Chevron Phillips CHEMICAL

Safe Handling & Storage of

AlphaPlus® 1-Hexene

&

AlphaPlus® 1-Octene

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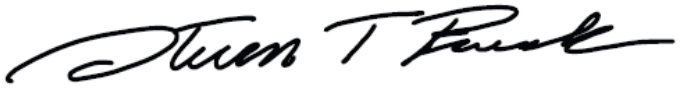
March 1, 2024

Operational Excellence Policy

We will strive each day to conduct our business in a safe, secure, injury-free, environmentally responsible, and sustainable manner. We are committed to comply with all laws and regulations applicable to our facilities and business activities and to comply with all voluntary programs to which we elect to subscribe. We will strive to make optimal use of the resources we consume and minimize emissions and waste. We will strive to continually reduce the risks of our products throughout their lifecycle and will encourage their responsible use and disposal. We are committed to reducing risks in our operations to safeguard our employees, contractors, and the communities where we operate and engage in business activities. We will openly communicate our results and welcome the input of our employees and contractors, regulatory agencies, our communities, our customers, and other interested stakeholders.

We will accomplish this by integrating safety, security, health, environmental, 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.



Steven T. Prusak
President & CEO
Chevron Phillips Chemical Company LLC

EHS-1000, Rev. 6

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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 Safety Data Sheet (SDS) for 1-Hexene (#PE0016) or 1-Octene (#PE0017). The most current SDS can be obtained from Chevron Phillips Chemical Company at www.cpchem.com or by calling (800) 852-5530 and should be carefully examined prior to working with these products.

INTRODUCTION

Gulf Oil Chemicals Company first commercialized the production of normal alpha olefins, Gulftene® alpha olefins, in 1965. Today, alpha olefin products are produced and marketed by Chevron Phillips Chemical Company. This brochure covers the safe handling and storage of 1-hexene (Alpha Olefin 6) and 1-octene (Alpha Olefin 8) alpha olefins. A brief description of typical applications of these products follows.

In the production of high-density polyethylene (HDPE) and linear low-density polyethylene (LLDPE) resins, 1-hexene and 1-octene are commonly used as comonomers. The use of either alpha olefin as a comonomer affects the density due to the amount of short-chain branching. An increase in the comonomer concentration results in a lowering of the density of the resin and affects the processing and mechanical properties of the polymer. In another application, 1-hexene and 1-octene are employed in the manufacturing of polyanhydrides (e.g., copolymers of maleic anhydride and alpha olefins).

Chevron Phillips Chemical Company's 1-hexene and 1-octene are employed in the production of surfactants (detergent alcohols and alkyl aromatics). They can be converted to linear alkyl benzene sulfonates, which are commonly used in dishwashing liquids, laundry detergents, all-purpose cleaners and lube-oil additives. The alpha olefin fraction 1-octene can be converted to a variety of nonionic ethoxylates when the corresponding alcohols are reacted with ethylene oxide. The nonionic ethoxylates can be employed as surfactants or undergo additional derivatization.

Polyol esters are prepared from 1-hexene and 1-octene. Polyol esters are characterized by a tolerance to a wide range of temperatures and are employed as base fluids for jet engine lubricants and refrigeration compressor oils for HFC-134a chlorine-free refrigerants. They can also be used to produce plasticizer alcohols and alkenyl succinic anhydrides, which are used as additives. Finally, these products are used in specialty chemicals such as epoxides, mercaptans, alkyl silanes and metal alkyls.

PART 1

SPECIFICATIONS, PROPERTIES AND TEST METHODS

1-HEXENE (C_6H_{12}) AND 1-OCTENE (C_8H_{16}) SALES SPECIFICATION

Please reference the Chevron Phillips Chemical Company website for sales specifications at www.cpchem.com.

