Chevron Phillips Chemical Company LP

*Safe Handling and Storage of*

# *Synfluid® Polyalphaolefins (PAO)*

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January 8, 2008

# Operational Excellence Policy

We will strive each day to conduct our business in a safe, secure, injury-free, and environmentally responsible manner. We are committed to comply with all laws and regulations. We will strive to make optimal use of the resources we consume and minimize emissions and waste. We will strive to limit the risks of our products throughout their lifecycle. We are committed to reducing risks in our operations to safeguard our employees and the communities where we operate. We will openly communicate our results and welcome the input of regulatory agencies, our communities, our customers, and other interested stakeholders.

We will accomplish this by integrating environmental, health, safety, security, reliability, and quality into our management processes using our Operational Excellence System (OE). OE will be used worldwide to: set goals for improvement, provide alignment of activities and resources, assess and manage risks, gain stakeholder input, and rigorously audit our performance against operational objectives and compliance requirements.

R. I. Wilcox
President & CEO
Chevron Phillips Chemical Company LLC

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## PRODUCT STEWARDSHIP

Chevron Phillips Chemical Company LP ("Chevron Phillips Chemical Company") is committed to being a good Product Steward of the products we produce. We want anyone who comes in contact with one of our products to have access to information that will help them to understand its potential risk and how to use it safely. The thrust of our Product Stewardship program is the implementation of an Operation Excellence Management System (OEMS) initiative, which makes health, safety and environmental protection an integral part of our products. Successful implementation of this system must include a shared responsibility of all those who come in contact with a product throughout its life cycle. Chevron Phillips Chemical Company will continue to work with customers and others to help ensure that all who use and handle our products follow safe and environmentally sound practices.

**The information contained in this technical bulletin is not intended to, nor does it, amend or replace the Chevron Phillips Chemical Company Material Safety Data Sheets (MSDS's) for Polyalphaolefin (PAO) products. The most current MSDS's can be obtained from Chevron Phillips Chemical Company by calling (800) 852-5530 and should be carefully examined prior to working with these products.**


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# INTRODUCTION

This brochure is intended to be a quick reference guide to help Chevron Phillips Chemical Company (CPChem) customers select, handle, store and effectively use the various grades of polyalphaolefins (PAO) safely and in a manner that protects the environment.

Everyone involved in handling and using the product has the responsibility to protect the integrity of the product, handle it safely, contain spilled product, recycle used or contaminated material and safely dispose of economically unrecyclable products.

This guide covers the following Chevron Phillips Chemical Company polyalphaolefin lubricants:

| | | |
|---|---|---|
| C10 Dimer | Synfluid® PAO 4 cSt | Synfluid® PAO 8 cSt |
| C12 Dimer | Synfluid® PAO 5 cSt | Synfluid® PAO 9 cSt |
| Synfluid® PAO 2 cSt | Synfluid® PAO 6 cSt | Synfluid® PAO 40 cSt |
| Synfluid® PAO 2.5 cSt | Synfluid® PAO 7 cSt | Synfluid® PAO 100 cSt |

Chevron Phillips Chemical Company manufactures various grades of polyalphaolefins at its Cedar Bayou plant in Texas. Polyalphaolefins are produced through the hydrogenation of oligomers (such as dimers, trimers, tetramers). Synthetic base stocks are oligomers of small molecules, synthesized to a defined molecular weight and distribution. These oligomers are highly uniform and provide a low volatility fluid that performs at both high and low temperatures without forming gum or deposits in machinery.

Polyalphaolefins produced at the Cedar Bayou plant are shipped to customers around the world. Products are shipped directly to customers in railcars and bulk trucks as well as in drums, totes and ISO containers.

Chevron Phillips Chemical Company's polyalphaolefin products include a range of lubricants which can be used in industrial gear oils, hydraulic oils, aviation lubricants, engine oils, compressor lubes, drilling fluids, heat transfer fluids, dielectric fluids, greases, and natural gas engine oils. These lubricants provide a range of specific characteristics such as high-pressure stability, high viscosity index (VI), low toxicity, low volatility, oxidative stability, low-temperature fluidity, low flammability, hydrolytic stability, and high-temperature stability. Synfluid® PAOs based on C10 alpha olefins consist of PAO 2, PAO 4, PAO 6, and PAO 8. C12 alpha olefin based Synfluid® PAOs consist of PAO 2.5, PAO 5, PAO 7, and PAO 9. The Dimer products (C10 and C12) and the higher viscosity grades, Synfluid® PAO 40 and PAO 100, are used to make alkenyl succinic anhydride (ASA) and additives for lubricants and fuels. Synfluid® PAO 2 cSt is used in industrial and automotive applications, such as hydraulic, transmission, heat transfer, and dielectric fluids. The Synfluid® PAO 2.5 cSt, PAO 4 cSt, PAO 5 cSt, PAO 6 cSt, PAO 7 cSt, PAO 8 cSt, PAO 9 cSt, PAO 40 cSt, and PAO 100 cSt are also used in various industrial and automotive lubricant applications which include gear oils, compressor oils, hydraulic fluids, greases, engine oils, and other functional fluids.

# PART 1

## *PROPERTIES, SPECIFICATIONS AND TEST METHODS*

### PRODUCT CHARACTERIZATION

| | | |
|---|---|---|
| Synonyms: | Synthetic Hydrocarbon Base Oil | Synfluid® |
| | Synfluid® Polyalphaolefin | Synfluid® PAO |
| | Highly Branched Isoparaffinic Polyalphaolefin | PAO |

| **Chemical Identity:** | **Synonyms:** |
|---|---|
| 1-Decene, Dimer, Unhydrogenated | C10 Dimer |
| 1-Dodecene, Dimer, Unhydrogenated | C12 Dimer |
| 1-Decene, Dimer, Hydrogenated | Synfluid® PAO 2 cSt |
| 1-Dodecene, Dimer, Hydrogenated | Synfluid® PAO 2.5 cSt |
| 1-Decene, Homopolymer, Hydrogenated | Synfluid® PAO 4 cSt |
| 1-Dodecene, Trimer, Hydrogenated mixed with 1-Dodecene, Homopolymer, Hydrogenated | Synfluid® PAO 5 cSt |
| 1-Decene, Homopolymer, Hydrogenated | Synfluid® PAO 6 cSt |
| 1-Dodecene, Homopolymer, Hydrogenated | Synfluid® PAO 7 cSt |
| 1-Decene, Homopolymer, Hydrogenated | Synfluid® PAO 8 cSt |
| 1-Dodecene, Homopolymer, Hydrogenated and 1-Dodecene Trimer, Hydrogenated | Synfluid® PAO 9 cSt |
| 1-Decene, Homopolymer, Hydrogenated and/or 1-Dodecene Polymer with 1-octene, Hydrogenated | Synfluid® PAO 40 cSt |
| 1-Decene, Homopolymer, Hydrogenated and/or 1-Dodecene Polymer with 1-octene, Hydrogenated | Synfluid® PAO 100 cSt |

