

## Storage and handling of NEODOL ethoxylates

NEODOL ethoxylates are produced by adding varying amounts of ethylene oxide (EO) to high purity linear C<sub>9</sub>-C<sub>15</sub> NEODOL alcohols. These products have a wide range of uses where surface active agents are required. These include detergents and personal care products (bath soaps, shampoos, etc.).

### Toxicology and Safety

NEODOL ethoxylates can be used safely when normal industrial handling practices are followed. NEODOL products are comparable in their properties to widely used coconut oil-derived materials. Acute toxicity studies in animals show these products to be of low order toxicity. However, undiluted NEODOL products can be irritating to the eye and skin. Eye protection, such as goggles, should be used if there is the potential of contact with the eyes. Chemical resistant gloves should also be worn, as well as other protective clothing (as needed) to prevent prolonged or repeated skin contact. Any undiluted material on the skin and especially in the eyes should be removed by flushing with water.

As in all ethoxylated materials, trace quantities of residual ethylene oxide (EO) may be present in NEODOL ethoxylates, typically from 0 to 6 ppm. As a result, EO could accumulate in headspace areas of storage and transport vessels. EO is a suspected human carcinogen and reproductive hazard, and repeated exposure to EO may be harmful. The small amounts of EO in ethoxylates are not expected to result in either acute or long-term hazard when handled properly. Although there are generally no Occupational Exposure Limits established for NEODOL ethoxylates, there are OEL's established for EO. If there is a potential for occupational exposure exceeding 1 ppm in air on an 8-hr TWA or 5 ppm in air on a 15 minute STEL a NIOSH approved respirator is required. For more information on safe handling, consult the Material Safety Data Sheet (MSDS) for the specific NEODOL product.

### Protective Equipment

	Normal operations	Spillage
Eye	Chemical monogoggles	Chemical monogoggles
Hand	Wrist length gloves; PVC, neoprene or nitrile	Gauntlet-type gloves; PVC, neoprene, or nitrile
Foot	Safety shoes or boots; chemical resistant	Safety boots, rubber, knee length Wellington type
Body	Standard issue work clothes	Chemical resistant PVC one piece suit with integral hood
Respiratory protection	Not normally required	If there is a risk of inhaling aerosol/mist/sprays, wear a full face mask respirator with organic vapor canister and built in particulate filter, Nominal Protection Factor (NPF) 20 (gas only). If spillage occurs in a poorly ventilated area, wear a compressed air line mask or self contained breathing apparatus

### Fire and Spills

NEODOL products can catch fire under certain conditions and should be kept away from heat and flames. Smoking should not be permitted where any of the NEODOL products are stored, handled or used. In the event of a small fire, carbon dioxide or dry chemical type fire extinguishers should be used. Larger fires should be extinguished with alcohol resistant foam or water fog. Do not use water in a jet. A positive pressure NIOSH approved self-contained breathing apparatus should be worn while fighting fires in confined areas. Other fire and spill considerations include:

- In the event of a spill or leak, remove all ignition sources

- Avoid walking in the spilled materials as they are very slippery
- Dike large spills. Remove all liquid by pumping into salvage tanks.
- Scoop any solidified material into disposal containers
- Spread sand or absorbent materials such as vermiculite to remove residues
- Place waste materials in leak-proof containers for later disposal
- Use water sparingly as a removal agent, as gels and foam can be formed which are difficult to handle and clean up

NEODOL ethoxylates are toxic to marine life if spilled directly into a waterway. The 23-, 25-, and 45-series are classified as 'Dangerous to the Environment' and as 'Marine Pollutants.' Miscibility with water is variable. Materials will mostly float on water and are mobile in soil. Evaporation will be negligible because of low volatility. If a spill occurs, the source should be controlled as soon as possible and diked off quickly to allow as little material as possible to enter a waterway. If leaking or damaged drums cannot be removed, a dike should be erected around them to prevent further leakage into the environment. Inform local authorities immediately if spilled product enters surface drains and water courses, since a potential environmental hazard may exist and congealed/diluted product may cause blockages.

### NEODOL Ethoxylate Storage Conditions

#### *Temperature*

NEODOL ethoxylates are stable products, which will maintain product quality for long periods of time if properly stored. Many NEODOL ethoxylates can solidify at ambient temperatures and should be stored at temperatures at least 5 °C /10 °F above their pour points in order to assure good fluidity. Heating is required when the ambient temperatures fall below the pour point. Overheating is a key variable that could have an adverse effect on product quality (eg, color degradation and carbonyl increase). Care should be taken, therefore, to store the product at the proper temperature and to use a heating medium that does not produce excessive localized temperature.