TYPICAL PROPERTIES

	1-Hexene	1-Octene
Aniline Point [1,2], °C (°F)	22.8 (73.0)	32.5 (90.5)
API Gravity[2] at 15.6°C (60°F)	77.4	65.2
Appearance	Clear & Bright	Clear & Bright
Autoignition Temperature[3], °C (°F)	253 (487.4)	230 (446)
Boiling Point[4], °C		
Vapor Pressure, mm of Hg		
760	63.478	121.286
700	60.907	118.366
600	56.209	113.029
500	50.849	106.933
400	44.559	99.776
300	36.861	91.009
200	26.728	79.454
100	11.11	61.611
80	6.48	56.321
50	-2.7	45.82
20	-18.6	27.54
Coefficient of Expansion[1] at 15.6°C (60°F), per °F, Calculated	0.00076	0.00058
Color		
Saybolt	+30	+30
Critical Density[4]		
gm/cm^3	0.238	0.238
lb/ft^3	14.86	14.86
Critical Pressure[4]		

atmosphere	30.990	25.265
lb/in^2	455.43	371.30
bar	31.401	25.600
Critical Temperature[4]		
^oK	503.8	567.1
^oC	230.6	293.9
^oR	906.8	1020.7
^oF	447.1	561.0
	1-Hexene	**1-Octene**
Critical Volume[4]		
cm^3/gm-mole	353.6	471.5
ft^3/lb-mole	5.664	7.553
ft^3/lb	0.0673	0.0673
Critical PV/RT(ref 4)	0.265	0.256
Density of the Liquid[4], gm/cm^3		
Temperature, ^oC		
10	0.6826	0.7233
20	0.67317	0.71492
25	0.66848	0.71085
Linear Least Squares Constants[5]		
(for units of gm/cm^3)		
m	-0.943714	-0.834303
b	0.692050	0.731610
Entropy of Vaporization[4] at Boiling Point,		
cal K^{-1} mole^{-1}	20.08	20.46
Flammability Limits[2], vol%		
Lower	2	0.7
Upper	7	6.8
Flash Point (TCC), ^oC (^oF)	-26 (-15)[6]	12.8 (55.0)[2]
Free Energy of Formation[4] at 25^oC, kcal/mole		
Gas, Ideal State	20.71	24.65
Freezing Point[2], ^oC (^oF)	-139.82 (-219.67)	-101.74 (-151.12)
Heat Capacity[4] at 25^oC, cal/gm-^oC		

Gas	0.3723	0.3755
Liquid	0.5206	0.5133
Heat of Combustion of the Liquid[4] at 25°C and Constant Pressure, Gross, kcal/mole		
$H_2O(l) + CO_2(g)$	956.8	1269.3
$H_2O(g) + CO_2(g)$	893.7	1185.2
Heat of Formation of the Gas[4] at 25°C, kcal/mole	-10.03	-19.98
Heat of Vaporization at Boiling Point[4], kcal/mole	6.76	8.07
	1-Hexene	**1-Octene**
Ideal Gas Thermodynamic Properties[4]		
Temperature, °C	Heat Capacity, cal/gm-mole-°C	Heat Capacity, cal/gm-mole-°C
0	29.45	39.64
25	31.63	42.56
100	37.89	51.01
500	62.83	84.56
1000	78.93	106.04
Temperature, °C	Enthalpy, cal/gm-mole	Enthalpy, cal/gm-mole
0	5,475	7,201
25	6,229	8,214
100	8,828	11,715
500	29,464	39,509
1000	65,409	87,838
Molecular Formula	C_6H_{12}	C_8H_{16}
Molecular Weight	84.16	112.21
Odor	Olefinic	Olefinic
Odor Threshold in Air[7], (ppm)	0.02	2.0
Refractive Index[1]		
Temperature, °C	(N_D)	(N_D)
20	1.38788	1.40870
25	1.38502	1.40620
Relative Density (Specific Gravity)[8],		
10°C/15.6°C	0.6833	0.7240
20°C/15.6°C	0.6739	0.7156
25°C/15.6°C	0.6692	0.7116

Relative Vapor Density[7] (Air = 1)		3	3.9
Solubility of Water in Product, ppmw			
20°C (68°F)[9]	343		—
25°C (77°F)[3]		129 max.	100 max.
40°C (104°F)[3]		162 max.	108 max.
Solubility of Product in Water[9] at 20°C (68°F), ppmw		46.7	2.5

		1-Hexene	**1-Octene**
Surface tension[4], dynes/cm			
Temperature, °C			
0		20.47	23.68
20		18.42	21.76
25		17.90	21.28
40		16.36	19.85
50		15.33	18.89
60		14.31	17.93
70		--	16.97
100		--	14.10
Vapor Pressure[4] at 100 °F, mm Hg		310.7	33.97
Antoine Coefficients[10]			
A	6.85770		6.93495
B		1,148.62	1,355.46
C		225.346	213.054
Viscosity[4]			
Temperature, °C		Absolute viscosity, centipoises	Absolute viscosity, centipoises
0		0.33	0.611
15		0.27	0.497
20		0.26	0.469
25		0.25	0.446
30		0.24	0.424
40		0.22	0.382
50		0.20	0.346
60		0.19	0.316
70		--	0.291
80		--	0.270
90		--	0.250
100		--	0.234