| **MSDS and CAS Numbers:** | **MSDS No.** | **CAS No.** |
|---|---|---|
| C10 Dimer | 003341 | 17438-89-0 |
| C12 Dimer | 005836 | 62132-67-6 |
| Synfluid® PAO 2 cSt | 003331 | 68649-11-6 |
| Synfluid® PAO 2.5 cSt | 005939 | 151006-61-0 |
| Synfluid® PAO 4 cSt | 003332 | 68037-01-4 |
| Synfluid® PAO 5 cSt | 005940 | 151006-62-1, 151006-63-2 |
| Synfluid® PAO 6 cSt | 003333 | 68037-01-4 |
| Synfluid® PAO 7 cSt | 005941 | 151006-63-2 |
| Synfluid® PAO 8 cSt | 003334 | 68037-01-4 |
| Synfluid® PAO 9 cSt | 005653 | 151006-62-1, 151006-63-2 |
| Synfluid® PAO 40 cSt | 004814 | 68037-01-4 and/or 163149-29-9 |
| Synfluid® PAO 100 cSt | 004371 | 68037-01-4 and/or 163149-29-9 |

| **Components and impurities (all values are approximate):** | |
|---|---|
| C10 Dimer | 99% decene dimer, unhydrogenated<br>1% decene monomer, unhydrogenated |
| C12 Dimer | 99% dodecene dimer, unhydrogenated<br>1% dodecene monomer, unhydrogenated |
| Synfluid® PAO 2 cSt | 98% decene dimer<br>1% monomer<br>1% trimer |
| Synfluid® PAO 2.5 cSt | 98% dodecene dimer and impurity:<br>2% decene/dodecene dimer |
| Synfluid® PAO 4 cSt | 85% decene trimer<br>13% decene tetramer<br>2% pentamer and higher |
| Synfluid® PAO 5 cSt | 87% dodecene, trimer<br>11% tetramer<br>2% pentamer and higher |
| Synfluid® PAO 6 cSt | 30% decene trimer,<br>47% decene tetramer,<br>23% decene pentamer and higher |
| Synfluid® PAO 7 cSt | 49% dodecene trimer<br>39% dodecene tetramer<br>12% dodecene pentamer and higher |
| Synfluid® PAO 8 cSt | 5% decene trimer<br>48% decene tetramer<br>47% decene pentamer and higher |
| Synfluid® PAO 9 cSt | 16% dodecene trimer<br>57% dodecene tetramer<br>27% dodecene pentamer and higher |
| Synfluid® PAO 40 cSt | Dimer to 30+ (all less than 50% of composition) |
| Synfluid® PAO 100 cSt | Dimer to 30+ (all less than 50% of composition) |

## PHYSICAL AND CHEMICAL PROPERTIES OF POLYALPHAOLEFINS:

| | |
|---|---|
| Physical state at room temperature | Clear, colorless, and odorless liquid |
| Appearance | Clear and bright |
| Odor | No foreign odor |
| Color, Pt-Co | 0 |
| Solubility in water<br>Synfluid® PAO 2,<br>Synfluid® PAO 2.5, 40, 100, C10 Dimer, C12 Dimer<br>Synfluid® PAO 5<br>Synfluid® PAO 4, 6, 7, 8, 9 | <br><1 ppb<br>Soluble in hydrocarbon solvents; insoluble in water<br>< 1 ppt<br>Expected to be < 1 ppm |
| Chemical stability | Stable |
| Incompatibility with other materials | May react with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc. |
| Total acid number | <0.03 |
| Reactivity | Polymerization will not occur; may react with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc. |

| **Physico-Chemical Typicals** | 2 cSt | 2.5 cSt | 4 cSt | 5 cSt | 6 cSt | 7 cSt |
|---|---|---|---|---|---|---|
| Boiling Point, °C (°F), at atmospheric pressure unless otherwise noted | 55 (131) @ 10 mm Hg | 277 (531) | 414 (778) | 402 (756) | 419 (786) | 425 (798) |
| Pour Point, °C (°F) | -73 (-100) | -52 (-62) | -69 (-92) | -42 (-47) | -61 (-78) | -42 (-44) |
| Flash Point (COC), °C (°F) | 161 (322) | 185 (365) | 226 (475) | 262 (504) | 246 (475) | 262 (504) |
| Fire Point (COC), °C (°F) | 178 (352) | 213 (415) | 254 (489) | 292 (558) | 275 (527) | 292 (558) |
| Volatility, Noack, wt% | ------ | ------ | 13 | 5.8 | 6.3 | 3.3 |
| Specific Gravity, 15.6°/15.6°C | 0.798 | 0.808 | 0.819 | 0.824 | 0.827 | 0.830 |
| Density, lb/gal | 6.66 | 6.73 | 6.83 | 6.88 | 6.90 | 6.93 |
| Kinematic Viscosity, cSt | | | | | | |
| 100°C (212°F) | 1.7 | 2.4 | 3.9 | 5.1 | 5.8 | 6.95 |
| 40°C (104°F) | 5.1 | 8.2 | 16.8 | 24.6 | 30.5 | 37.5 |
| -40°C (-40°F) | 255 | 1811 | 2432 | 4830 | 7749 | 10506 |
| -54°C (-65°F) | 1200 | ------ | ------ | ------ | ------ | ------ |
| Viscosity Index | ------ | ------ | 124 | 144 | 138 | 148 |
| Vapor Pressure, (ASTM D2879) | <1 mm Hg @ 75 °C | <1.2 mm Hg @ 150 °C | 1.7 mm Hg @ 177 °C | <1.6 mm Hg @ 232 °C | 0.7 mm Hg @ 149 °C | 0.3 mm Hg @ 121 °C |
| Vapor Density, (Air=1) | 9.0 | 10 | ------ | ------ | ------ | ------ |
| Autoignition, °C (°F) | 324 (615) | 324 (615) | 343 (650) | 351 (664) | 354 (670) | 380 (716) |
| NFPA Rating, (Health, Flammability, Reactivity) | 1,1,0 | 1,1,0 | 0,1,0 | 0,1,0 | 0,1,0 | 0,1,0 |

