VISCOPLEX® and VISCOBASE® products

STORAGE AND HANDLING GUIDELINES

EVONIK
Leading Beyond Chemistry

ADVANCING GLOBAL EXPECTATIONS FOR EFFICIENCY AND PERFORMANCE

Evonik's Oil Additives business has taken a leadership role in developing lubricant additive technology designed to improve fuel efficiency and productivity. Evonik's DRIVON™ technology has demonstrated fuel savings in automotive applications through the use of advanced VISCOPLEX® and VISCOBASE® products in engine oils and transmission fluids. NUFLUX™ technology with VISCOBASE® synthetic base fluids at its core delivers increased protection, performance and optimal fluid service costs for industrial gears.

Evonik's DYNAVIS® technology for hydraulic fluids has been extensively tested in stationary and mobile equipment, achieving up to double-digit fuel and electric energy savings, increased productivity rates, and reductions in green house gas emissions.

In all of its many applications, Evonik's VISCOPLEX® Viscosity Index Improvers, VISCOPLEX® Pour Point Depressants and VISCOBASE® synthetic base fluids strive for efficient and sustainable solutions.

The Oil Additives specialists at Evonik are experts in high-performance additives and technologies for fuels and refinery products. VISCOPLEX® Cold Flow Improvers provide outstanding flow properties for biofuels in any region or season. VISCOPLEX® Dewaxing Aids are designed to increase the efficiency of the oil-wax separation and improve the processing rate in solvent dewaxing refining processes. VISCOPLEX® COPI™ technology – or Crude Oil Paraffin Inhibitors were developed to help the oilfield industry maintain crude oil flow in production, transportation and storage. Advanced regional technology centers, modern global manufacturing centers, and a secure and reliable supply chain enable Evonik's continuous development of tailormade solutions for customers worldwide.

This document contains guidelines intended to assist Evonik's Oil Additives customers in the storage and handling of its products. While this guidance is intended to reflect most commonly encountered conditions for storage and handling, it cannot account for all circumstances. Therefore, these guidelines should be used in conjunction with any site's regulatory compliance and safety and health programs. Always ensure employees have the proper safety equipment and training.

AVAILABILITY

VISCOPLEX® products are available in bulk, in railcars, and in tank trucks/containers, ranging in capacity from 20 metric tons (~6,000 gallons) to 80 metric tons (~25,000 gallons). In addition, they are available in green, ISO-standard, "global" 1.0 mm (top), 0.9 mm (body), 1.0 mm (bottom) steel drums weighing approximately 191 kg (421 lbs) gross with a net content of 175 kg (386 lbs). VISCOBASE® products are generally available in drums. For the availability of VISCOBASE® products in bulk, contact your local Evonik Oil Additives technical, sales or customer service representative.

STORAGE AND SHELF LIFE

Evonik stores some VISCOPLEX® products in steel tanks, which are well-insulated and equipped with steam heat.

Many VISCOPLEX® and VISCOBASE® grades are highly viscous at ambient temperatures. It is customary to pump and blend at elevated temperatures. Table 1 on page 7 provides general guidelines on recommended storage and handling temperatures. Some selected VISCOPLEX® 10- and 14-series products should not be stored at temperatures below -10°C. For detailed information on specific products, consult your Evonik representative and the Product Data Sheet. Check the Safety Data Sheet for other handling and exposure information.

VISCOPLEX® and VISCOBASE® may darken gradually when stored at elevated temperatures; however, the color change does not impact the performance of the polymer product. If the storage tanks will be inactive for long periods, steam should be turned off to minimize ageing and conserve steam.

When applying heat to VISCOPLEX® and VISCOBASE® products, avoid high surface temperatures of heating elements

(e. g., exhaust, live steam). The recommended maximum temperature of the products that are in contact with heating surfaces should not exceed 130°C (266°F). Storage tanks may be heated more quickly by agitating the contents of the tank. Agitation also helps minimize carrier oil oxidation by removing hot spots in the storage vessel. Agitation can be conducted by several means, including recirculation with a pump, using a mechanical stirrer or by blowing inert gas into the tank. Nitrogen or carbon dioxide are preferred versus dry air to avoid color development.

Typically, VISCOPLEX® and VISCOBASE® products, stored in sealed drums in dry ambient conditions, will have a shelf life of between 2-4 years. In hot climates, drums should be stored in the shade.

