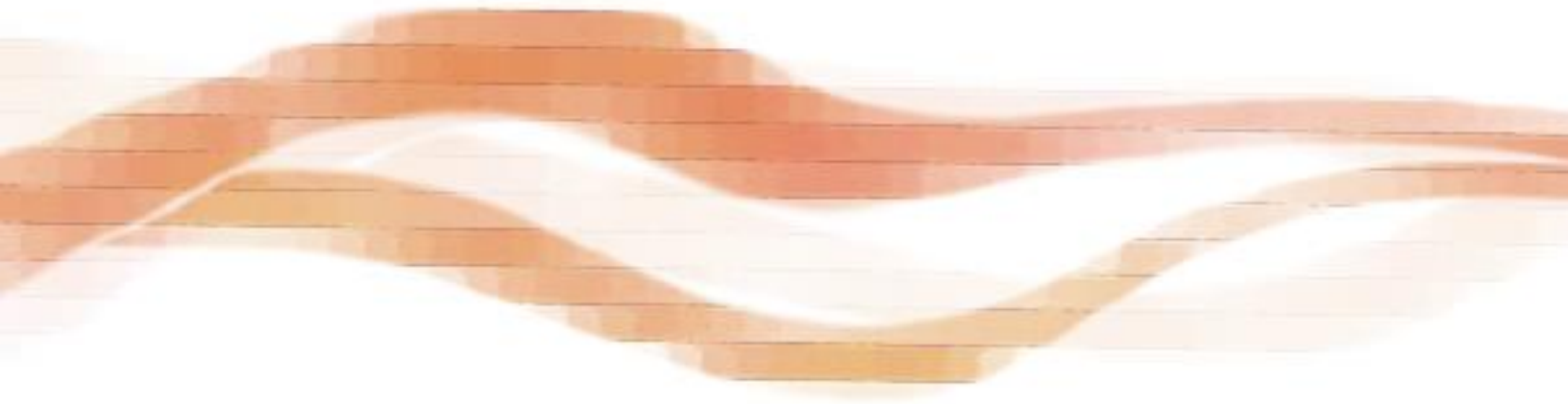
Dynalene MV

engineering guide



DYNALENE

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Product Overview

Dynalene MV is an environmentally acceptable low temperature heat transfer fluid. It was developed to extend the "low end" operating temperature range far below the boundaries of most competitive brands. Dynalene MV heat transfer fluid has a limited toxicity; it is also biodegradable and CFC free. Dynalene MV has a recommended use temperature range of –170°F to 325°F. It is essential that all personnel handling this product review and understand this manual and the Dynalene MV material safety data sheet (MSDS). Please contact Dynalene for more information.

Freezing & Melting Point

Dynalene MV has a freezing and melting point below -129°C (-200°F), allowing broader application to systems using cryogenic liquids or ultra-low temperature mechanical refrigeration equipment. This results in greater tolerance when lowering the surface film temperature.

Flash Point

Dynalene MV heat transfer fluid has a closed cup flash point of 53°C (127°F), and an open cup flash point of >60°C (141°F). Like other hydrocarbon based heat transfer fluids, Dynalene MV and its vapors may ignite if released into the environment by being exposed to hot surfaces, sparks, open flames, or any other source of ignition.

Vapor Pressure

Vapor pressure is a critical property to be considered when calculating Net Positive Suction Head (NPSH), a major factor in the sizing of fluid handling equipment. "Air tight" containment is recommended to limit the escape of Dynalene MV vapors. See Table 1 below for vapor pressures of Dynalene MV at various temperatures.

Table 1. Vapor pressure of Dynalene MV.

Temperature, °C (°F)	Vapor Pressure, mmHG (psi)
0 (32)	1.0 (0.019)
25 (77)	1.9 (0.037)
100 (212)	63.7 (1.232)

General Properties

General properties of Dynalene MV can be found in Table 2.

Table 2. General properties of Dynalene MV.

Property	
Composition	Hydrocarbon blend
Appearance	Translucent, light yellow
Odor	Mild orange odor
Operating range	-115°C to 163°C (-175°F to 325°F)
Freezing point	<-129°C (<-200°F)
Boiling point	176°C (348°F)
Flash point (closed)	53°C (127°F)
Flash point (open)	61°C (142°F)
Fire point	64°C (147°F)
Autoignition temp.	388°C (730°F)
Critical temp.	387°C (729°F)
Critical pressure	34 bar (33.6 atm)
Molecular weight	135 g/mol
Dielectric constant	2.3

Odor Evaluation

Dynalene MV heat transfer fluid is produced using hydrocarbon liquid blends. Proper safety procedures must be practiced at all times. Dynalene MV has a mild hydrocarbon/orange odor that will become evident in the surrounding area if the fluid or its vapors are released into the environment.