| **Physico-Chemical Typicals** | 8 cSt | 9 cSt | C10 Dimer | C12 Dimer | 40 cSt | 100 cSt |
|---|---|---|---|---|---|---|
| Boiling Point, °C (°F), at atmospheric pressure unless otherwise noted | 430 (806) | 452 (846) | 283 (541) | 264 (507) | >250 (>482) | >250 (>482) |
| Pour Point, °C (°F) | -55 (-67) | -36 (-33) | -73 (-100) | -53 (-63) | -34 (-29) | -25 (-13) |
| Flash Point (COC), °C (°F) | 264 (507) | 277 (531) | 154 (309) | 180 (356) | 294 (561) | 290 (554) |
| Fire Point (COC), °C (°F) | 295 (563) | 305 (581) | 170 (338) | 202 (396) | 315 (599) | 325 (617) |
| Volatility, Noack, wt% | 3.0 | 2.1 | ------ | ------ | ------ | ------ |
| Specific Gravity, 15.6°/15.6°C | 0.832 | 0.834 | 0.800 | 0.808 | 0.851 | 0.853 |
| Density, lb/gal | 6.94 | 6.96 | 6.67 | 6.74 | 7.087 | 7.103 |
| Kinematic Viscosity, cSt | | | | | | |
| 100°C (212°F) | 7.8 | 9.0 | 1.6 | 2.3 | 40 | 100 |
| 40°C (104°F) | 46.7 | 54.2 | 4.8 | 7.5 | 410 | 1250 |
| -40°C (-40°F) | 19877 | ------ | 220 | 858 | ------ | ------ |
| -54°C (-65°F) | ------ | ------ | 810 | ------ | ------ | ------ |
| Viscosity Index | 137 | 146 | ------ | ------ | 145 | 160 |
| Vapor Pressure (ASTM D2879) | 0.1 mm Hg @ 232 °C | 0.29 mm Hg @ 149 °C | <0.52 mm Hg @ 100 °C | <1.03 mm Hg @ 38 °C | <0.52 mm Hg @ 20 °C | <0.52 mm Hg @ 20 °C |
| Vapor Density, (Air=1) | ------ | ------ | 9.7 | >7.0 | >7.0 | >7.0 |
| Autoignition, °C (°F) | 369 (695) | 388 (730) | ------ | ------ | 310 (590) | 310 (590) |
| NFPA Rating, (Health, Flammability, Reactivity) | 0,1,0 | 0,1,0 | 1,1,0 | 1,1,0 | 0,1,0 | 0,1,0 |

## TYPICAL COMPOSITIONAL PROPERTIES

| | 2 cSt | 4 cSt | 6 cSt | 8 cSt |
|---|---|---|---|---|
| Carbon No. Distribution, wt% | | | | |
| C20 | 100 | ------ | ------ | ------ |
| C30 | ------ | 85 | 29 | 4 |
| C40 | ------ | 14 | 45 | 54 |
| C50+ | ------ | 1 | 26 | 42 |
| Water, ppm | 20 | 20 | 20 | 20 |
| Ash, wt% | <0.001 | <0.001 | <0.001 | <0.001 |
| Carbon Residue, Conradson, wt% | <0.001 | <0.001 | <0.001 | <0.006 |
| Carbon Residue, Ramsbottom, wt% | 0.01 | 0.03 | 0.05 | 0.04 |
| Bromine Index | <100 | <100 | <100 | <100 |
| Peroxide No. | 0.3 | 0.1 | 0.1 | ------ |
| Aniline Point, $^{o}$C ($^{o}$F) | 101 (214) | 120 (248) | 127 (261) | 134 (273) |
| Thermal Decomposition Temperature, $^{o}$C ($^{o}$F) | 322* (>611) | 324 (615) | 327 (620) | 371* (>700) |
| Viscosity Stability, 72 hr at -40$^{o}$C (-40$^{o}$F), % Change | 0.04 | 0.61 | 0.16 | 0.86 |
| Borderline Pumping Temperature, cP at -35$^{o}$C | ------ | 1600 | 3700 | 8700 |
| Cloud Point, $^{o}$C ($^{o}$F) | -39 (-38) | <-73 (<-100) | <-68 (<-90) | <-71 (<-95) |

* No decomposition observed up to termination of vapor pressure test by Isoteniscope.

| | 2.5 cSt | 5 cSt | 7 cSt | 9 cSt |
|---|---|---|---|---|
| Carbon No. Distribution, wt% | | | | |
| C24 | 100 | ------ | ------ | ------ |
| C36 | ------ | 89 | 48 | 21 |
| C48 | ------ | 9 | 38 | 58 |
| C60+ | ------ | 2 | 14 | 21 |
| Water, ppm | 20 | 20 | 20 | 20 |
| Ash, wt% | <0.001 | <0.001 | <0.001 | <0.001 |
| Bromine Index | <100 | <100 | <100 | <100 |
| Peroxide No. | 0.3 | 0.1 | 0.1 | ------ |
| Borderline Pumping Temperature, cP at -35$^{o}$C | ------ | 2300 | 4600 | 10600 |

## RECOMMENDED TEST METHODS:

The following ASTM methods are recommended for the analysis of Polyalphaolefins:

1. ASTM D 86 Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure
2. ASTM D 92 Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
3. ASTM D 97 Standard Test Method for Pour Point of Petroleum Products
4. ASTM D 150 Standard Test Method for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation
5. ASTM D 156 Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
6. ASTM D 189 Standard Test Method for Conradson Carbon Residue of Petroleum Products
7. ASTM D 287 Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
8. ASTM D 445 Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)
9. ASTM D 446 Standard Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers
10. ASTM D 471 Standard Test Method for Rubber Property- Effect of Liquids
11. ASTM D 524 Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products
12. ASTM D 611 Standard Test Methods for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents
13. ASTM D 892 Standard Test Method for Foaming Characteristics of Lubricating Oils
14. ASTM D 924 Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids
15. ASTM D 971 Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method
16. ASTM D 972 Standard Test Method for Evaporation Loss of Lubricating Greases and Oils
17. ASTM D 974 Standard Test Method for Acid and Base Number by Color-Indicator Titration
18. ASTM D 1160 Standard Test Method for Distillation of Petroleum Products at Reduced Pressure
19. ASTM D 1169 Standard Test Method for Specific Resistance (Resistivity) of Electrical Insulating Liquids
20. ASTM D 1209 Standard Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)
21. ASTM D 1218 Standard Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids

22. ASTM D 1296 Standard Test Method for Odor of Volatile Solvents and Diluents

23. ASTM D 1298 Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

24. ASTM D 1500 Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)

25. ASTM D 1748 Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet

26. ASTM D 2266 Standard Test Method for Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)

27. ASTM D 2270 Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40°C and 100°C

28. ASTM D 2272 Standard Test Method for Oxidation Stability of Steam Turbine Oils by Rotating Pressure Vessel

29. ASTM D 2273 Standard Test Method for Trace Sediment in Lubricating Oils

30. ASTM D 2300 Standard Test Method for Gassing of Insulating Liquids Under Electrical Stress and Ionization (Modified Pirelli Method)

