

Material Safety Data Sheet

Uniroyal Chemical Company, Inc.
World Headquarters
Middlebury, CT 06749

UNIROYAL Emergency Phone: (203) 723-3670
CHEMTREC Transportation Emergency Phone: 1-800-424-9300
SAFETY DATA Information (203) 573-3303

MSDS No. C267016

Date Issued: 8/5/85

Date Revised 11/16/87

R-2

IDENTIFICATION

Trade Name: **NAUGARD® 76**

CAS Number: **2082-79-3**

Chemical Name: **Octadecyl 3, 5-di-tert-butyl
4-hydroxyhydrocinnamate**

Chemical Family: **Hindered Phenolic**

SPECIAL REGULATORY HAZARDS

Ingredient
Product

CAS No.
2082-79-3

Exposure Limit
ND

OSHA (1910.1200)
Not hazardous

EEC*
Not hazardous

Hazard assessment based on available data.

Transportation: **NA**

PHYSICAL DATA

Appearance and Odor: **White crystalline flake, granular or powder; odorless**

Solubility: **Insoluble in water
Soluble in most organic solvents**

Melting Point: **122-131°F (50-55°C)**

Boiling Point: **NA**

Other Data: **NA**

Specific Gravity (H₂O = 1): **1.02**

Vapor Pressure @ 20°C: **ND**

Vapor Density (Air = 1): **ND**

Volatility @ 70°F: **Low**

FIRE AND EXPLOSION HAZARD DATA

Flash Point: **ND**

Autoignition Temp: **ND**

Extinguishing Media: **Water spray, dry chemical**

Flammable Limits: **ND**

Special Fire Fighting Procedures: **Protect against inhalation of combustion products.**

Unusual Hazards: **May form explosive dust-air mixtures.**

REACTIVITY DATA

Stability: **Stable at ambient temperatures and pressures.**

Incompatibility: **Strong oxidizing agents.**

Decomposition Products: **Oxides of carbon under burning conditions.**

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NA = Not Applicable

ND = Not Determined

*European Economic Community

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SPECIAL PROTECTION INFORMATION

Engineering Controls: Sufficient ventilation to minimize dust exposure. Protect closed handling systems against possible dust explosions. Avoid dust accumulation on building or equipment surfaces.

Personal Protection Equipment: Avoid all personal contact. Observe good personal hygiene. Impervious gloves and goggles should be worn when handling. In the absence of adequate ventilation, use NIOSH-certified dust cartridge respirator.

STORAGE, SPILLS AND DISPOSAL INFORMATION

Storage: Store away from sources of direct heat in a dry area. Keep containers closed when not in use.

Spills: Sweep or vacuum up. Shovel into secure containers for proper disposal. Avoid creating dust. Use personal protective equipment as outlined above.

Disposal: In accordance with any applicable local, state, or federal regulation regarding organic waste.

Environmental Information: Environmental effects have not been determined.

HEALTH RELATED DATA

Specific Hazard(s): Contact with skin may cause irritation. No chronic health effects have been identified. There are no known medical conditions that are aggravated by exposure to this material.

Primary Route(s) of Entry: Powder - inhalation, skin absorption.

First Aid Procedures: **Eye contact:** Flush with water for 15 minutes.

Skin contact: Wash thoroughly with soap and water

Inhalation: Remove to fresh air.

Toxicology Information: **Oral toxicity:** LD50 (rats) - > 10 g/kg

Dermal toxicity: LD50 (rabbits) - > 2 g/kg

Irritation: eye (rabbits) - negative

skin (rabbits) - slight

Sensitization: skin (guinea pigs) - negative.