Do not handle or expose personnel to Dynalene MV liquid without reviewing and understanding the Material Safety Data Sheet (MSDS). Always handle the fluid in well ventilated areas; the area should be free from sparks, open flames, or smoking. Use respiratory protection consistent with the recommendations in the MSDS.

Packaging & Shipping

Dynalene MV heat transfer fluid is available in 5 gallon pails, 55 gallon drums, and bulk quantities. Dynalene MV heat transfer fluid has a shipping hazard classification of number 3 in the USA. Dynalene MV is listed as a Combustible or Flammable Liquid when transported by highway or rail, but must be listed as a Flammable Liquid when shipped by air or waterway.

Shelf Life

Dynalene MV heat transfer fluid will remain stable for a period of at least one year if:

(1) It is stored in the original unopened pail or drum
(2) The storage area is a dry environment below 100°F.

Partially full pails and drums should be blanketed with an inert gas such as nitrogen to eliminate oxygen from the container head space.

Metals Compatibility

Dynalene MV heat transfer fluid has an acceptable compatibility rating when installed in vapor tight systems constructed within the temperature, pressure, and structural limitations of the following metals:

- Aluminum
- Brass
- Bronze (All)
- Carbon Steel
- Cast Steel
- Copper
- Copper Nickel (All)
- Hastelloy (All)
- Inconel
- Incoloy 825
- Monel
- Nickel
- Stainless Steel (All)
- Stainless Steel Clad
- Tantalum

Gasket & Polymer Compatibility

Dynalene MV heat transfer fluid has an acceptable compatibility when used within the temperature and pressure limitation of the following polymers or gasketing materials:

- Acetal
- Aramid Fiber
- Chemraz (FFKM)
- Epoxy
- Fluorocarbon (FILM)
- Fluoroelastomer
- Glass Fiber
- Gylon Style 3500, 3504, & 3510
- Kalrez
- PEEK
- Polytetrafluoro-ethylene
- Teflon (All)
- Teflon Encapsulated Silicone
- Teflon Encapsulated Viton
- Telfon Impregnated Fiberglass
- Kel-F (CTE)
- Viton
- Resin Impregnated Carbon Graphite

General Installation Guidelines

The following recommendations are provided to assist the designer/user in achieving proper installation.

1 **Understanding the engineering guide**
Prior to purchasing any Dynalene MV, review and understand all of the information contained in this manual—especially the sections titled ‘Retrofitting for Dynalene MV’ and ‘Preparing New Systems Using Dynalene MV’. Only qualified personnel with expertise in safe handling of potentially hazardous liquids (in compliance with local, state, and federal regulations) should be involved with work processes of this nature.

2 Moisture content

Moisture content within Dynalene MV in system operation is recommended to be less than 100 parts per million (.01% H_20 in Dynalene MV). The freezing point, viscosity, and heat transfer coefficient of Dynalene MV may be adversely affected if moisture content is above recommended levels. Moisture is heavier than Dynalene MV and will drop out of the solution at approximately 400 to 500 PPM, depending upon liquid temperature.

In low temperature applications, excessive moisture in Dynalene MV will impair heat transfer; this may result in frozen heat exchangers, seized regulators, etc. Desiccating Dynalene MV as shown in Figure 1 (page 8) is one recommended method of removing moisture from Dynalene MV. If a moisture analysis is required for your Dynalene MV, contact Dynalene at 1-877-244-5525 or email info@dynalene.com.

3 Presence of oxygen

Limit the presence of oxygen within the wetted areas of a piped system. An inert gas, such as nitrogen, is the favored substitute to air in the vapor space. A replenishable supply of air or oxygen in contact with Dynalene MV will promote premature fluid degradation. The basic fluid system sketch illustrated in Figure 1 (page 8), is an example of a typical Dynalene MV heat transfer fluid system using an inert gas purge as a method of excluding oxygen. The inert gas pressure regulator BPV set point should be approximately 50% higher than the maximum Dynalene MV vapor pressure value anticipated with the system.

4 Maximum surface temperature

Surface temperature of heat source components should not exceed 400°F (204°C). Fluid velocity should maintain a minimum of 8 feet per second (2.44 meters per second).