31. ASTM D 2500 Standard Test Method for Cloud Point of Petroleum Products

32. ASTM D 2710 Standard Test Method for Bromine Index of Petroleum Hydrocarbons by Electrometric Titration

33. ASTM D 2766 Standard Test Method for Specific Heat of Liquids and Solids

34. ASTM D 2879 Standard Test Method for Vapor Pressure-Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope

35. ASTM D 2887 Standard Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography

36. ASTM D 3829 Standard Test Method for Predicting the Borderline Pumping Temperature of Engine Oil

37. ASTM D 4052 Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter

38. ASTM D 4176 Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)

39. ASTM D 5293 Standard Test Method for Apparent Viscosity of Engine Oils Between -5°C and -35°C Using the Cold-Cranking Simulator

40. ASTM D 5386 Standard Test Method for Color of Liquids Using Tristimulus Colorimetry

41. ASTM D 5800 Standard Test Method for Evaporation Loss of Lubricating Oils by the Noack Method

42. ASTM D 5950 Standard Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)

43. ASTM D 7042 Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

44. ASTM E 659 Standard Test Method for Autoignition Temperature of Liquid Chemicals

45. ASTM E 1064 Standard Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration

# PART 2

## *SAMPLING AND HANDLING*

### TRAINING

All employees involved in the handling, storage and use of polyalphaolefins should be trained to handle all elements of the job safely and in an environmentally acceptable manner. The content of the training should be designed to address all individual job requirements. Training may include:

1. All written procedures related to the job.
2. How to effectively use all equipment and materials needed to safely perform work.
3. Proper disposal of recovered material.
4. Responsibilities and procedures to clean up spill.
5. Repair of damaged containers.

### RECOMMENDED PRACTICE FOR SAMPLING POLYALPHAOLEFINS

This information is provided for use in establishing sampling and handling procedures. This information should only be utilized in conjunction with an existing health and safety program and cannot be used as a substitute for expert safety and medical advice.

Glass containers are used when sampling PAO products. The handling and transporting of glass containers is a safety hazard. Extreme caution should be taken when handling these containers. The following steps should be used when taking samples in a glass container:

1. Before collecting a sample, be sure the glass container is clean.
2. Properly tag the sample container with sample description, date and time of sample, appropriate hazards, analysis required, and name of person taking sample.
3. Ensure metal flush bucket located under the sample point is grounded prior to use.
4. Open sample block valve slightly to purge sample point into a flush bucket until sample stream is clear, then close block valve. Use caution if product is hot.
5. Fill sample container approximately 25% and shake vigorously to scrub the container. Empty into flush bucket and repeat this step twice more.
6. Fill sample container approximately 75%.
7. Send sample to the laboratory for appropriate analysis.
8. Properly dispose of flush bucket contents and ensure sample block valve is closed.

### STATIC ELECTRICITY AND GROUNDING

Polyalphaolefins are characterized by high electrical resistivity (low conductivity) which can result in the buildup of excess static charge during transfer operations. PAO's are classified as low vapor pressure products under the API RP 2003 Guidelines (i.e., products with a flash point above 100 $^{o}$F). If these products are handled at temperatures well below their flash points, flammable vapors will not develop. However, a condition for ignition may exist if these products are handled at temperatures near their flash points or are contaminated with intermediate or high vapor pressure products. Likewise, in transporting these products, a condition for ignition can exist when the previous load contained a flammable vapor which was not flushed from the vessel being loaded. This type of loading is commonly called "switch loading".

Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not

by themselves be sufficient. Review all operations that have the potential of generating an accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, "Flammable and Combustible Liquids", National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity", and/or the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents."

Grounding of railcars is required because the product accumulates static charges during transfer and handling. This may lead to a flashback or explosion. Personnel sampling the railcar should be aware that static charges are present. The shock does not normally cause injury but sudden movements after a shock could lead to injuries if, for example, the person is on top of the car and does not have a harness properly attached to a stationary bar.

## PRODUCT LOADING AND UNLOADING REQUIREMENTS

### *WHEN LOADING OR UNLOADING TANK CARS:*

1. Use only clean, oil and dirt free, spark-resistant tools and implements.
2. Make sure the tank car's internal pressure has been relieved before removing the manhole or outlet valve cap.
3. Visually inspect hoses and fittings prior to use.
4. Ground the tank car before connecting any part of it to the unloading lines or equipment. Loading and unloading lines should be continuously bonded during loading and unloading.
5. Unload the car through the dome connection or through the bottom outlet.
6. Use of air pressure to unload tank cars is not recommended. If pressure must be used, the operator should demonstrate caution.
7. Use an approved pump to unload the tank car. If the car does not have an eductor pipe, insert a pipe through the open dome and pump its contents out that way.
8. Carefully vent the car through a flame arrester during both loading and unloading. The location of the tank car loading and unloading should be distant from ignition sources.
9. If unloading is interrupted, disconnect all unloading connections, close all valves tightly and securely apply all other closures.
10. Tank cars should be cleaned and prepared for shipment in accordance with DOT regulations prior to releasing.

Note: Loading lines used to transfer PAO products to the loading rack must be blown clear with nitrogen prior to loading a product different from the product last pumped through it. After loading dimer, the loading line is to be blown clear with nitrogen, and the filters may need to be changed to eliminate cross contamination.

## SAFETY REFERENCES

The following publications are excellent references for polyalphaolefin handling information:

**NFPA 10 –**
Standard for Portable Fire Extinguishers

**NFPA 11 –**
Standard for Low-, Medium-, and High-Expansion Foam Systems

**NFPA 70 –**
National Electrical Code®

**NFPA 77 –**
Recommended Practice on Static Electricity

**Manual Sheet D-33,**
**Chemical Manufacturer's Association –**
55-Gallon Single-Trip Metal Drums for Liquid Chemicals

# PART 3

## *STORAGE DESIGN RECOMMENDATIONS*

### STORAGE TANKS

Storage tanks should be of welded steel construction. Underground storage tanks are not recommended because of the difficulty of locating leaks. However, some states require underground storage tanks. Diking, drainage, and tank supports should be designed to conform to local regulations. A rule of thumb commonly used for determining the size of storage facilities suggests that storage facilities be 1½ times the size of shipments received. The secondary containment requirements as well as tank layout and spacing requirements should be in accordance with NFPA 30. Rotating equipment such as pumps should be kept outside of the secondary containment area. Some facilities may require larger inventories, and thus storage facilities, because of seasonal transportation problems.

The storage tank inlet should be located at the bottom of the tank. Should a top inlet be desired, the fill pipe should be extended to a depth no greater than the diameter of the fill pipe from the bottom of the tank to minimize static charge accumulating during filling. The fill pipe should be connected electrically to both the tank flange and the transfer pipeline. The purpose of this electrical connection is to dissipate any static charge which may build up during filling.