The normal and maximum storage temperatures, as well as maximum skin temperatures of heating devices should not be exceeded for extended periods. It is generally recommended that NEODOL products not be stored above 50 °C/122 °F for extended periods. It is best to store the products at as low a temperature as necessary to keep them fluid enough to pump and process.

The temperature of the heating medium is critical as an excessively high heat source could cause high temperature on the skin of the heating element. This could cause a charring effect of the product at the skin surface. It is recommended that the temperature of the heating medium for large storage vessels not exceed 66 °C/150 °F and the temperature of the heating medium for short-term use for heating tank trucks, tank cars, and drums not exceed 115 °C/240 °F (10 psia steam). For continuous storage in large vessels, tempered water (65 °C/150 °F) or thermostatically controlled electric heat is recommended.

#### *Nitrogen Blanketing*

In order to help maintain maximum product quality, nitrogen blanketing of tank vapor space is recommended for long-term storage. Nitrogen blanketing protects against color degradation, carbonyl formation, and water absorption. It is not a requirement, but is recommended, especially if product is stored at elevated temperatures for long periods of time.

If storage is under air, and it is important to minimize moisture absorption, a desiccant unit can be installed in the tank vent line to dry the incoming air as the tank breathes and as air is pulled into the tank during product pump-out.

#### *Shelf-Life*

Shell does not set a shelf life or expiration date as product quality is affected by storage conditions. If NEODOL products are stored under nitrogen blanket at the recommended temperatures, they will maintain product quality for an extended period. Samples should be taken periodically and analyzed for water, color and/or carbonyls if these properties are critical to end use. Drummed and smaller (laboratory) sizes should be stored at ambient temperatures and heated only as needed. Minimal exposure to heat and air will allow products to maintain quality indefinitely.

If drummed material is not maintained under continuous heat (only heated as used) and has limited exposure to air (not opened too often), the products should maintain their quality for at least two years. Samples should be taken periodically and analyzed for color and/or carbonyls to assure product quality is maintained.

## Construction Materials and Equipment

*Tanks, Piping, Valves, Pumps, Etc.*

NEODOL ethoxylates as shipped are not corrosive to carbon steel. They may be stored and handled in steel tanks and piping. However, with the addition of excessive moisture, rusting of the carbon steel may occur. If it is critical to end usage to keep rust particles or dissolved iron out of the product, tankage may consist of either internally coated carbon steel or fiberglass-reinforced epoxy or polyester resins.

The selection of internal coating material for tanks is affected materially by the storage temperature of the product, by the method of heating, and by the surface temperature of the heater. Suitable coatings for NEODOL ethoxylates having internal heating coils are high baked phenolics, modified high baked phenolics, or modified medium baked phenolics. Zinc silicates cannot be used for ethoxylate storage, since the ethoxylates tend to pick up zinc on long-term contact. Galvanized coils should also be avoided for alcohol ethoxylates. Inorganic zinc coatings should not be used on tanks that are externally heated (versus internal coils), as the tank wall temperature can deteriorate the zinc lining. If tanks are externally heated and a tank lining is preferred, then a high baked phenolic coating or a modified phenolic coating is recommended.

For non-critical end usage, an acceptable alternative to tank coating could be unlined steel with a filter located in the tank discharge piping system. A replaceable polypropylene or cotton filter cartridge (50 micron) should be used for removal of any rust particles.

Carbon steel piping is acceptable; however, if products are to be rust or iron free, alternative piping should be used. Acceptable piping is stainless steel, fiberglass-reinforced polyester or epoxy piping, or polypropylene (temperature must not exceed 60 °C/140 °F). Polyvinyl chloride (PVC) or chlorinated polyvinyl chloride (CPVC) piping is not recommended due to potential for stress cracking (particularly CPVC).

Aluminum piping/tankage is acceptable for NEODOL ethoxylates provided temperatures do not exceed 65 °C /150 °F. NEODOL ethoxylates are not as reactive to aluminum as NEODOL alcohols. Copper, brass, or bronze pumps, valves, fittings, etc., should not be as they can cause product discoloration.