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Carcinogenic per NTP _____ IARC _____ OSHA _____ None X

**UNIROYAL
CHEMICAL**

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UNIROYAL Emergency Phone: (203) 723-3670
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SAFETY DATA Information (203) 573-3303

MSDS No. C267011

Date Issued: 9/12/85

IDENTIFICATION

R-1

Trade Name: NAUGARD® XL-1

CAS Number: 70331-94-1

Chemical Name: 2,2'-oxalyldiamidobis[ethyl 3-(3,5-di-*t*-butyl-4-hydroxyphenyl) propionate]
Chemical Family: Phenolic

SPECIAL REGULATORY HAZARDS

<u>Ingredient</u>	<u>CAS No.</u>	<u>Exposure Limit</u>	<u>OSHA (1910.1200)</u>	<u>EEC*</u>
Product	70331-94-1	ND	Not hazardous	Not hazardous

Hazard assessment based on available data.

Transportation: NA

PHYSICAL DATA

Appearance and Odor: White powder, negligible odor

Solubility: Insoluble in water, moderately
Soluble in acetone & chloroform.

Melting Point: 347-356°F (175-180°C)

Boiling Point: NA

Other Data: NA

Specific Gravity (H₂O = 1): ND

Vapor Pressure @ 20°C: NA

Vapor Density (Air = 1): NA

Volatility @ 70°F: Low

FIRE AND EXPLOSION HAZARD DATA

Flash Point: 500°F (260°C) TOC

Autoignition Temp: 525°F (273°C) Fire point

Extinguishing Media: Water spray, dry chemical

Flammable Limits: ND

Special Fire Fighting Procedures: Protect against inhalation of combustion products.

Unusual Hazards: May form explosive dust-air mixtures.

REACTIVITY DATA

Stability: Stable at ambient temperatures and pressures.

Incompatibility: Strong oxidizing agents, acids and bases.

Decomposition Products: Oxides of carbon, nitrogen and sulfur under burning conditions.

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NA = Not Applicable

ND = Not Determined

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SPECIAL PROTECTION INFORMATION

Engineering Controls: Sufficient ventilation to minimize dust exposure. Protect closed handling systems against possible dust explosions. Avoid dust accumulation on building or equipment surfaces.

Personal Protection Equipment: Avoid all personal contact. Observe good personal hygiene. Impervious gloves and goggles should be worn when handling. In the absence of adequate ventilation, use NIOSH-certified dust cartridge respirator.

STORAGE, SPILLS AND DISPOSAL INFORMATION

Storage: Store away from sources of direct heat in a dry area. Keep containers closed when not in use.

Spills: Sweep or vacuum up. Shovel into secure containers for proper disposal. Avoid creating dust. Use personal protective equipment as outlined above.

Disposal: In accordance with any applicable local, state, or federal regulation regarding organic waste.

Environmental Information: Environmental effects have not been determined.

HEALTH RELATED DATA

Specific Hazard(s): Contact with eyes can cause irritation.

Primary Route(s) of Entry: Inhalation, skin absorption.

First Aid Procedures: **Eye contact:** Flush with water for 15 minutes. Get medical attention.

Skin contact: Wash thoroughly with soap and water

Inhalation: Remove to fresh air.