Drums can be emptied easily, if they are well-heated. Proper heating is achieved by putting them in a hot house, in drum heaters or under steam blankets. The recommended oven temperature for drum heating is 80°C (176°F). Drums should not be heated above 80°C (176°C) for VISCOPLEX® Series 3, 6, 7, 10 and 12 and VISCOBASE® products, or above 95°C (203°F) for all other VISCOPLEX® products, to avoid spillage. Recertification of some products beyond their initial shelf life is possible. Please contact your Evonik regional sales representative for more details.

HEALTH AND SAFETY INFORMATION

Evonik's Oil Additives Team automatically sends an SDS with each new customer order. If an SDS is changed, every customer who ordered up to 12 months prior to the change will automatically receive an updated SDS. For additional copies of our SDS, contact your local Evonik representative. We suggest that you review the SDS before using any of our products in your facilities. We also suggest that you contact suppliers of materials recommended for use with our products for appropriate environmental, health and safety information.

Evonik maintains Safety Data Sheets (SDS) on all of its products. These sheets contain important information useful for protecting the environment and your employees and customers from any known health or safety hazards associated with our products.

VISCOPLEX® and VISCOBASE® products are typically viscous, colorless to yellow colored liquids. They may cause eye and skin irritation. Material should be stored in tightly stored containers in a well-ventilated area. Avoid formation of oil mists. VISCOPLEX® and VISCOBASE® can be a thermal hazard. Take precautions to avoid contact with hot material. Specific instructions are contained in Evonik's SDSs and on product labels.

Personal protective equipment (at a minimum) should include eye protection, chemical-resistant gloves, protective clothing and safety shoes. Check the SDS for appropriate respiratory protection. Dispose of material in accordance with federal and state regulations.

CLEAN-UP OF SPILLS AND LEAKS

While the recommended response to spills will vary depending on the circumstances, simple spills of product are best handled by mixing the product with an inert commercial-grade oil absorbent to form a mixture with the consistency of bread dough. Residue from this process can then be cleaned with petroleum-based solvents. Follow any site and local requirements for spill response.

In case of larger spills or leaks, we recommend to dike and contain the spill with inert material, such as sand or earth. Transfer the liquid to containers for recovery or disposal and transfer the solid diking material to separate containers. The ground may be slippery. Use care to avoid falling. Remove contaminated clothing promptly and wash affected skin areas with soap and water. Keep spills and cleaning runoffs out of municipal sewers and open bodies of water.

BULK HANDLING

Most VISCOPLEX® products are mixtures of polyalkyl methacrylate polymers and a highly refined mineral oil. Some selected products are mixtures of polyalkyl methacrylate and a synthetic or bio-based oil. Please consult the product data sheet and SDS to determine the specific composition of the product in question. VISCOBASE® products are pure synthetic fluids and do not contain mineral oil. The density of VISCOPLEX® and VISCOBASE® at 40ºC can range from 0.83 to 0.94 g/cm^3 (6.9 to 7.8 lbs/gallon). The bulk viscosity can range from 3 to 2500 mm^2/s (3 to 2500 cSt) at 100°C (212°F). Please refer to Evonik product data sheets for product-specific physical property information and the Safety Data Sheets for additional handling and safety information. Because of their physical characteristics, these materials require care in handling and may require some specialized equipment.

VISCOPLEX® and VISCOBASE® products are transported in railcars and tank trucks/containers. On request, bulk shipments can be delivered according to customer specified temperatures (up to 95°C). Bulk containers can be equipped with external steam coils designed to handle pressures up to 4–10 bar (58–145 psi). Steam heat will improve product fluidity. To conserve steam, and to minimize the time required for heating, outlets on steam coils of railcars and tank trucks/containers should be equipped with steam traps during heating.

Although VISCOPLEX® and VISCOBASE® products are very stable at high temperatures, oxidation can occur if the products are exposed to high temperatures over prolonged periods. We recommend that low-pressure saturated steam [2.4–3.4 bar (35–50 psi)] be used if possible. If high-pressure steam is used, we recommend that the heating process be monitored to avoid overheating and long exposure to high temperatures.

The temperature required to handle VISCOPLEX® and VISCOBASE® products will depend on the particular product, viscometrics of the product and handling system used. Evonik's Oil Additives customer service personnel are available to review your system and make appropriate recommendations.

Lines used to transfer VISCOPLEX® and VISCOBASE® products should be well-insulated and traced with steam. The lines may also be traced electrically, if properly sized. Sufficient heat should be applied to achieve a product viscosity below 5000 mm^2/s, which is the maximum viscosity recommended for transferring products. Good pumping conditions can be achieved when the product is heated to a temperature, which results in a viscosity of 1000 mm^2/s. The product at ambient temperatures may become very difficult to pump and eventually cause plugging in the unloading lines. Refer to the product technical data sheet for specific information on product temperature/viscosity relationships. Pressure relief valves are highly recommended to avoid pressure build-up in heat-traced lines.