PAO and dimer storage tanks are kept under a nitrogen-blanketed atmosphere (10 in. $H_2O$). A nitrogen blanketing system is necessary in applications where the product is going to be stored for long periods of time and peroxides/carbonyls would present a problem in the process. A nitrogen system maintains a positive pressure and adds nitrogen as the product is withdrawn and the tank breathes. This prevents the introduction of air that can cause peroxide buildup in the product and keeps moisture from condensing in the tank. Free water will settle out in the bottom of the tank and will normally not be seen until the tank is stripped. Dissolved water up to the saturation level may be found in products. If water is a critical contaminant, the PAO or dimer sample should be tested periodically and free water withdrawn through the sump.

All product storage tanks should have combination pressure relief/vacuum breaker valves. The combination pressure relief/vacuum breakers are designed to relieve to atmosphere to prevent over-pressuring as well as to open to atmosphere to protect against damage from low pressures (vacuum).

All of the lines and valves, as well as the tank, can be carbon steel. However, carbon steel lines will accumulate rust if allowed to remain empty for long periods of time. In this situation the first few gallons of product moved down the line may have a yellow to orange color and may contain particulates depending on the amount of rust that has accumulated.

Unlined carbon steel tanks may also accumulate rust above the liquid level. This rust, along with the condensate, will settle to the bottom of the tank and may not be seen until the tank is stripped. Rust can be avoided by having storage tanks lined with zinc, epoxy, or another coating that is compatible with these products.

Viton® gasket and seal materials are recommended with PAO and dimer products.

**Specific bulk storage designs must conform to insurance underwriter's codes and local fire and building regulations. Critical design, placement, installation, and maintenance requirements are usually addressed in these codes and regulations and must be followed.**

Inspect tanks periodically for leaks and service in accordance with API Standard 653.

**Workers should never be permitted to enter an empty tank which has been used for polyalphaolefin products until the requirements of the OSHA Permit-required Confined Space Standard (29 CFR 1910.146) and the Safe Entry Recommendation of API**

**Standard 2015 have been met, including, but not limited to, required concentrations for oxygen.**

## API AND ANSI DESIGN REFERENCES

American Petroleum Institute
1220 L Street, NW
Washington, DC 20005

***Part I – Design:***

API RP 520: *Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries*

***Part II – Installation:***

API Standard 601: *Metallic Gaskets for Raised-Face Pipe Flanges and Flanged Connections (Double-Jacketed Corrugated and Spiral-Wound)*

API Standard 620: *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*

API Standard 650: *Welded Steel Tanks for Oil Storage*

API Standard 653: *Tank Inspection, Repair, Alteration, and Reconstruction*

API Standard 2000: *Venting Atmospheric and Low-Pressure Storage Tanks; Nonrefrigerated and Refrigerated*

API RP 2003: *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*

API Standard 2015: *Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks*

API RP 2028: *Flame Arresters in Piping Systems*

API RP 2210: *Flame Arresters for Vents of Tanks Storing Petroleum Products*

API RP 2350: *Overfill Protection for Storage Tanks in Petroleum Facilities*
American National Standards Institute
25 West 43rd Street, 4th Floor
New York, New York 10036

ANSI B16.21: *Nonmetallic Flat Gaskets for Pipe Flanges*

ANSI B31: *Interpretations of Code for Pressure Piping*

## PARTICULATE MATTER

Polyalphaolefin and dimer products should be free of particulate matter when shipped. However, some particulate matter may originate from outside contamination via the receiving-transfer system.

Particulate matter may be avoided by:

1. Paying careful attention to cleanliness.

2. Filtering product to remove particulate matter before use.

## FILTERS

Since small amounts of foreign matter may enter storage tanks and transport vessels from various sources, a filter in the transfer piping between the storage tank and processing equipment is recommended. This can be accomplished by inserting a corrugated cellulose filter paper (5 μm) inside a woven polyester fiber (10 μm mesh) cartridge-type filter. Chevron Phillips Chemical Company uses a 2 μm filter paper in a steel case housing. Other types of product compatible filters might also be used. Flow rates and pressures should be used to determine the proper filter for specific situations. Contact Chevron Phillips Chemical Company's Customer Technical Services Group at 800-852-5531 for specific recommendations. Inspect and renew filter cartridges periodically.

## HOSES

Hard piping is preferred to the use of hoses where possible and practical. If hoses are needed for loading or unloading operations, they should be inspected and pressure tested at the intervals required by the various regulations. The preferred type hose would be a steel braided hose. A satisfactory type hose is Goodyear, rough-bore, style WH-7

with Viton® tube, or the equivalent. Multi-layered polypropylene and Teflon® are also recommended. U.S. Coast Guard regulation 33 CFR, Part 154.500 applies to hoses used for bulk transfers to and from tank vessels.

## PUMPS

Liquid product can be transferred by pump or vacuum. For most product handling operations, centrifugal pumps with mechanical seals perform satisfactorily. The pump manufacturer can recommend the proper type of pump if the following parameters are known: 1) flow, in gallons per minute, 2) size and length of suction and discharge lines, 3) suction and discharge pressures, and 4) range of product temperatures during transfer. A drain valve should be installed at the lowest point in the system so that the pump and all piping can be completely drained and washed before any maintenance work is done. Totally enclosed fan-cooled (TEFC) motors are recommended. However, local fire and insurance codes should be consulted to determine if an explosion-proof motor must be used. Pump seals must be capable of meeting EPA emission standards - this requires tandem or double seals. Tandem seals enhance safety when pumping these products (at elevated temperatures). Demisting systems should be used to keep pump bearings lubed.

1. The following practices are recommended to minimize the possibility of pump leakage:

2. Mechanical seals in conformance with API RP 682.

3. Pumps in conformance with API Standard 610.

4. The pump should be designed so that pump bearings will be able to carry thrust at no flow. Consider selecting non-metallic (PEEK) wear rings to minimize damage if the pump runs dry.

5. The pump shaft should be highly polished.

6. Pumps should not be subjected to forces beyond specified pump tolerances.

7. Vibration monitoring with automatic pump shutdown may be applicable in certain situations.

## VALVES

Full-bore ball valves are preferred for pigged pipelines. Gate valves, butterfly valves, or ball valves may be used for pipelines that are not pigged. These valves should be made of cast iron, case steel, or other recommended materials. Valves should be packed with the following graphite materials:

Garlock® EVSP Simplified (#9000/98)(1)
Garlock® 70# / 98 (-400 to 1200 °F; 10,000 psi)(2)
Garlock® 1303 (good for steam)(2)
Slade® 3300G (-400 to 1200 °F; 10,000 psi)(2)

(1) Most efficient packing is a flexible die-form ring with flexible braided end-rings.
(2) Used for field repacking.