Toxicology Information: **Oral toxicity:** LD50 (rats) - > 10 g/kg

Irritation: eye (rabbits) - slight
skin (rabbits) - negative

Sensitization: skin (guinea pigs) - negative

Mutagenicity: Ames *Salmonella* - negative

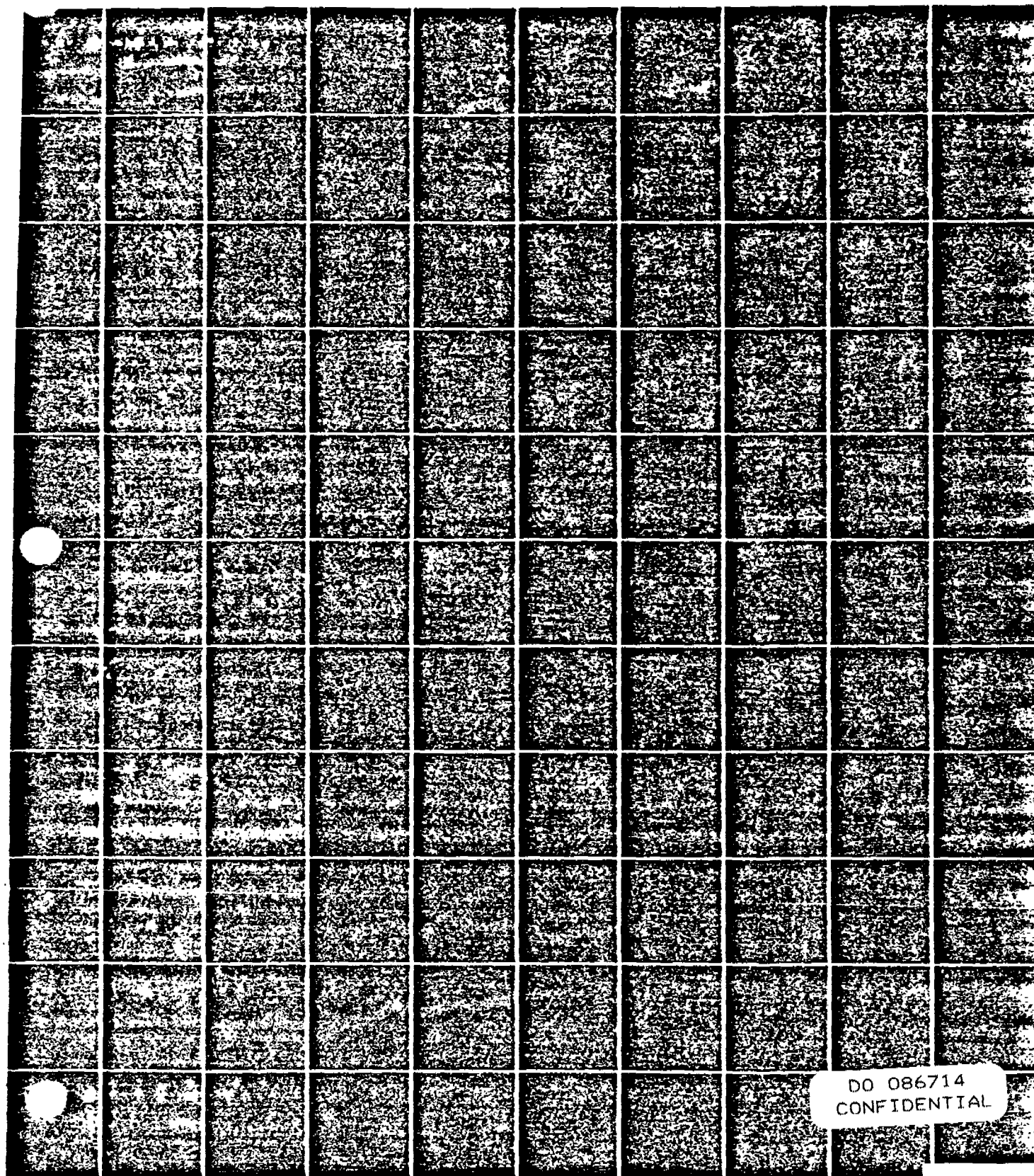
Subchronic: The feeding to rats and dogs of up to 2% did not produce significant adverse effects.

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UNIROYAL CHEMICAL COMPANY, INC.
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Customer Service: 1-800-243-3024

Naugard® 445

a non-discoloring amine antioxidant



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NAUGARD® 445

Non-Discoloring Amine Antioxidant for Polymers and Lubricants

NAUGARD 445 is a new amine antioxidant which is relatively non-discoloring. Both by itself and in combination with other stabilizers NAUGARD 445 protects hot melt adhesives, polyacetals, nylon 6, polypropylene, polyethylene, ethylene-propylene copolymers and terpolymers, ABS, synthetic lubricants, polyether polyols and other oxidation susceptible products from degradation caused by high temperatures, oxygen and shearing action during fabrication of products.