5 Using electric resistance heaters

Electric resistance heaters used in Dynalene MV heat transfer fluid applications are recommended to use a maximum watt density of 28 watts per square inch. If you require a review on the heating equipment you have considered, consult Dynalene.

6 Pump equipment

To eliminate cavitation when using Dynalene MV near its boiling point, apply sufficient inert gas (nitrogen, argon) pressure in the head space.

7 Available ancillary equipment

Dynalene desiccation canisters are available upon request.

8 Safety dos and don'ts

- Handling Dynalene MV in the drum: ensure drums containing Dynalene MV are properly grounded and keep all drums away from sources of ignition, power tools, heat, smoking, and sparks.
- Pumping Dynalene MV into the system: only pump Dynalene MV in well-ventilated areas and wear the required personnel protective equipment as recommended in the Dynalene MV MSDS.
- System maintenance: prior to cutting or welding systems that use Dynalene MV, ensure all residual Dynalene MV and its vapor are removed from the system. This can be accomplished by fully purging and evacuating all fluid and vapors using the methods described in 'Retrofitting for Dynalene MV.'
- Draining Dynalene MV from a system: when draining Dynalene MV from a system, be sure to use sealed connections on all pipes, tubes, and containment to minimize leakage of vapor and mists.

  For precautionary measures, all systems using Dynalene MV should be properly grounded.

Retrofitting for Dynalene MV

Dynalene MV heat transfer fluid is an excellent replacement for the fluid chemistries listed below:

- CFC Refrigerant
- Chlorinated Solvent
- HFC Refrigerant
- Hydrocarbon Based
- Alcohols (methanol, ethanol, isopropanol)
- Perfluorocarbon
- Silicone
- d-Limonene

Once the original liquid is removed, systems may retain small amounts of residual liquid in low lying areas such as piping traps, inverted coils, pump housings, valve housings, drain pipes, etc. The residual liquids must be removed for Dynalene MV to function properly as specified.

The following recommendations are provided by Dynalene to assist the installer or end user in achieving a successful retrofit:

- To determine the actual volume of the heat transfer fluid needed in the retrofit, there are two methods that can be used:
  1. If the system drawing is available, then perform a volume calculation based on size and length of piping, reservoirs, heat exchangers, pumps, and all other wetted components.
  2. Drain the existing heat transfer fluid from the system and measure the volume removed. To account for the residual fluid left after draining, follow the steps in the next section.
- To remove residual fluids, purge the existing system with compressed air or an inert gas such as nitrogen (for combustible liquids). For best results, purge intermittently with disruptions to zero pressure once every two minutes. For example, purge with pressure for one minute, and then disrupt purge to zero pressure in system for the next minute. Continue this process for several minutes until there is no more fluid leaving the system.
- Measure the volume of the residual fluid and add to the volume of the drained fluid to determine the total heat transfer fluid volume. Combine the residual fluid and drained fluid into a vented container and dispose accordingly.

  Other methods to remove residual liquid:

  1 **System evacuation**
  Systems evacuation is performed by creating a vacuum, usually more than 20" Hg, within the existing system containing the residual liquid at room temperature. As the vacuum within the system increases, the boiling point of the residual liquid will decrease and evaporate. 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**
  Liquid evaporation using air or an inert gas may be another feasible method of removing residual liquid from an existing piped system. This is performed by allowing an adequate volume of dry compressed air or inert gas, such as nitrogen, to enter the existing system and flow through the inner piped wetted areas, including low points. The intent is to evaporate the residual liquid and allow the effluent to exit the piped system at a point that is generally opposite the inlet air or inert gas connection. Compressed air or inert gas is recommended to have a dew point lower than –95°F, and sufficiently below the evaporation point of liquid being removed.

  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.

Preparing New Systems Using Dynalene MV

The following recommendations are provided to assist the installer or end user in achieving a proper installation:

1 **Flush the system**
Systems intending to use Dynalene MV heat transfer fluid should be properly flushed clean after installing components such as pipes, valves, pumps, etc. Materials from welding operations, excess pipe joint compound, oils, and other unwanted contaminants must be removed completely prior to installing Dynalene MV.

Using a dilution solvent that is completely miscible with the contaminants generated during an installation is one recommended method of flushing a system clean.