Temperature, °C	Kinematic Viscosity, centiStokes	Kinematic Viscosity, centiStokes
0	0.47	0.835
15	0.41	0.690
20	0.39	0.654
25	0.37	0.627
30	0.36	0.597
40	0.34	0.546
50	0.32	0.501
60	0.30	0.464
70	--	0.432
80	--	0.407
90	--	0.382
100	--	0.362

REFERENCES AND NOTES:

1. "Physical Constants of Hydrocarbons C_1 to C_{10}", ASTM Data Series DS 4A, Philadelphia, PA, 1971.
2. "Physical Constants of Hydrocarbon and Non-Hydrocarbon Compounds", 2nd edition, ASTM Data Series DS 4B, Philadelphia, PA, 1988.
3. Chevron Phillips Chemical Company Test Results
4. TRC Thermodynamic Tables-Hydrocarbon; The Texas A&M University System, College Station, TX 77843-3124.
5. Density (gm/cm^3) = [(m/1000) * (Temperature (°C))] + b; 0 °C ≤ Temperature ≤ 60 °C for 1-hexene and 0°C ≤ Temperature ≤ 120 °C for 1-octene. Values are good to 4 decimal places up to 100 °C.
6. "NFPA Haz-Mat Quick Guide", National Fire Protection Association, Inc., 1997.
7. Stahl, W. H., Ed. Compilation of Odor and Taste Threshold Values Data. American Society for Testing and Materials, Philadelphia, PA, 1973.
8. Values are calculated.
9. McAuliffe, C., J. Phys. Chem., 1966, 70, 1267.
10. $Log_{10}P = A - B/ (C+t)$ (10 mm Hg ≤ P ≤ 1500 mm Hg, t in °C).

RECOMMENDED TEST METHODS

The following ASTM methods are recommended for the analysis of 1-hexene and 1-octene:

1. ASTM D 56 Standard Test Method for Flash Point by Tag Closed Cup Tester
2. ASTM D 287 Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
3. ASTM D 3120 Standard Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
4. ASTM D 4176 Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
5. ASTM D 6045 Standard Test Method for Color of Petroleum Products by the Automatic Tristimulus Method
6. ASTM D 6450 Standard Test Method for Flash Point by Continuously Closed Cup (CCCFP) Tester
7. ASTM E 411 Standard Test Method for Trace Quantities of Carbonyl Compounds with 2,4-Dinitrophenylhydrazine
8. ASTM E 659 Standard Test Method for Autoignition Temperature of Liquid Chemicals
9. ASTM E 1064 Standard Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration

PART 2

SAMPLING AND HANDLING

TRAINING

In any workplace, training should be conducted before sampling and handling operations of 1-hexene and 1-octene are undertaken. Several commercial websites provide access to the Code of Federal Regulations, NIOSH, and OSHA databases which may help in answering questions and setting up safety programs. The training program may include the following:

1. Properties and health hazards of 1-hexene or 1-octene.

2. Safe work and good housekeeping practices.

3. The importance of protection from 1-hexene or 1-octene contact; the proper clothing and cleaning requirements to ensure worker protection.

4. Signs and symptoms of 1-hexene or 1-octene exposure and action to be taken.

5. The care that must be taken whenever and wherever 1-hexene or 1-octene is used, handled, stored and transported.

6. Emergency procedures for leaks, spills and fires, including protective clothing to be worn in such instances. Check the product's MSDS for further information.

7. First aid measures to be used after exposure.

8. The availability of written 1-hexene or 1-octene usage, health hazard and training program procedures.

It is recommended that this generalized sampling and handling training program should be part of a worker's initial instruction. Refresher training should be scheduled at least annually thereafter.

A summary of accidental release, fire, and health information is presented in PART 4 of this brochure.

RECOMMENDED PRACTICE FOR SAMPLING

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.