Initial test results also suggest NAUGARD 445 as a stabilizer for polyesters, polyacrylates, industrial lubricants and monomers such as the methacrylates.

Because of its unusual structure NAUGARD 445 shows a reduced tendency to discolor during heat aging. The combination of high amine-antioxidant activity and good color makes NAUGARD 445 an ideal antioxidant and heat stabilizer for many materials.

HOT MELT ADHESIVES

NAUGARD 445 is an excellent antioxidant for polyamide hot melt adhesive formulations. It inhibits skin formation at elevated temperatures and prevents breakdown of the polymer.

The data below compares NAUGARD 445 with another antioxidant used for this purpose.

STABILITY OF POLYAMIDE RESIN

Formulation	Hours to Skinning @ 400° F. (204° C.)
Polyamide resin (unstabilized)	0-1
Polyamide + 1.0% NAUGARD 445	4-5
Polyamide + 1.0% Antioxidant A ⁽¹⁾	1.5-2.5

POLYACETAL RESINS

NAUGARD 445 is an excellent heat stabilizer for polyacetals. Discoloration and decomposition, as evidenced by weight loss due to "unzipping" of polymer to volatile components, is inhibited by the use of small

amounts of NAUGARD 445.

The following table illustrates the advantages of NAUGARD 445 over commercial phenolic antioxidants in preventing discoloration and decomposition.

THERMAL STABILITY OF POLYACETAL

Test: Five grams of powdered resin placed in open aluminum cup and exposed in 446° F. (230° C.) oven for 45 minutes.

Formulation	Total Wt. Loss, %	Ave. % Wt. Loss per min.	Color After Exposure
Polyacetal resin (unstabilized)	31.9	.709	buff-yellow (crumbled)
Polyacetal + 0.2% NAUGARD 445	0.70	.015	white
Polyacetal + 0.5% NAUGARD 445	0.81	.018	off-white
Polyacetal + 0.5% Antioxidant B ⁽²⁾	1.97	.044	buff
Polyacetal + 0.5% Antioxidant C ⁽³⁾	2.10	.047	buff
Stabilized commercial resin	1.72	.039	light buff

⁽¹⁾ 2,4-bis(octylthio)-6-(3,5-di-tert-butyl-4-hydroxyphenylamino)-1,3,5-triazine

⁽²⁾ 4,4'-butylidenebis(3-methyl-6-tert-butylphenol)

⁽³⁾ 2,2'-methylenebis(4-methyl-6-tert-butylphenol)

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NYLON 6

NAUGARD 445 reduces discoloration and prevents loss in physical properties of Nylon 6 upon thermal aging.

NAUGARD 445 does not interfere with polymerization and may be added before, during or after polymerization.

Thermal Stability of Nylon 6

Formulations:

- A — unstabilized
- B — unstabilized + 0.5% NAUGARD 445
- C — unstabilized + 0.5% AminoX®⁽⁴⁾

Formulation:	Tensile Strength			Percent Retained			Color		
	A	B	C	Tensile Impact			A	B	C
				A	B	C			
Aged @ 250° F. (121° C.), 11 days	44	94	92	1.5	79	76	Tan	Buff	Brown
Aged @ 320° F. (160° C.), 48 hrs.	42	99	97	—	—	—	Lt. Brn.	Buff	Brown
Aged @ 320° F. (160° C.), 72 hrs.	23	69	65	—	—	—	Brown	Tan	Dk. Brn.

POLYPROPYLENE

NAUGARD 445 is an efficient heat stabilizer for polypropylene when used in combination with thiodipropionate esters. NAUGARD 445-NAUGARD®

DLTDP (dilauryl thiodipropionate) combinations are synergistic and comparable in performance to several commercial phenolic-thiodipropionate formulations.