## PIPELINES

The following are recommended practices in engineering pipelines for polyalphaolefin products:

1. A minimum of flanged connections should be used to avoid potential leaks.

2. Lines should not be buried because of the difficulty of checking for leakage.

3. All lines should be sloped with drain valves at appropriate locations so that they can be completely drained for maintenance.

4. All newly installed pipelines should be pressure tested by an approved method before use.

5. Bellows valves for 2-inch and smaller lines are recommended to eliminate emissions from packing glands.

# PART 4

## HEALTH, ENVIRONMENT, FIRE, AND ACCIDENTAL RELEASE INFORMATION

All grades of CPChem polyalphaolefins are synthetic base oils (not refined petroleum base stocks). The potential of these base oils (that are prepared by this process) to cause cancer has not been specifically addressed by the OSHA Hazard Communication Standard 29 CFR 1910.1200, the International Agency for Research on Cancer (IARC), nor the National Toxicology Program (NTP) Annual Report. Based on the results from mutagenicity tests, process conditions, and chemical analysis, these oils are not expected to cause cancer.

Material Safety Data Sheets (MSDS) for polyalphaolefin products are available from Chevron Phillips Chemical Company to help customers further satisfy safe handling and disposal needs and OSHA Hazard Communication Standard requirements. Such information should be requested and studied prior to working with this product. Please call Chevron Phillips Chemical Company at 800-852-5530 to request the MSDS for the type of polyalphaolefin being used.

**NOTE:**
**The following information is not intended to, nor does it, amend or replace the MSDSs for polyalphaolefins. The most current MSDS should be carefully examined prior to working with these products.**

### HEALTH HAZARDS AND FIRST AID

***EYE CONTACT:*** This substance is not expected to cause prolonged or significant eye irritation. **First Aid:** No first aid procedures are required. As a precaution, remove contact lenses if worn and flush eyes with water.

***SKIN CONTACT:*** This substance is not expected to cause prolonged or significant skin irritation. Not expected to be harmful to internal organs if absorbed through the skin. Prolonged and frequent skin contact with this material should be avoided as a good safety procedure. **First Aid:** No first aid procedures are required, but as a precaution the skin should be washed thoroughly with soap and water. The contaminated clothes should be removed and washed.

***INGESTION:*** Since Synfluid® PAO 2 cSt, PAO 2.5 cSt, and PAO 4 cSt, as well as C10 Dimer and C12 Dimer, have low viscosities, these materials can enter directly into the lungs if swallowed or if subsequently vomited; they are difficult to remove once in the lungs and can cause serious injury or death. **First Aid:** If swallowed, do not induce vomiting. Give the person a glass of water or milk and then acquire immediate medical attention. If the person is unconscious, do not give them anything to drink, but obtain appropriate medical attention immediately.

***INHALATION:*** This substance may cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit (ACGIH TLV = 5 $mg/m^3$; STEL = 10 $mg/m^3$). Synfluid PAO 2 cSt and 2.5 cSt may be toxic if inhaled as an oil mist. **First Aid:** Individuals exposed to excessive levels of oil mist in the air should be moved to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if coughing or respiratory discomfort occurs.

### ECOTOXICITY/ENVIRONMENTAL FATE

***ECOTOXICITY:*** Based on results of laboratory tests with rainbow trout, daphnia, and freshwater algae, PAO's are not expected to be harmful to aquatic organisms. PAO's are not expected to bioaccumulate.

***ENVIRONMENTAL FATE:*** PAO's are not considered to be readily biodegradable, but

some products are inherently biodegradable based on standard biodegradation tests. However, they are expected to completely biodegrade over extended periods of time.

## FIRE INFORMATION

***FIRE HAZARDS:***

Polyalphaolefins are not considered to be flammable or combustible or highly reactive. However, despite their low flammability ratings, they will burn at high temperatures. They do react with strong oxidizing agents, such as peroxides, nitrates, and chlorates.

***FIRE FIGHTING INSTRUCTIONS AND COMBUSTION PRODUCTS:***

For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus to protect against products of combustion or oxygen deficiency. Normal combustion forms carbon dioxide and water vapor, while incomplete combustion may produce carbon monoxide.

Fires involving polyalphaolefins can be safely extinguished with carbon dioxide ($CO_2$), dry chemical, foam and water fog. If electrical equipment, such as motors, open hot plates, or open electrical switches, is involved, the foam should be used with caution.

Drainage and runoff should be controlled and collected in a remote location for recovery or disposal. Minimize spread to reduce clean up cost.

## PERSONAL PROTECTIVE EQUIPMENT & OCCUPATIONAL EXPOSURE LIMITS

***PERSONAL PROTECTIVE EQUIPMENT:***

Consider the potential hazards of this material, applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

No special skin protection is usually needed. No protective clothing is normally required. However, wearing protective clothing can minimize skin contact. No eye protection is normally required. No respiratory protection is normally required. If user operations generate an oil mist, determine if airborne concentrations are below the recommended mineral oil mist exposure limits. If not, wear a NIOSH approved respirator that provides adequate protection from measured concentrations of this material. Use the following elements for air-purifying respirators: particulate.

***ANSI REFERENCES:***

| | |
|---|---|
| ANSI Z41.1 | Protective Footwear |
| ANSI Z87.1 | Practice for Occupational and Educational Eye and Face Protection |
| ANSI Z88.2 | Practices for Respiratory Protection |
| ANSI Z89.1 | Protective Headwear for Industrial Workers |
| ANSI Z358.1 | Emergency Eyewash and Shower Equipment |

## ACCIDENTAL RELEASE MEASURES

If a transportation incident involving polyalphaolefins does occur, the Chemical Transportation Emergency Center (CHEMTREC) should be contacted for immediate assistance. CHEMTREC is a public service organization established by the American Chemistry Council to provide assistance in hazardous material incidents. **FOR A CHEMICAL EMERGENCY CALL CHEMTREC AT (800) 424-9300 toll free in the United States, Canada, Puerto Rico, and the Virgin Islands. For emergency calls outside the United States call (703) 527-3887.**

CHEMTREC will provide the caller preliminary emergency assistance in the form of Material Safety Data Sheet (MSDS) information. In all

cases once CHEMTREC determines the incident involves a Chevron Phillips Chemical material, CHEMTREC will immediately contact the on-call Chevron Phillips Chemical Company Crisis Management Team (CMT) member at 1-866-4HAZMAT (442-9628). The contacted Chevron Phillips Chemical CMT member will then be responsible for coordinating an appropriate response to the transportation incident. In addition, if the CMT member determines that the incident involves exposure or potential health effects, the on-call Chevron Phillips Chemical toxicologist will also be contacted.