2 **Perform a moisture analysis**
After installing Dynalene MV and circulating for at least one hour, Dynalene recommends removing a fluid sample for moisture analysis. A pre-labeled sample kit will be provided upon request. Dynalene will perform a moisture analysis and report the necessary actions or corrections that need to be taken. This is to ensure the moisture content is within the recommended level, especially when operating Dynalene MV below 35°F.

3 **Install line filtration**
Dynalene MV should remain free of debris throughout the operational life of the liquid. An appropriately sized in-line strainer using a perforation size (1⁄32") or less, 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, combined with an in-line strainer as a prefilter, is the best method of keeping Dynalene MV particulate free. Use of bypass and slip-stream filtration is also acceptable.

Ongoing Fluid Maintenance

Dynalene can provide a pre-labeled sample kit upon request, which includes the sample bottle, an instruction page, and an MSDS sheet. Dynalene offers the first sample analysis free of charge.

For best results:

1. Take a fluid sample when the system is at room temperature to prevent moisture from contaminating the Dynalene MV.
2. Before filling up the sample bottle, allow the fluid to flow out for a few seconds into another container to clear any debris. Leave about one inch of airspace from the top of the sample bottle to minimize leakage. After closing the cap, secure by wrapping electrical tape around it several times.
3. It is best to take a fluid sample while the fluid is circulating.