Thermal Stability of Polypropylene

Formulation	Initial Color	Days to Break*		Color @ Break
		300° F. (148° C.)	320° F. (160° C.)	
Blank	White	1	1	off-white
0.4% NAUGARD DLTDP	White	13	6	lt. buff
0.3% NAUGARD DLTDP + 0.2% NAUGARD 445	White	42	—	white
0.2% NAUGARD DLTDP + 0.1% NAUGARD 445	White	33	—	white
0.4% NAUGARD DLTDP + 0.1% NAUGARD 445	White	41	30	off-white
0.4% NAUGARD DLTDP + 0.2% NAUGARD 445	White	41	—	off-white
0.4% NAUGARD DLTDP + 0.3% NAUGARD 445	White	61	—	off-white
0.4% NAUGARD DLTDP + 0.1% Antioxidant B ⁽²⁾	White	42	—	off-white
0.4% NAUGARD DLTDP + 0.1% Antioxidant D ⁽⁵⁾	White	47	—	off-white
0.4% NAUGARD DLTDP + 0.1% Antioxidant E ⁽⁶⁾	White	45	33	off-white

(*) Two out of three 90 mil disks craze or crumble

⁽⁴⁾ UNIROYAL

⁽⁵⁾ Stearyl ester of beta-(4-hydroxy-3,5-di-t-butylphenyl) propionic acid

⁽⁶⁾ Tris(3-methyl-6-t-butylphenol) butane

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POLYETHYLENE

NAUGARD 445 inhibits resinification of polyethylene exposed to air at high temperatures. Also, weather-o-meter studies indicate that NAUGARD 445 prevents

cross-linking and embrittlement of polyethylene as measured by change in brittle point after 300 and 500 hours exposure in the weather-o-meter.

STABILITY OF LDPE BRITTLE POINT, °F. (°C.)

	Initial	Weather-o-Meter Exposure		Min. to Resinifi- cation @ 375° F. (190.5° C.)
		300 hrs.	500 hrs.	
Blank	-45 (-43)	-30 (-34.5)	-30	120
0.1% NAUGARD 445	-60 (-51)	-60 (51)	-65	300

ACRYLONITRILE-STYRENE-BUTADIENE RESINS (ABS)

NAUGARD 445 is an excellent heat stabilizer for ABS resins when used in combination with thiodipropionate esters. These combinations are synergistic and prevent heat induced oxidation of the resin.

NAUGARD 445-thiodipropionate combinations are most effective with dark colored resins such as those used for pipe compounds because some discoloration may be encountered in light colored resins exposed to ultraviolet radiation.

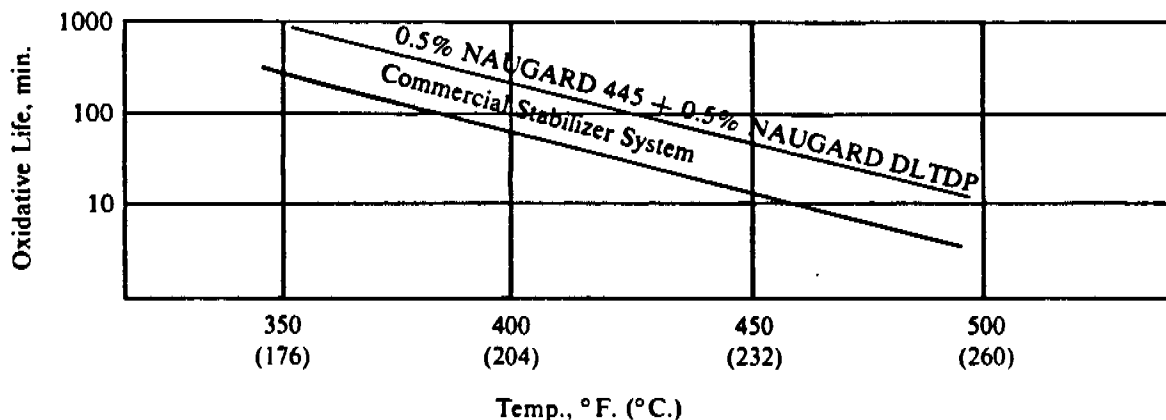
Thermal Stability of ABS Resins

Formulation

Oxidative Life⁽⁸⁾ @ 400° F. (204.5° C.), Minutes

ABS ⁽⁷⁾ + commercial phenolic system	75
ABS + 0.5% NAUGARD 445 + 0.5% NAUGARD DLTPD ..	135
ABS + 0.7% NAUGARD 445 + 0.7% NAUGARD DLTPD ..	190

Oxidative Life vs. Temperature



⁽⁷⁾Resin containing approximately 20% rubber.