SAMPLING:

If testing for water, peroxide or carbonyl contaminants, samples must be obtained using a gas cylinder. As a best practice, Chevron Phillips Chemical Company uses cylinders specified by 49 CFR, Subpart C, Section 178.36 (3A or 3AX seamless steel cylinders). The charging of these cylinders must conform to Section 173.302. Purge the cylinder with product before collecting the final sample. Ensure the appropriate outage be left for the liquid. For all other testing procedures and before sampling 1-hexene or 1-octene, the nitrogen atmosphere within the storage container or transport vessel should be depressurized safely. Samples may be taken through the sampling port (tank) or the manway opening (vessel) by means of a clean, dry 1-qt. (1-L) bottle held in a clean, dry sheath of nickel or stainless steel attached to a long rod or lightweight chain of the same material. Fit the bottle with a glass stopper to which is attached a light metal chain. Lower the bottle to near the bottom of the tank and pull out the stopper with a sharp jerk of the chain. Raise it at such a rate that it is about three-fourths full when it emerges from the liquid. Stopper the bottle before attempting to rinse the material from the outside. Label the sample bottle according to OSHA Regulations (refer to 29 CFR 1910.1200). Also as required by DOT, an emptied 1-hexene or 1-octene cylinder or bottle

must retain the same markings and labels used during its initial transport until the container has been sufficiently purged.

NOTE: Fresh air and other personal protective gear may be required depending on exposure limits set in the individual workplace.

Emphasis should be placed on cleanliness and dryness. Both the sample bottle and its holder must be CLEAN AND DRY. Transfer the sample to another bottle for storage. A suitable bottle for storing the sample is one known as a "Boston Round." The closure should be a screw cap with a Teflon® or aluminum foil liner.

Before using new bottles, first rinse them thoroughly with carbonyl-free ethanol and then dry in a hot-air oven. Hold the bottles in a desiccator while cooling to ambient temperature. Protect them from dirt or moisture by enclosure in a polyethylene bag.

The sampling device should be bonded to the tank manway (e.g., by resting the chain on the lip of the manway) prior to sampling.

REFERENCE DOCUMENTS:

ASTM E 300 –
Standard Practice for Sampling Industrial Chemicals

ANSI Z 288.1 –
Flammable and Combustible Liquids Code

API RP 500 –
Classification of Locations for Electrical Installation at Petroleum Facilities Classified as Class I, Division 1, and Division 2

OSHA Regulations –
29 CFR, Paragraphs 1910.1000 and 1910.2000

U.S. DOT Regulations –
49 CFR, Transportation Subchapters B and C, Parts 171-179

STATIC ELECTRICITY AND GROUNDING

Alpha olefins are characterized by high electrical resistivity (low conductivity), which can result in the buildup of excess static charge during transfer operations. Both 1-hexene and 1-octene are classified as intermediate vapor pressure products under the API RP 2003 Guidelines. At 37.8°C (100°F), 1-hexene and 1-octene have vapor pressures of 310.7 and 33.97 mm Hg, respectively. These products are likely to create a flammable mixture in the vapor space during handling. Thus, the situation can exist for extremely dangerous explosions within closed containers, storage tanks or transport vessels.

Key operations which have the potential of generating a flammable atmosphere and/or static charge include tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing/agitation and vacuum truck operations. To minimize the hazard of static electricity during these operations, bonding and grounding may be necessary but may not by themselves be sufficient. 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".

PRODUCT LOADING/UNLOADING REQUIREMENTS

Loading operations must be performed only by qualified personnel. These individuals must be properly instructed in the loading of hazardous materials and made responsible for careful compliance with 49 CFR, Parts 172 and 173. Workers should refer to their site's fire and safety guidelines for required personal protective equipment. Due to the flammable nature of these products, use caution to avoid creating any sparks that could ignite the product. As the product is being loaded/unloaded, static buildup can occur. Therefore, a ground cable must be placed on the container to prevent the buildup of static electricity. Use only clean, oil- and dirt-free, spark-resistant tools and implements.

The importance of thorough pre-trip and post-trip safety inspections cannot be overemphasized. The process of physical inspection of the container is one of the best methods of minimizing human error, the principle cause of transportation incidents.

Take extreme care to prevent spills. In case material is spilled, wash contaminated areas thoroughly with large quantities of water and collect the liquid in the plant chemical waste system. Drums and trucks can be used for temporary storage until product can be recycled or disposed of properly. See PART 5 of this brochure for further information.