If an accidental release of polyalphaolefins has occurred, stop the source of the leak or release. Clean up releases as soon as possible, observing precautions in the Personal Protective Equipment section. All spill cleanup activities must meet the requirements of any state and local regulations. Contain liquid to prevent further contamination of soil, surface water, or groundwater. Clean up small spills using appropriate techniques such as sorbent materials or pumping. Effective absorbents include sand or Claymax®, a loose "vermiculite-like" material. Claymax® may be purchased from:

Road Fabric, Inc.
Environmental Division
27 West 045 St. Charles Road
Carol Stream, IL 60188
Phone: (630) 293-3111

Where feasible and appropriate, remove contaminated soil. Follow prescribed procedure for reporting and responding to larger releases. Contact local environmental or health authorities for guidance on how to dispose of the used absorbing agent, contaminated liquid product, or soil. If the spill is on a hard surface, the area should be scrubbed with soap and water after the bulk of the polyalphaolefin product has been removed.

Release of this product should be prevented from contaminating soil and water and from entering drainage and sewer systems. U.S.A. regulations require reporting spills of materials that could reach any surface waters. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.

Polyalphaolefins do not pose a significant health hazard to the handler or general population; neither do they pose a significant risk to the environment. Nevertheless, procedures designed to keep oils out of the environment during manufacture, handling, packaging and transportation should be instituted. Unloading and sampling operations are the primary sources of accidentally spilled oils.

## DISPOSAL

PAO products are not intentionally disposed of in quantity because of their commercial value. Chevron Phillips Chemical Company recommends that waste oil be taken to a certified waste oil collector who then gives the waste oil to a registered refiner to recycle. Off-specification material may possibly be recycled or used as a fuel.

For approved disposal methods of contaminated polyalphaolefins, local health and environmental authorities must be contacted. Contaminated materials have to be placed in disposable containers. The containers must then be disposed of in compliance with the applicable regulations.

# PART 5

## *TRANSPORTATION INFORMATION AND REGULATORY PROFILE*

### TRANSPORTATION INFORMATION

***BILL OF LADING DESCRIPTION:*** **PAO's 2, 2.5, 4, 5, 6, 7, 8, 9, 40, 100, C10 Dimer, C12 Dimer**

| | |
|---|---|
| Bulk Truck Bill of Lading Description: | Not Regulated by DOT |
| Bulk Rail Bill of Lading Description: | Not Regulated by DOT |
| Package Bill of Lading Description: | Not Regulated by DOT |

**Note: The preceding descriptions are subject to frequent changes. Consult current DOT regulations and other appropriate sources to verify proper bill of lading descriptions.**

***CHEMICAL DESIGNATIONS:***

| | |
|---|---|
| CG Compatibility Class: | Paraffin |
| Chemical Identity: | See Product Characterization in Part 1 |
| CAS Registry No.: | See Product Characterization in Part 1 |

***INTERNATIONAL MARITIME ORGANIZATION (IMO):***

| | |
|---|---|
| Pollution Category | III |

***SHIPPING INFORMATION:***

| | |
|---|---|
| Storage Temperature: | Ambient |
| Inert Atmosphere: | No Requirement |
| Venting: | Open (flame arrester) |

## HAZARD CLASSIFICATIONS

| | PAO's 2, 2.5, 4, 5, 6, 7, 8, 9, 40, 100, C10 Dimer, C12 Dimer |
|---|---|
| OSHA (29 CFR 1910.1200): | Not Classified as Flammable/Combustible |
| American National Standards Institute Precautionary Labeling Standard (1994): | Noncombustible |
| U.S. Dept. of Transportation (49 CFR 173.120): | Not Regulated as a Hazardous Material |
| EU Dangerous Substance Directive (93/21/EEC): | Not Classified as Flammable/Combustible |

| | PAO's 2, 2.5, 4, 5, 6, 7, 8, 9, 40, 100 | C10 Dimer, C12 Dimer |
|---|---|---|
| National Fire Protection Association (NFPA 30): | N/A | Class IIIB Combustible Liquid |

| NFPA Hazard Classification: | PAO's 2, 2.5, C10 Dimer, C12 Dimer | PAO's 4, 5, 6, 7 8, 9, 40, 100 |
|---|---|---|
| Category | Classification | Classification |
| Health Hazard (Blue) | 1 | 0 |
| Flammability (Red) | 1 | 1 |
| Reactivity (Yellow) | 0 | 0 |

**Various restrictions apply to the preceding classifications. Please refer to the specific regulation for details concerning classification requirements. 46 CFR, Part 30 should also be referenced for information about Coast Guard regulations governing the transport of polyalphaolefins.**

## REGULATORY PROFILE

(1) ODC's: Contains Class 1 or Class 2 Ozone Depleting Chemicals (ODC's)? **NO**

(2) TSCA: Is this product or its components subject to any of the following TSCA requirements of 40CFR?

| Part: | | |
|---|---|---|
| 707 | (Export Notification) (12b) | **NO** |
| 712 | (Chemical Information Reporting) (8a) | **NO** |
| 716 | (Health & Safety Data Reporting) (8d) | **NO** |
| 721 | (Significant New Use) (5e) | **NO** |
| 723.50 | (Low Volume Exemption) | **NO** |
| 720.38 | (Test Marketing Exemption) | **NO** |
| 723.25 | (Polymer Exemption) | **NO** |
| 790 | (Health and/or Environmental Effects Testing) (4e) | **NO** |

Is this material distribution under limitations of a 5(e) or 5(l) Consent Order? **NO**

(3) INTERNATIONAL REGISTRATION: Are all components of this material listed on the following international inventories?

| **PAO, cSt** | **2** | **2.5** | **4** | **5** | **6** | **7** | **8** | **9** | **40** | **100** | **C10 Dimer** | **C12 Dimer** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSCA (United States) | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** |
| DSL (Canada) | **Y** | **N**[1] | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **N** | **N** |
| EINECS/ELINCS (Europe) | **E** | **Y*** | **Y** | **N** | **E** | **E** | **E** | **N** | **E** | **E** | **N** | **N** |
| METI (Japan) | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** |
| AICS (Australia) | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **N** | **N** |
| PICCS (Philippines) | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **N** | **N** |
| KMOE (South Korea) | **Y** | **N** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **N** | **N** |
| LECSC (China) | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **N** | **N** |

*Number not assigned. **Y**=Yes, **N**=No, **E**=Exempt
[1]NSN 10144

(4) FDA: Do FDA regulations permit use of this material as a direct or indirect food additive?