During the transfer, care should be taken to keep the product temperature below 80°C (176°F) for VISCOPLEX® Series 7, 10 and 12 products and below 95°C (203°F) for all other VISCOPLEX® and VISCOBASE® products. However, the temperatures must be high enough to maintain optimal pumping conditions based on viscometrics. If air is used to unload the product on a cold day, the product in the railcar or tank truck/container will cool faster. In the case of using air on a cold day to unload the product, care should be taken to maintain product-acceptable unloading temperatures.

Gear pumps should be used when unloading VISCOPLEX® and VISCOBASE® products from railcars or tank trucks/containers. Gear pumps should be equipped with an internal or external pressure relief valve to relieve excess pressure between the suction and discharge lines.

Suction lines on the unloading pumps should have a minimum diameter of 7.7 cm (3 in.). To avoid excessive pressure drop, transfer lines within the blending area should have a minimum diameter of 7.7 cm (3 in.). Should you require further information on pumping rates through various line sizes and the pressure drop involved, please contact your Oil Additives representative at Evonik.

Evonik fills railcars and tank trucks/containers to about 98% capacity. Outage tables for railcars are available on request. Actual gross weights can be obtained from the following Evonik manufacturing plants for rail cars/over the road containers, but will extend the shipping time:

- Houston, Texas, USA
- Lauterbourg, France
- Morrisburg, Ontario, Canada
- Weiterstadt, Germany
- Jurong Island, Singapore

For maximum efficiency and safety in unloading VISCOPLEX® and VISCOBASE® products from tank trucks, use the following recommended checklist. Be sure to use proper safety equipment at all times. Personal Protection Equipment (PPE) should be used during unloading. Additional fall protection is recommended when accessing the top of tank trucks. Be sure to unload tank trucks in a contained area (impervious surface unloading area). Avoiding gravel or sand near the unloading area will ensure easier containment/cleaning of the product in case of a spill. If existing unloading areas have sewers, it is recommended to lock them closed and/or to have mats that could be used to cover the sewers during unloading to prevent product from entering the sewers. Cleaning the sewers will be very difficult since the product may solidify when it cools. Follow any other local spill prevention or wastewater management procedures.

UNLOADING PREPARATIONS

1. Check results of laboratory testing and obtain release document.
2. If trailers are disconnected from trucks, make sure proper support is used for trailer (e.g. "A" support frames).
3. Use chock blocks for the wheels.
4. Gladhand locks are recommended for trailers that remain connected to the truck.
5. Compare contents on outlet valve tag and receiving report with instructions to unload. Inspect seal to ensure it has not been tampered with. Record seal number on the unloading documents. Extra precaution (i.e. inspection of equipment and lab testing of material) might be necessary if seal has been tampered with.
6. Place "Container Connected" signs (if available).
7. Attach ground wire.
8. Vent the tank truck properly. Open manhole or follow any special instructions for venting.
9. Check that transfer lines and receiving tanks are clean and free from contaminants.
10. Check for sufficient room in the receiving tank.
11. In the event that on-site heating is required, hook unloading hoses to containers prior to any heat-up.
12. Open inlet and outlet coils. Check for leaks and product in coils.
13. Apply low-pressure steam or tempered water to the coils if necessary. Also check that coils are rated for the steam pressure that is available. Bleed the tap.
14. Set valves and lines properly. Wire quick coupling ears.
15. If air pressure is required to unload, make sure the truck's air compressor is equipped with a pressure gauge and a relief valve.
16. Nitrogen or carbon dioxide are preferred versus pressurized air, to avoid color development.

DURING UNLOADING

1. Start the transfer.
2. Make sure the material is flowing properly.
3. Check all connections for leaks.
4. Make sure the tank truck/container is empty (by tilting it if possible).
5. Make sure you completely empty the lines to ensure no product residue is left in the transfer hoses or unloading lines.

AFTER UNLOADING

1. Stop the transfer by closing valves and shutting off the pump.
2. Close and check that the indicator pins are in the down position on the internal valve.
3. Vent and drain coil lines before disconnecting.
4. Place coil inlet and outlet in open position.
5. Bleed off pressure in hoses before disconnecting.
6. Disconnect and drain hoses into a suitable container.
7. Close all openings on the top of the tank truck/container.
8. Remove any special fittings.
9. Remove grounding wire.
10. Remove "Container Connected"sign (if used).
11. Remove Gladhand locks (if used).
12. File the checklist in the unloading department.
13. During cold conditions, make sure to drain the heating coil to avoid frost damage (unless otherwise protected by coil antifreeze fluid). If anti-freeze has to be drained, ensure proper disposal.