⁽⁸⁾Oxidative life is measured as the time that a sharp increase in the optical density at 5.85 (ca

ETHYLENE-PROPYLENE-DIENE TERPOLYMER⁽⁹⁾

NAUGARD 445 inhibits degenerate cross-linking and gelation of ethylene-propylene copolymers, terpolymers of ethylene, propylene and dienes, and other similar olefin heteropolymers exposed to heat and mechanical shearing in the presence of air. The amount of NAUGARD 445 required for polymers containing unsaturat-

ed carbon groups is generally higher than that required for the essentially saturated homopolymers and copolymers.

Results below illustrate the effectiveness of NAUGARD 445 as a processing stabilizer and anti-gel additive for an ethylene-propylene-diene terpolymer.

Thermal Stability of Ethylene-Propylene-Diene Terpolymer

Formulation	Mooney Viscosity vs. Time on 148° C. Mill					Hrs. to Initial Gelation Oven Exposure @ 300° F. (148° C.)
	0"	15"	30"	45"	60"	
Blank	53	57	74	90	97	24 Hours
0.1% NAUGARD 445	52	51	51	50	50.5	72 Hours

SYNTHETIC LUBRICANTS

NAUGARD 445 retards oxidation, viscosity increase, acid number increase and metal corrosion in synthetic lubricants used for high temperature applications. The effectiveness of NAUGARD 445 in di-(2-ethylhexyl) sebacate is illustrated below.

Test: Fluid samples containing copper and iron catalyst were placed in glass cells and exposed to 400° F. (204.5° C.) temperature for 72 hours with 12.5 liters of air per hour blown through the samples continuously.

Formulation	S.U.S. Viscosity Increase @ 210° F. (99° C.), %	Acid No. Increase	Sludge Formation
Unstabilized Di (2-ethylhexyl) sebacate	32	29	Trace
2% Phenyl-alpha-naphthylamine	8	18	Moderate
2% NAUGARD 445	5	16	Moderate

POLYETHER POLYOLS

NAUGARD 445 both alone and in combination with phenolic compounds will effectively stabilize polyether polyols at concentrations of 500-1000 ppm. Increasing the stability of the polyol helps to reduce discoloration and scorch in flexible polyurethane foams during preparation. The table below shows the results obtained using NAUGARD 445 by itself and in combination with

NAUGARD BHT. DSC's in an oxygen atmosphere, a technique developed by Olin Corporation, was used to determine the effect of the stabilizers. The higher the Transition Temperature, the temperature at which oxidative decomposition begins, the more stable the polyol formulation.

Polyol - 3000 MW, propoxylated glycerine-based triol.
D.S.C. Perkin-Elmer Model 1B

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Stabilizer	Concentration (ppm)	Transition Temperature, ° C.
Blank	—	155
NAUGARD BHT	1000	162
NAUGARD 445	500	176
BHT 445	1000/500	187

⁽⁹⁾ Terpolymer of ethylene, propylene and a small amount of non-conjugated diene.

TYPICAL PROPERTIES OF NAUGARD 445

Chemical Composition: Substituted diphenylamine
Color and Appearance: White to off-white powder
Melt Range: 205-210° F. (96-99° C.)
Solubility, RT

gms/100ml solvent

Hexane	0.68
Heptane	0.74
Cyclohexane	3.5
Benzene	35.2
Toluene	32.8
Acetone	40.8
Methyl ethyl ketone	41.2
Methanol	0.66

Storage Stability: Excellent, store in a cool dry place.