DIRECT: **NO**

INDIRECT: **YES** May be used as a component of non-food articles intended for use in contact with food pursuant to the provisions of the technical white mineral oil indirect additive regulations [21CFR 178.3620 (b)(1)]

(5) HAZARDOUS METALS: Does the sum of the concentration levels of lead, cadmium, mercury and hexavalent chromium present in these materials exceed 100 ppm by weight? **NO**

(6) ADDITIONAL REGULATORY INFORMATION: See Chevron Phillips Chemical Company MSDSs 3331, 3332, 3333, 3334, 3341, 4090, 4371, 4814, 5653, 5836, 5939, 5940, and 5941 for additional regulatory information.

*REGULATORY STATUS:*

| | |
|---|---|
| **EPA list of carcinogens:** | **NO** |
| **NTP list of carcinogens:** | **NO** |
| **IARC list of carcinogens:** | **NO** |
| **California Prop. 65 list of carcinogens:** | **NO** |
| **California Prop. 65 list of reproductive hazards:** | **NO** |
| **SARA 313:** | **NO** |
| **CERCLA 302.4:** | **NO** |
| **DOT Marine Pollutants:** | **NO** |
| **Permissible exposure limits:** | |
| **OSHA Permissible Exposure Limits** | |
| **Time Weighted Average:** | **NONE ESTABLISHED** |
| **ACGIH Threshold Limit Values** | |
| **Time Weighted Average:** | **NONE ESTABLISHED** |
| **Reportable Quantity:** | **NONE** |
| **Maximum Contaminant Level or Goal:** | **NONE ESTABLISHED** |
| **Reference Dose for Oral Exposure:** | **NONE ESTABLISHED** |

## REVISION STATEMENTS

This revision updates the following sections:

February 2008

1. Operational Excellence statement added
2. Part 1 – Product Characterization updated
3. Part 1 – Physio-Chemical Typicals updated
4. Part 1 – Recommended ASTM Test Methods updated
5. Part 4 – all sections updated
6. Part 5 – Regulatory Profile updated

*Replaces PAO 2005 Rev 0.doc*

# PART 6

## *APPENDIX*

### GLOSSARY OF TERMS, ABBREVIATIONS, AND ORGANIZATIONS

| | |
|---|---|
| ACC | American Chemistry Council |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| AIAG | Automotive Industry Action Group |
| AIHA | American Industrial Hygienists Association |
| AALA | American Association for Laboratory Accreditation |
| ANSI | American National Standards Institute |
| API | American Petroleum Institute |
| ASME | American Society of Mechanical Engineers |
| ASQ | American Society for Quality |
| ASTM | American Society for Testing and Materials |
| BABT | British Approvals Board of Communication |
| BACT | Best Available Control Technology |
| Bonding | The connection of two or more conductive objects by means of a conductor (most commonly a wire or metal plate) |
| BSI | British Standards Institute |
| CAA | Clean Air Act |
| CAAA | Clean Air Act Amendments |
| CAD | Computer-Aided Design |
| CANUTEC | Canadian Transport Emergency Center |
| CE mark | Conformity European Union Mark |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CG | Coast Guard |
| CHEMTREC | Chemical Transportation Emergency Center |

| | |
|---|---|
| Confined Space | An area that by design has limited openings for entry and exit. A confined space has unfavorable natural ventilation and is not intended for continuous worker occupancy. |
| CPC | Chemical protective clothing |
| DOT | Department of Transportation |
| EPA | Environmental Protection Agency |
| ESD | Electro-static discharge |
| EU | European Union |
| FDA | Food & Drug Administration |
| Flashpoint | The minimum temperature at which a liquid gives off vapor in sufficient concentrations to form an ignitable mixture with air near the surface of a liquid. |
| FMEA | Failure Mode Effect Analysis |
| GLP | Good Laboratory Practices |
| Grounding | The connection of one or more conductive objects to the ground: a specific form of bonding. Grounding is also referred to as earthing. |
| HAP | Hazardous Air Pollutant |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| HON | Hazardous Organic NESHAP |
| IATA | International Air Transport Association |
| ICAO | International Civil Aviation Organization |
| IDLH | Immediately dangerous to life and health, the airborne concentration of a toxic material from which one could escape within 30 minutes without any escape-impairing symptoms or irreversible health effects |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMDG | International Maritime Dangerous Goods |
| IMO | International Maritime Organization |
| IQA | Institute of Quality Assurance |
| ISGOTT | International Safety Guide for Oil Tanker and Terminals |
| ISO | International Organization of Standardization |
| LFL | Lower flammability limit |
| MACT | Maximum achievable control technology |

| | |
|---|---|
| MIL | Military |
| MSDS | Material Safety Data Sheet |
| MSHA | Mine Safety and Health Administration |
| NACCB | National Accreditation Council for Certification Board |
| NDE | Nondestructive Evaluation |
| NDT | Nondestructive Testing |
| NEC | National Electrical Code |
| NESHAP | National Emission Standard for Hazardous Air Pollutants |
| NFPA | National Fire Protection Association |
| NIST | National Institutes of Standards and Technology |
| NIOSH | National Institute for Occupational Safety and Health |
| NPDES | National Pollutant Discharge Elimination System |
| OEM | Original Equipment Manufacture |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible Exposure Limit. An occupational exposure limit established under OSHA's regulatory authority. It may be a time-weighted average (TWA) concentration or a maximum concentration never to be exceeded either instantaneously (CEILING) or during any 15-minute period (STEL). |
| Peroxides | Compounds containing the -O-O linkage. They occur as impurities in many organic compounds, where they have been slowly formed by the action of oxygen. |
| PAO | Polyalphaolefin |
| PM | Preventative Maintenance |
| PPE | Personal protective equipment |
| ppb | parts per billion |
| ppm | parts per million |
| ppt | parts per thousand |
| QA | Quality Assurance |
| QC | Quality Control |
| QMI | Quality Management Institute |
| RAB | Registrar Accreditation Board |

| | |
|---|---|
| RCRA | Resource Conservation and Recovery Act |
| RQ | Reportable Quantity |
| SARA | Superfund Amendment and Reauthorization Act |
| SCC | Standards Council of Canada |
| SPC | Statistical Process Control |
| SPI | Society for the Plastics Industry |
| SQC | Statistical Quality Control |
| STEL | Short term exposure limit |
| TLV | Threshold limit values |
| TOC | Total organic carbon |
| TPQ | Threshold planning quantity - under the Superfund Amendments Reauthorization Act (SARA Title III) Section 302, 304, 4311/312, a chemical specific quantity, in pounds, that triggers certain reporting requirements |
| TQC | Total Quality Control |
| TQM | Total Quality Management |
| TWA | Time-weighted average |
| UL | Underwriters Laboratory |
| Ullage | Amount by which a packaging falls short of being liquid full |
| UN | United Nations |
| USCG | United States Coast Guard |
| Vapor Pressure | The pressure exerted by a volatile liquid while under defined equilibrium conditions. Vapor pressure is usually measured in millimeters of mercury (mm Hg). |
| VOC | Volatile organic compound |