Centrifugal, rotary, or positive displacement pumps with mechanical seals are suitable for transfer service. The pumps should be heated and insulated as appropriate. Heating the mechanical seals has been found to be helpful in preventing deposition on the seal face. Iron, steel, or stainless steels are suitable materials for pumps. The oxidation rate of ethoxylates is increased by contact with air (oxygen) and as temperature is increased. As such, any pumping activity, which increases contact time of ethoxylates with air, should be minimized. In order not to transfer hot air directly into the ethoxylate, it is important that the pumps not be allowed to run dry and are shut off immediately after liquid transfer.

Bulk Storage										
Tank type	BHC or BLC tanks may be used. Both types should be fitted with pressure/vacuum valves to the following settings:									
	<table border="1"> <thead> <tr> <th></th> <th>Pressure</th> <th>Vacuum</th> </tr> </thead> <tbody> <tr> <td>BHC</td> <td>5.6 kPa (56 mbar)</td> <td>0.6 kPa (6 mbar)</td> </tr> <tr> <td>BLC</td> <td>2.0 kPa (20 mbar)</td> <td>0.6 kPa (6 mbar)</td> </tr> </tbody> </table>		Pressure	Vacuum	BHC	5.6 kPa (56 mbar)	0.6 kPa (6 mbar)	BLC	2.0 kPa (20 mbar)	0.6 kPa (6 mbar)
		Pressure	Vacuum							
	BHC	5.6 kPa (56 mbar)	0.6 kPa (6 mbar)							
BLC	2.0 kPa (20 mbar)	0.6 kPa (6 mbar)								
Free standing horizontal storage tanks may also be used up to 90 m <sup>3</sup> capacity										
Manometer	A manometer should be fitted in order that the working of the pressure/vacuum valve may be checked.									
Acceptable Internal tank surface	Stainless steel High bake phenolics									

<b>Foam injection</b>	Not required
<b>Nitrogen blanket</b>	Recommended
<b>Driers</b>	Fit silica gel driers on small tanks if not nitrogen blanketed
<b>Maximum storage time</b>	Not critical
<b>Maximum storage temperature</b>	50 °C/122 °F
<b>Minimum storage temperature</b>	Product should be stored at least 5 °C/10 °F above its pour point
<b>Heating</b>	Tanks should be fitted with heating coils in areas where the ambient temperature can fall to within 5 °C/10 °F of the product's freezing point. Refer to temperature section
<b>Cooling</b>	Not required
<b>Lagging</b>	Tanks should be lagged to minimize heat losses
<b>Pumping rate</b>	Should be minimized to avoid excessive contact of product with air.

#### *Hoses and Gaskets*

Suitable gasketing materials include tetrafluoroethylene (TFE), high-density polyethylene (HDPE), polypropylene (PP), and butyl rubber. Ethylene Propylene (EPDM) elastomer can be used in NEODOL ethoxylate service but cannot be used in NEODOL alcohol service. Care must be taken in using any elastomer that the manufacturer's recommended temperature limit is not exceeded.

Polyethylene, polypropylene, TFE, or butyl rubber lined transfer hoses are recommended for use with these products - as are stainless steel flex hoses. Unheated hoses, after use, must be drained to avoid solidification and consequent plugging.

#### *Heating Systems*

For large installations involving bulk storage, the preferred method of heating is by means of tempered hot water. Complete, packaged hot water systems are available. If desired, inexpensive hot water systems are available for small installations. These systems consist of a residential or commercial type water heater, equipped with a small circulation pump, surge tank and controls.

Thermostatically controlled electric resistance heating may be used for "wrap-around" external heating of insulated metal storage tanks. This method of heating is appropriate for maintaining temperatures, or where a very small increase in product temperature is required. Similarly, this method is recommended only for the maintenance of the existing product storage temperature in insulated fiberglass reinforced plastic tanks. However, its relative ease of installation and freedom from maintenance may make it attractive within its limitations. The same attributes usually make electrical heat tracing of piping, valves, pumps, etc., the preferred method of heating this equipment. Electric heat tracing is obtainable from a number of sources.

Drums of NEODOL ethoxylates can be stored at ambient temperatures and, if necessary, can then be heated prior to use by storage in a "hot room" or by the application of low-level heat. Drums may be heated in a number of ways: steam blowing under a tarpaulin cover, in an oven, or special thermostatically controlled external type electrical or hot water type heater designed to wrap around 55-gallon drums. Individual electrical heaters for heating drums are available at a low cost. Care should be taken not to overheat drums and allowance made for product expansion as it is heated in the drum. In no case should product be heated over 65 °C/150 °F as product expansion could cause the drum fill capacity to be exceeded.