HANDLING PRECAUTIONS

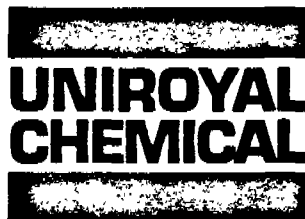
Normal handling precautions should be exercised. Avoid ingestion, eye contact, prolonged contact with skin and prolonged inhalation of dust.

TOXICOLOGY

NAUGARD 445 has an oral LD₅₀ for rats greater than 10 gm/kg. body weight. It is not a primary skin irritant as these terms are defined in the Regulations of the Federal Hazardous Substances Labeling Act (Federal Register Aug. 12, 1961). These conclusions are based on studies performed on laboratory animals. NAUGARD 445 is FDA approved for use in adhesives under 121.2520 of the Food Additives Regulations.

The recommendations for the use of our products are based on tests believed to be reliable. However, we do not guarantee the results to be obtained by others under different conditions. Nothing in this brochure is intended as a recommendation to use our products so as to infringe on any patent.

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SAFETY DATA Information (203) 573-3303

MSDS No. C266001

Date Issued: 8/5/85
Date Revised 8/25/87

R-1

IDENTIFICATION

Trade Name: NAUGARD® 445

CAS Number: 10081-67-1

Chemical Name: 4,4' Di(α,α - dimethylbenzyl)
diphenylamine

Chemical Family: Aromatic Amine

SPECIAL REGULATORY HAZARDS

<u>Ingredient</u>	<u>CAS No.</u>	<u>Exposure Limit</u>	<u>OSHA (1910.1200)</u>	<u>EEC*</u>
Product	10081-67-1	ND	Not hazardous	Not hazardous

Hazard assessment based on available data.

Transportation: NA

PHYSICAL DATA

Appearance and Odor: White to off-white powder; characteristic odor

Solubility: Insoluble in water

Soluble in most organic compounds

Melting Point: 203°F (95°C)

Boiling Point: NA

Other Data: NA

Specific Gravity (H₂O = 1): 1.14

Vapor Pressure @ 20°C: ND

Vapor Density (Air = 1): ND

Volatility @ 70°F: Low

FIRE AND EXPLOSION HAZARD DATA

Flash Point: 531°F (276.7°C) TCC

Autoignition Temp: 569°F (298°C) Fire point

Extinguishing Media: Water spray, dry chemical

Flammable Limits: ND

Special Fire Fighting Procedures: Protect against inhalation of combustion products.

Unusual Hazards: May form explosive dust-air mixtures.

REACTIVITY DATA

Stability: Stable at ambient temperatures and pressures.

Incompatibility: Strong oxidizing agents.

Decomposition Products: Oxides of carbon and nitrogen under burning conditions.

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CONFIDENTIAL

NA = Not Applicable

ND = Not Determined

*European Economic Community

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SPECIAL PROTECTION INFORMATION

Engineering Controls: Sufficient ventilation to minimize dust exposure. Protect closed handling systems against possible dust explosions. Avoid dust accumulation on building or equipment surfaces.

Personal Protection Equipment: Avoid all personal contact. Observe good personal hygiene. Impervious gloves and goggles should be worn when handling. In the absence of adequate ventilation, use NIOSH-certified dust cartridge respirator.

STORAGE, SPILLS AND DISPOSAL INFORMATION

Storage: Store away from sources of direct heat in a dry area. Keep containers closed when not in use.

Spills: Sweep or vacuum up. Shovel into secure containers for proper disposal. Avoid creating dust. Use personal protective equipment as outlined above.

Disposal: In accordance with any applicable local, state, or federal regulation regarding organic waste.

Environmental Information: Environmental effects have not been determined.

HEALTH RELATED DATA

Specific Hazard(s): No acute or chronic health hazards have been identified. There are no known medical conditions aggravated by exposure to this material.

