.845	0.825	0.805
220	0.956	0.941	0.925	0.909	0.892	0.874	0.856	0.837	0.817

1 Btu/lb·°F = 4,186 J/kg°C

Dynalene Ethylene Glycol Properties: Density

Densities of Dynalene ethylene glycol solutions vs. temperature are given in Table 9.

Table 9. Densities of Dynalene ethylene glycol solutions.

Temp	Density, lb/ft³								
	Dynalene ethylene glycol concentration =								
°F	20%	25%	30%	35%	40%	45%	50%	55%	60%
-30									70.40
-20							69.26	69.76	70.26
-10							69.12	69.61	70.10
0					67.93	68.45	68.97	69.46	69.94
10			66.68	67.24	67.79	68.31	68.82	69.30	69.78
20	65.36	65.96	66.55	67.10	67.64	68.15	68.66	69.13	69.60
30	65.23	65.82	66.41	66.95	67.49	67.99	68.49	68.96	69.43
40	65.10	65.69	66.27	66.80	67.33	67.83	68.32	68.78	69.24
50	64.97	65.54	66.11	66.64	67.17	67.66	68.14	68.61	69.08
60	64.83	65.40	65.96	66.48	66.99	67.48	67.96	68.41	68.86
70	64.68	65.24	65.79	66.31	66.82	67.30	67.77	68.22	68.66
80	64.52	65.07	65.62	66.13	66.63	67.11	67.58	68.02	68.46
90	64.36	64.91	65.45	65.95	66.44	66.91	67.38	67.82	68.25
100	64.20	64.74	65.27	65.76	66.25	66.71	67.17	67.60	68.03
120	63.85	64.37	64.88	65.36	65.84	66.29	66.74	67.16	67.58
140	63.47	63.98	64.48	64.95	65.41	65.85	66.28	66.69	67.10
160	63.07	63.56	64.05	64.50	64.95	65.38	65.80	66.21	66.61
180	62.65	63.12	63.59	64.03	64.47	64.89	65.30	65.70	66.09
200	62.20	62.66	63.11	63.54	63.97	64.38	64.78	65.16	65.54
220	61.72	62.17	62.61	63.03	63.44	63.84	64.23	64.61	64.98

1 lb/ft³= 16 kg/m³

Toxicological Report

For complete toxicological information regarding Dynalene ethylene glycols, consult the MSDS. The MSDS for Dynalene EG should be understood prior to use.

Dynalene ethylene glycol is a heat transfer fluid used in cooling and heating process applications. Do not use ethylene-glycol-based coolants where contact with food or drinking water is possible. A propylene glycol-based coolant is a safer alternative and should be used.

Product Disclaimer

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