## Intermediate Bulk Containers

### *Drums, Totes and ISO-Containers*

Any of the NEODOL ethoxylates that are regulated as bulk shipments are considered non-regulated by US DOT if shipped in containers of 119-gallon capacity or less and shipped solely by domestic air or land transportation. If a NEODOL ethoxylate that is normally regulated as a bulk shipment is shipped in drums, totes, or ISO-containers via marine vessel, then the shipment is considered regulated and is classified as a marine pollutant under 49 CFR 172.101.

DOT specification drums are not required for non-regulated product. The type of drum used will be dependent upon the particular product's freezing point or pour point, and the ultimate ability to heat drums. A typical drum is a 20/18 gauge closed head gallon steel drum lined with epoxy/phenolic or phenolic. The drum should have standard 2-inch and 3/4 inch fittings. Filling weights will vary depending on individual product density, but should range between 375-465 pounds. In some instances, plastic drums can be used, but particular attention should be paid to the product freeze point, as heating of plastic drums is not generally recommended. It is recommended that only steel drums (not plastic) be used for export shipments.

## Bulk vehicles, North America

### *Tank Cars*

Tank cars for NEODOL ethoxylates are a conventional 23,500-gallon size. All tank cars have the following features:

- Externally coiled
- Insulated with a minimum of 4 inches of fiberglass insulation
- Dual purpose, with both top and bottom loading and unloading
- Carbon steel tank, interior coated with a high baked phenolic coating
- Tank bottom is sloped to center for complete drainage
- Bottom outlet has a 4-inch internal stainless steel ball valve equipped with a standard American Association of Railroads fitting having 5 1/4-inch diameter threads
- Vapor connection on top with a 1-inch ball valve

All tank cars are equipped with a tank relief valve and heater coil relief valves. The tank relief valve is set at 75 psig (this setting is stenciled on the sides of each car). Low-pressure steam (115 °C /240 °F) should be used to heat the product as higher-pressure steam could cause product discoloration due to overheating in area adjacent to steam coils.

### *Tank Trucks*

Tank trucks for NEODOL ethoxylates are constructed of either stainless steel or aluminum. NEODOL ethoxylates can be transported in aluminum equipment at the recommended temperatures. The metal wall temperature must be kept below 65 °C /150 °F. Low pressure steam (115 °C /240 °F), or tempered water should be used to heat the product, as the use of higher pressure steam could cause product discoloration due to overheating. Preferably the tanks are insulated. From September through May, in transit heating equipped trailers in the US will be provided for the low pour point products to assure that product arrives at an adequate temperature to stay in a fluid/pumpable condition. The trailers will be equipped with temperature sensing devices so that the product temperature can be monitored to assure proper transport temperature. In transit heat is designed to maintain product temperature as opposed to heating the product. There is no guarantee that the product will arrive at the preferred temperature.

Tank trucks are normally equipped with pumps, hoses, and fittings for connection to most receiving lines in the 2-inch to 3-inch range. Quick-coupling type hose connections are common used, and the flexible hoses furnished usually have polyethylene, butyl rubber, or neoprene liners.

When ordering products by truck, special requirements should be specified in advance. Special requirements could include abnormal size or type of hose connection, a need for more than the normal 40 feet of hose accompanying a truck (due to unloading spot location), or vapor connections for introduction of inert gas into the tank truck during discharge. If pressure unloading is to be used, please specify the desired tank pressure relief valve setting required, as they vary from tank to tank.

Bulk vehicles, outside North America (Road and Rail)	
Type	Rail and Road Tank Cars and Isotanks must conform to national or international transport regulations as appropriate.
Acceptable internal tank surface	Stainless steel Aluminum
Filling/discharge temperature	Minimum 5 °C/10°F above product's pour point
Method of filling	Unrestricted When loading at facilities where Class I or II products are also loaded or parked, Road Tank Cars must be fitted with a battery isolation switch which must then be used to switch off the electrical system of the vehicle.
Method of discharge	Gravity, pump, dry compressed air or nitrogen
Product dedication	Not required
Special Requirements	Tanks should be insulated and fitted with heating coils in areas where the ambient temperature is less than product's pour point plus 5 °C.