WHEN LOADING OR UNLOADING A VESSEL OR BARGE:

Requirements for shipments of flammable liquids such as 1-hexene or 1-octene over water are defined in 46 CFR. Additionally, barge shipments are regulated by the U.S. Coast Guard and the regulations are published in 46 CFR, Part 151. Refer to current International Safety Guide for Oil Tankers and Terminals (ISGOTT) and United States Coast Guard (USCG) rules (46 CFR, Part 153) for regulations governing transportation by sea-going vessels. Chevron Phillips Chemical Company and independent inspectors ensure that 1-hexene and 1-octene are loaded in uncontaminated tanks.

Plan and control the loading and unloading of 1-hexene or 1-octene to limit personnel exposure and environmental releases. OSHA and the U.S. Coast Guard have published regulations applicable to personnel involved in the handling of these products. Some of the key elements are:

1. Employee Training
2. Personal Protective Equipment
3. Warning Signs

To reduce exposure of personnel to 1-hexene or 1-octene, gauging on the barge should consist of a closed device for use during transfer of product and a restricted device to determine product quantity during transfer. Vapor return lines are also required in some states and countries to control vapor releases.

Clean stainless steel tanks, rust-free mild steel tanks or suitably washed steel tanks are acceptable for transport of 1-hexene or 1-octene. ChevronTexaco Shipping carefully selects barges to ensure that product quality is not negatively affected during transport.

Qualified contractors should be used to inspect, clean and repair barges in which 1-hexene and 1-octene are shipped. The contractor should have facilities to dispose of residual product in an acceptable manner.

WHEN LOADING OR UNLOADING TANK CARS:

DOT regulations allow both 1-hexene and 1-octene to be shipped in General Purpose (GP) tank cars. Chevron Phillips Chemical Company has chosen to use dedicated pressure (LPG) cars because of nitrogen blanketing, and the greater containment potential and strength of LPG cars in comparison to GP cars.

Pressure tank cars in the Chevron Phillips Chemical Company fleet are DOT 105A300W and DOT 112J340W rated and are stenciled accordingly. These cars are insulated and have top loading/unloading capability.

Loading

Erect track warning signs, set hand brakes, place wheel chocks, turn on track warning lights (if available) and connect ground cable. Rail cars with no tank pressure should be nitrogen purged to displace oxygen. Once car is oxygen free (< 1% O_2 as determined by an O_2 analyzer), check car loading and vent valves making sure they are closed. Remove plug from vent valve and attach vent line extension (nipple) with Dry Link connection. Depressurize tank car to flare header. Disconnect vent line and tighten valve plug.

Visually inspect tank car exterior for damage and inspection dates. Connect vent line to vapor recovery unit and product loading hose to car, using Dry Link connections for both. Load product by opening product valve on tank

car, starting product pump and opening product line at the rack. Fill car to the desired capacity. Shut down transfer pump and block product line valve. Nitrogen purge the loading hose and vent line for approximately 30 seconds to remove residual product. Block tank car product and vent valves and remove product vent hose. Remove extension nipples. Block and plug all fittings. Apply appropriate placards and seals. Remove ground cable, wheel chocks and warning signs. Turn off track warning lights.

Unloading

Brakes must be set, wheels chocked, ground cables connected and caution signs erected. Check unloading and vent valves making sure they are closed. Remove plugs and connect unloading hose to the liquid valve and a nitrogen hose to the vapor valve (check gaskets before connecting hoses). Open product valve and start unloading pump, bleeding any vapors prior to start. Pressurized rail cars are equipped with high-flow check valves. The product valve must be opened slowly and off-loading must be within the valve's limits or it will check. Maintain positive tank pressure with nitrogen. After offloading is completed, shut off pump, close vent valve and remove nitrogen line. Close product valve and slowly unscrew unloading hose connection relieving any pressure. Close, plug and tighten all fittings. Placard tank car with appropriate placards. Remove wheel chocks, ground cable and caution signs.

WHEN LOADING OR UNLOADING TANK TRUCKS:

DOT-407 cargo tanks are the most common trailer used to transport low pressure flammable liquids such as 1-Hexene and 1-Octene.

Loading

Place wheel chocks in front and back of truck's rear wheels allowing ¾" clearance for ease of removal. Connect ground cable. Ensure that the trailer is oxygen-free before proceeding (< 1% O_2 as determined by an O_2 analyzer). Purge trailers with nitrogen to displace oxygen if needed. Vent trailer to flare header. Disconnect vent line.