Ensure unloading hoses (including steam hoses, gaskets) and other unloading equipment is properly maintained according to manufacturer's recommendation.

DRUM HANDLING

Drum handling can be accomplished by following the following recommended procedures as guidelines. Since the drums have to be heated, precaution must be taken when handling the hot drums. Personal Protection Equipment (PPE), e.g. eye protection, chemical-resistant gloves, protective clothing and safety shoes might be necessary. Follow local safety requirements.

1. Be sure to crack open the larger bung before heating. This precaution will keep pressure from building up in the drum during heating.
2. For safety considerations, four drums should be placed on a pallet. Evonik suggests the customer orders a minimum of four drums on a pallet. When handling the drums at the customer site, caution should be taken, especially if there are less than 4 drums on a pallet.
3. Drums can be emptied easily, if they are well-heated. Proper heating is achieved by putting them in a hot house, in drum heaters or under steam blankets. The recommended oven temperature for drum heating is 80°C (176°F). Drums should not be heated above 80°C (176°F) for VISCOPLEX® Series 3, 6, 7, 10, 12 and 14 and VISCOBASE® products, or above 95°C (203°F) for all other VISCOPLEX® products, to avoid spillage.
4. Drums are best emptied by using a positive displacement pump and/or gravity draining. Other pumps do not work as well.

If a drum is found to be leaking, immediately (if feasible) empty drum or use an overpack drum. Follow local spill response or cleanup procedures. Also, please report any incidents to Evonik's customer service.

SUMMARY INFORMATION

Table 1 provides recommended storage, handling and heating conditions for most VISCOPLEX® and VISCOBASE® products. Table 2 provides minimum handling temperatures and recommended temperatures when decanting drums for all VISCOPLEX® products.

Table 1

	VISCOPLEX® Series 3, 6, 7, 10, 12 and 14, VISCOBASE® Series 5 and 11 products – °C (°F)	VISCOPLEX® Series 0, 1, 8 and 9 products – °C (°F)
Recommended temperature for bulk storage	55 (131)	70 (158)
Recommended maximum temperature for storage	80 (176)	100 (212)
Recommended maximum temperature for contact with heated surfaces	110 (230)	130 (266)
Recommended maximum temperature for handling	80 (176)	107 (225)
Recommended oven temperature for drum heating	80 (176)	95 (203)

Table 2
Product Bulk Viscosity @ 100°C/212°F

Minimum mm^2/s	Maximum mm^2/s	Minimum handling temperature for bulk viscosity below 5,000 mm^2/s – °C (°F)	Recommended temperature for decanting drums – °C (°F)
0	150	20 (68)	35 (95)
151	200	25 (77)	40 (104)
201	250	30 (86)	40 (104)
251	300	35 (95)	45 (113)
301	400	40 (104)	50 (122)
401	500	45 (113)	55 (131)
501	625	50 (122)	60 (140)
626	800	55 (131)	65 (149)
801	1000	60 (140)	70 (158)
1001	1250	65 (149)	75 (167)
1251	1600	70 (158)	80 (176)
1601	2000	75 (167)	85 (185)
2001	2500	80 (176)	90 (194)
2501	3200	85 (185)	95 (203)

This information and all further technical advice is based on our present knowledge and experience. However, it implies no liability or other legal responsibility on our part, including with regard to existing third party intellectual property rights, especially patent rights. In particular, no warranty, whether express or implied, or guarantee of product properties in the legal sense is intended or implied. We reserve the right to make any changes according to technological progress or further developments. The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Performance of the product described herein should be verified by testing, which should be carried out only by qualified experts and is the sole responsibility of the customer. Reference to trade names used by other companies is neither a recommendation, nor does it imply that similar products could not be used.

In case of spill, leak, fire, exposure or accident contact:

USA – CHEMTREC:
PHONE +1 800 424-9300

Canada – CANUTEC:
PHONE +1 613 996-6666

Europe/Africa/Middle East :
PHONE +49 6151 18-4342

China (domestic sales):
PHONE +86 532 8388 9090

China (indent sales)/ Hong Kong/Japan/ Singapore/South Korea:
Singapore Emergency Provider
PHONE +65 6542 9595

Other locations – CALL COLLECT:
PHONE +1 703-527-3887

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