Bulk movement by ship											
Vapor return line during loading	Not a mandatory transport regulatory requirement, however, if required by operating license/local requirements, specific locations may demand it or a closed loading system.										
Acceptable internal tank surface	Stainless steel High bake phenolics										
Shipping temperature	<table border="1"> <tbody> <tr> <td>NEODOL 91-2.5</td> <td>Ambient</td> </tr> <tr> <td>NEODOL 23-1, 23-2, 23-3, 25-2.5, 25-3, 91-5, 91-6</td> <td>15 - 25 °C</td> </tr> <tr> <td>NEODOL 23-6.5, 91-8, 1-9, 25-5, 45-4</td> <td>25 - 35 °C</td> </tr> <tr> <td>NEODOL 25-7, 25-9, 45-7</td> <td>30 - 40 °C</td> </tr> <tr> <td>NEODOL 25-12</td> <td>35 - 45 °C</td> </tr> </tbody> </table>	NEODOL 91-2.5	Ambient	NEODOL 23-1, 23-2, 23-3, 25-2.5, 25-3, 91-5, 91-6	15 - 25 °C	NEODOL 23-6.5, 91-8, 1-9, 25-5, 45-4	25 - 35 °C	NEODOL 25-7, 25-9, 45-7	30 - 40 °C	NEODOL 25-12	35 - 45 °C
NEODOL 91-2.5	Ambient										
NEODOL 23-1, 23-2, 23-3, 25-2.5, 25-3, 91-5, 91-6	15 - 25 °C										
NEODOL 23-6.5, 91-8, 1-9, 25-5, 45-4	25 - 35 °C										
NEODOL 25-7, 25-9, 45-7	30 - 40 °C										
NEODOL 25-12	35 - 45 °C										
Loading and discharge temperature	Minimum 5 °C /10 °F above product's pour point										
Maximum product temperature	55 °C /130 °F										
Minimum product temperature	Should be maintained at least 5 °C/10 °F above product's pour point										
Nitrogen blanketing	Required										
Reference source	International Safety Guide for Oil Tankers and Terminals (ISGOTT)										

## Typical physical properties and temperature requirements

NEODOL Ethoxylates		91-2.5	91-5	91-6	91-8	1-9	23-1	23-2	23-3	23-6.5
Pour point	° C	-20	4	6	16	18	5	0	0	15
	° F	-4	39	43	60	64	41	32	32	59
Flash point (PMCC)	° C	120	150	150	160	176	138	152	160	182
	° F	248	302	302	320	349	280	306	320	360
Recommended storage temp (minimum)	° C	-15	9	11	21	23	10	5	5	20
	° F	6	49	53	70	74	51	42	42	69
Recommended storage temp (maximum)	° C	38	38	38	50	50	50	50	50	50
	° F	100	100	100	122	122	122	122	122	122

NEODOL Ethoxylates		25-3	25-5	25-7	25-9	25-12	45-4	45-7
Pour point	° C	5	16	20	25	29	13	24
	° F	41	61	68	77	85	72	75
Flash point (PMCC)	° C	163	165	186	188	225	179	190
	° F	325	329	367	370	437	354	374
Recommended storage temp (minimum)	° C	10	21	25	30	34	18	29
	° F	51	71	78	87	95	82	85
Recommended storage temp (maximum)	° C	50	50	50	50	55	50	50
	° F	122	122	122	122	130	122	122

## Regulations Affecting Storage, Handling and Shipping

NEODOL products must be stored and handled in accordance with local and federal regulations. The following regulations are applicable:

NEODOL ethoxylates all have flash points greater than 200 ° F (PMCC) and are rated as Class III B combustible liquids by the NFPA No. 30.

For Hazardous Materials/Dangerous Goods classifications per the US Department of Transportation (DOT), the International Air Transportation Association (IATA) and the International Maritime Dangerous Goods Code (IMDG) please refer to the product MSDS. Compliance with applicable regulations assures proper product identification, packaging, documentation, storage, and transportation.



## Shell Chemicals

Shell Chemical LP

PO Box 4407

Houston

Texas 77210

USA

**Tel** +1 866 897 4355

**Internet** <http://www.shell.com/chemicals>

### **Disclaimer**

The information contained in this publication is, to the best of our knowledge, true and accurate, but any recommendations or suggestions that may be made are without guarantee, since the conditions of use are beyond our control. Furthermore, nothing contained herein shall be construed as a recommendation to use any product in conflict with existing patents covering any material or its use.

### **Shell Chemicals**

The expression "Shell Chemicals" refers to the companies of the Shell Group of companies which are engaged in chemical businesses. Each of the companies which make up the Shell Group of companies is an independent entity and has its own separate identity