Visually inspect trailer exterior for damage and inspection dates. Check loading and vent valves making sure they are closed. Slowly remove caps. Connect product loading hose to truck spray bar and vapor recovery vent lines. Only Dry Link connections are acceptable. Open product valve to load product, start transfer pump and vent vapors to the vapor recovery system as necessary during loading to maintain product flow into the trailer. After loading is completed, shut down transfer pump and block product line valve. Purge loading line with nitrogen for approximately 30 seconds to clear free liquid through spray fill line. Block trailer product and vent. Remove product and vent lines. Block and plug all fittings. Apply appropriate placards and seals. Remove wheel chocks and ground cable.

Unloading

Place wheel chocks in front and back of truck's rear wheels allowing ¾" clearance. Connect ground cable. Check internal and external trailer valves making sure they are closed. Remove unloading valve cap. Check gasket and connect unloading hose. Only Dry Link connections are acceptable. Check valve on trailer vent line making sure valve is closed. Remove cap and connect a nitrogen hose to vent line. Open internal and external valves and start unloading pump. Bleed vapors before starting pump, if required, otherwise valves may check. Add nitrogen to maintain positive tank pressure as required.

After product transfer is complete, shut off unloading pump, close vent line and remove nitrogen line. Close internal and external valves; slowly unscrew unloading hose connection to relieve pressure. Close, cap and tighten all fittings. Remove wheel chocks and ground cable. Placards must be retained on trailer until trailer is cleaned.

SAFETY REFERENCES

The following publications are excellent references for product handling, safety and fire control:

NFPA 10 -
Standard for Portable Fire Extinguishers

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

NFPA 30 -
Flammable and Combustible Liquids Code

NFPA 70 -
National Electrical Code®

NFPA 77 -
Recommended Practice on Static Electricity

Manual Sheet TC-4,
Chemical Manufacturer's Association
Recommended Practice for Unloading Flammable Liquids from Tank Cars.

PART 3

STORAGE DESIGN RECOMMENDATIONS

STORAGE TANKS

Storage tanks for 1-hexene and 1-octene 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 customer 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 in order 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 that may build up during filling.

Chevron Phillips Chemical Company's 1-hexene and 1-octene have vapor pressures of 6.00 and 0.66 psia at 37.8°C (100°F) respectively. Local environmental regulations may require that either product be stored in a tank that is either a pressure tank, equipped with an internal floating roof or connected to a vapor recovery system. An internal floating roof along with a nitrogen blanket is one of the best methods of preventing peroxide or carbonyl buildup.

A nitrogen blanketing system is necessary for applications where the product is going to be stored for long periods of time and peroxides and/or carbonyls would present a problem in the process. A nitrogen system that maintains positive pressure and adds nitrogen as the product is withdrawn, and as the tank breathes, 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, an olefin sample should be tested periodically and withdrawn though the sump. When peroxide and carbonyl development is a concern, use a closed handling system that maintains nitrogen atmosphere on the product through the loading, unloading, and other handling activities to minimize exposure to atmospheric oxygen.

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.

Exercise care in selecting the gasket and seal materials to be used. White Canadian Asbestos, Teflon®, and glass-impregnated Teflon® have proven to be compatible with these products.

Coat storage tanks with reflective paint to reduce temperature fluctuations. While there is no recommended maximum storage temperature for 1-hexene and 1-octene, both the flash point and air permitting requirements must be considered.

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.

Tanks should be periodically inspected for leaks and serviced in accordance with the principle of API Standard 653.

Workers should never be permitted to enter an empty tank which has been used for 1-hexene or 1-octene until the requirements of the OSHA 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 and limitations on concentrations of 1-hexene or 1-octene.

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

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

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

Chevron Phillips Chemical Company's 1-hexene and 1-octene 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. 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 Service Group at 800-852-5531 for recommendations. Inspect and renew filter cartridges periodically.

IMPURITY FORMATION

Small amounts of impurities, such as peroxides, carbonyls, and water may be formed during transport or long-term storage. Alumina or Molecular Sieve are effective in removing these impurities. Contact Chevron Phillips Chemical Company's Customer Technical Service Group at 800-852-5531 if additional assistance is required.

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. A satisfactory type hose is SW-309 PETRO-VAC 150 Tank Truck Hose (seamless nitrile tube with multiple plies of polyester with helix wire and a one-piece nitrile blend cover) or SP-483 modified X-link chemical hose (seamless X-link polyethylene tube with multiple plies of polyester which is supported by a PVC rod helix and a one-piece blue synthetic cover). Teflon® is 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, centrifugal pumps with mechanical seals perform satisfactorily. The pump manufacturer can make recommendations regarding the proper type of pump if the following parameters are known: 1) flow rate, 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 flammable materials and reduce vapor emissions of product into the atmosphere. Demisting systems should be used to keep pump bearings lubed.