Basic heat transfer fluid system design

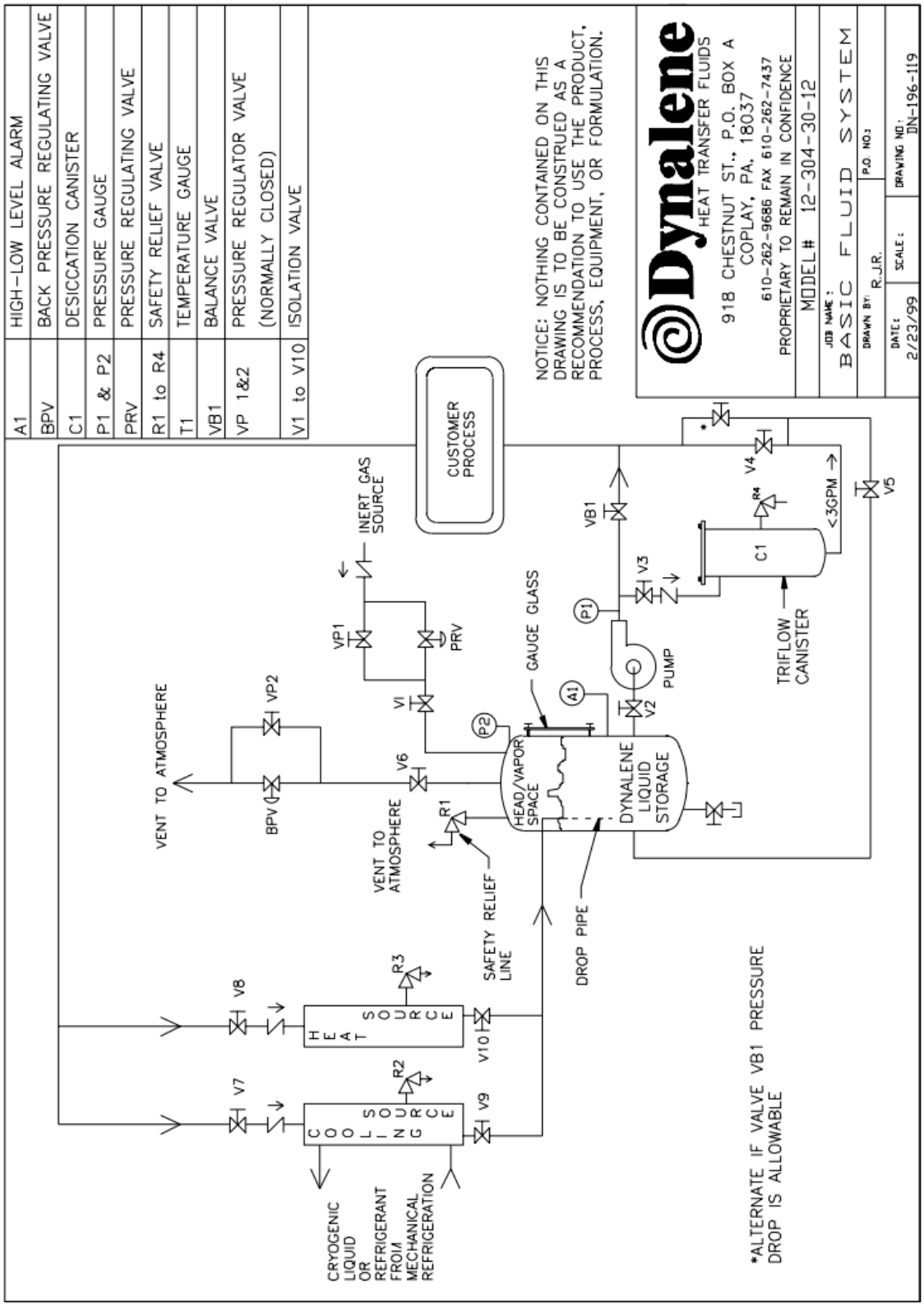

Figure 1. Basic Dynalene MV heat transfer system.

Dynalene MV Properties: SI Units

Properties of Dynalene MV vs. temperature in SI units are given in Table 3.

Table 3. Properties of Dynalene MV.

Temp	Viscosity	Thermal Cond.	Specific Heat	Density
°C	mPa·s	W/m·K	kJ/kg·K	kg/m³
-112	215.3	0.165	1.330	948
-100	46.4	0.162	1.373	938
-90	19.9	0.159	1.408	931
-80	10.7	0.157	1.443	923
-70	6.66	0.155	1.479	915
-60	4.58	0.152	1.514	907
-50	3.38	0.150	1.549	900
-40	2.63	0.148	1.584	892
-30	2.13	0.145	1.620	884
-20	1.78	0.143	1.655	876
-10	1.53	0.140	1.690	869
0	1.34	0.138	1.726	861
10	1.19	0.136	1.761	853
20	1.07	0.133	1.796	845
30	0.97	0.131	1.831	838
40	0.90	0.128	1.867	830
50	0.83	0.126	1.902	822
60	0.78	0.124	1.937	815
70	0.73	0.121	1.973	807
80	0.69	0.119	2.008	799
90	0.65	0.117	2.043	791
100	0.62	0.114	2.078	784
110	0.59	0.112	2.114	776
120	0.57	0.109	2.149	768
130	0.55	0.107	2.184	760
140	0.53	0.105	2.219	753
150	0.51	0.102	2.255	745
163	0.49	0.099	2.301	735

Dynalene MV Properties: English Units

Properties of Dynalene MV vs. temperature in English units are given in Table 4.

Table 4. Properties of Dynalene MV.

Temp	Viscosity	Thermal Cond.	Specific Heat	Density
°F	cP	BTU/hr·ft·°F	BTU/lb·°F	lb/ft³
-170	218.0	0.095	0.318	59.2
-160	97.1	0.094	0.322	58.9
-140	30.3	0.093	0.332	58.4
-120	13.7	0.091	0.341	57.8
-100	7.64	0.090	0.350	57.3
-80	4.92	0.088	0.360	56.8
-60	3.47	0.087	0.369	56.2
-40	2.62	0.085	0.379	55.7
-20	2.08	0.084	0.388	55.2
0	1.72	0.082	0.397	54.6
20	1.46	0.081	0.407	54.1
40	1.26	0.079	0.416	53.5
60	1.12	0.078	0.425	53.0
80	1.00	0.076	0.435	52.5
100	0.91	0.074	0.444	51.9
120	0.84	0.073	0.453	51.4
140	0.77	0.071	0.463	50.9
160	0.72	0.070	0.472	50.3
180	0.68	0.068	0.482	49.8
200	0.64	0.067	0.491	49.3
220	0.61	0.065	0.500	48.7
240	0.58	0.064	0.510	48.2
260	0.56	0.062	0.519	47.6
280	0.53	0.061	0.528	47.1
300	0.51	0.059	0.538	46.6
320	0.50	0.058	0.547	46.0
325	0.49	0.057	0.549	45.9

Toxicological Report

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

Product Disclaimer

The information contained in this entire publication is presented in good faith at “no charge” and is believed to be correct as of the date indicated no representations or warranties are made as to its completeness or accuracy. The information listed is supplied upon the condition that the persons receiving it will make their own determination as to its suitability for their purposes prior to use. In no event will the seller be responsible for damages of any nature whatsoever resulting from the use of, or reliance upon, this information or the product to which this information refers. Nothing contained on this page is to be construed as a recommendation to use the product, process, equipment or formulation in conflict with any patent. No representation or warranty, expressed or implied, is made that the use of this product will not infringe any patent.

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