Primary Route(s) of Entry: Inhalation, skin absorption.

First Aid Procedures: **Eye contact:** Flush with water for 15 minutes.

Skin contact: Wash thoroughly with soap and water

Inhalation: Remove to fresh air.

Toxicology Information: **Oral toxicity:** LD50 (rats) - > 10 g/kg

Irritation: eye (rabbits) - negative
skin (rabbits) - negative

Mutagenicity: Ames *Salmonella* - negative

No significant adverse effects have been noted with long-term production and use of this material.

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Carcinogenic per NTP _____ IARC _____ OSHA _____ None X



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SAFETY DATA Information (203) 573-3303

MSDS No. C279010

Date Issued: 8/5/85

IDENTIFICATION

Trade Name: NAUGARD® 512

CAS Number: 26523-78-4

Chemical Name: Tris (mono-nonylphenyl) phosphite Chemical Family: Organophosphite

SPECIAL REGULATORY HAZARDS

<u>Ingredient</u>	<u>CAS No.</u>	<u>Exposure Limit</u>	<u>OSHA (1910.1200)</u>	<u>EEC*</u>
Product	26523-78-4	ND	Not hazardous	Not hazardous

Hazard assessment based on available data.

Transportation: NA

PHYSICAL DATA

Appearance and Odor: Clear viscous liquid; phenolic odor

Solubility: Insoluble in water

Miscible with most organic solvents

Melting Point: NA

Boiling Point: ND

Other Data: Pour Point: 20°F; - Color (Gardner): 2

Viscosity @ 77°F - 5,200 cps @ 120°F - 500 cps

Specific Gravity (H₂O = 1): 0.978 @ 25/15.5°C

Vapor Pressure @ 20°C: ND; @ 437°F: 5mmHg

Vapor Density (Air = 1): ND

Volatility @ 70°F: Low

FIRE AND EXPLOSION HAZARD DATA

Flash Point: 430°F (221°C) TOC

Autoignition Temp: 455°F (235°C) Fire point

Extinguishing Media: Water spray, dry chemical

Flammable Limits: ND

Special Fire Fighting Procedures: Protect against inhalation of combustion products.

Unusual Hazards: None identified.

REACTIVITY DATA

Stability: Stable at ambient temperatures and pressures.

Incompatibility: Moisture and strong oxidizing agents.

Decomposition Products: Upon hydrolysis, phosphorous acid and phenols. Under burning conditions, oxides of carbon, phosphorous.

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NA = Not Applicable

ND = Not Determined

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SPECIAL PROTECTION INFORMATION

Engineering Controls: Sufficient ventilation to minimize vapor exposure.

Personal Protection Equipment: Avoid all personal contact. Observe good personal hygiene. Impervious gloves and goggles should be worn when handling. In the absence of adequate ventilation, use NIOSH-certified respiratory protection for organic vapors.

STORAGE, SPILLS AND DISPOSAL INFORMATION

Storage: Store away from sources of direct heat in a dry area. Keep containers closed when not in use. Avoid any moisture contamination.

Spills: Absorb on inert material. Shovel into secure containers for proper disposal. Use personal protective equipment as outlined above.

Disposal: In accordance with any applicable local, state, or federal regulation regarding organic waste.

Environmental Information: Environmental effects have not been determined.

HEALTH RELATED DATA

Specific Hazard(s): No health hazards have been identified.

Primary Route(s) of Entry: Inhalation

First Aid Procedures: **Eye contact:** Flush with water for 15 minutes.

Skin contact: Wash thoroughly with soap and water

Inhalation: Remove to fresh air.

Toxicology Information: The following data are for a mixture of tris (mono and dinonylphenyl) phosphite.

Oral toxicity: LD50 (rats) - 19.5 g/kg

Irritation: eye (rabbits) - negative

Sensitization: skin (guinea pigs) - negative

Chronic: The feeding of up to 3300 ppm to dogs and rats for two years did not produce significant adverse health effects.

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