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

1. Mechanical seals in conformance with API Standard 682.

2. Pumps in conformance with API Standard 610.

3. Pumps 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.

4. The pump shaft should be highly polished.

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

6. 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 flexible die-formed rings with flexible braided end-rings.
(2) Used for field repacking.

INCOMPATIBLE MATERIALS

Viton® is not recommended for use with 1-hexene or 1-octene. Viton® is permeable and will absorb gases or vapors. This absorption causes swelling making the material incompatible for couplings and connections.

PIPELINES

The following are recommended practices in engineering pipelines for 1-hexene or 1-octene:

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.

TEMPERATURE CONTROL

Proper pressure relief must be provided. Storage facilities should be designed to avoid the possibility of overheating and boiling. Coating storage tanks and lines with reflective paint will help prevent temperature buildup. Insulation is not needed nor is it recommended since corrosion and deterioration of the lines can occur. Also, vapor lock may result from overheating.

VAPOR CONTROL SYSTEMS

Evaporative emissions from 1-hexene and 1-octene are not regulated by the Federal Clean Air Act. However, some states and localities may regulate evaporative emissions of these materials. Check local regulations in the facility's state. For control of these vapor emissions, the U.S. EPA has recognized two types of systems as the "Best Available Control Technology (BACT)." The two recognized technologies are Hydrocarbon Vapor Recovery using the Carbon Adsorption-Absorption process and Hydrocarbon Vapor Combustion.

Generally, storage vapor recovery systems are favored in medium-to-large terminals where a sufficient quantity of product can be recovered to justify the higher capital cost. Other factors, which favor vapor recovery, include easier permitting and inherent safety advantages. In absence of a regulatory requirement, closed loading should be carried out with vapor return to recovery systems when these facilities are available.

Note - Recommendations concerning the construction of either type of vapor recovery system are listed in the USCG Regulations in 33 CFR.

PART 4

HEALTH, ENVIRONMENT, FIRE AND ACCIDENTAL RELEASE INFORMATION

Safety Data Sheets (SDS) and Product Stewardship Summary for NAO products are available from Chevron Phillips Chemical Company to help customers satisfy safe handling and disposal needs and OSHA Hazard Communication Standard requirements. Such information should be requested and studied prior to working with these products. The most current SDS's and Product Stewardship Summary for NAO can be obtained from Chevron Phillips Chemical Company at www.cpchem.com or by calling (800) 852-5530. Specific questions about SDS's can be sent to sds@cpchem.com .

PART 5

TRANSPORTATION INFORMATION AND REGULATORY PROFILES

Safety Data Sheets (SDS) and Product Stewardship Summary for NAO products are available from Chevron Phillips Chemical Company to help customers satisfy safe handling and disposal needs and OSHA Hazard Communication Standard requirements. Such information should be requested and studied prior to working with these products. The most current SDS's and Product Stewardship Summary for NAO can be obtained from Chevron Phillips Chemical Company at www.cpchem.com or by calling (800) 852-5530. Specific questions about SDS's can be sent to sds@cpchem.com .

REVISION STATEMENTS

This revision updates the following sections:

December 2013

1. Operational Excellence statement updated
2. Part 1- Sales Specs removed and replaced with the website information
3. Part 4 – Removed and replaced with SDS reference statement
4. Part 5 – Regulatory Profile removed and replaced with SDS reference statement

December 2024

1. Part 5 – Updated to include reference to Product Stewardship Summary

PART 6

APPENDIX

GLOSSARY OF TERMS, ABBREVIATIONS, AND ORGANIZATIONS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
Bonding	The connection of two or more conductive objects by means of a conductor (most commonly a wire or metal plate).
CEIC	Chevron Emergency Information Center
CFR	Code of Federal Regulations
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.
DOT	Department of Transportation
EPA	Environmental Protection Agency
FDA	Food & Drug Administration
Flash Point	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.
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
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.
SDS	Material Safety Data Sheet
Vapor Pressure	The pressure exerted by a volatile liquid while under defined equilibrium conditions. A common way to measure vapor pressure is in millimeters of mercury (mm Hg).