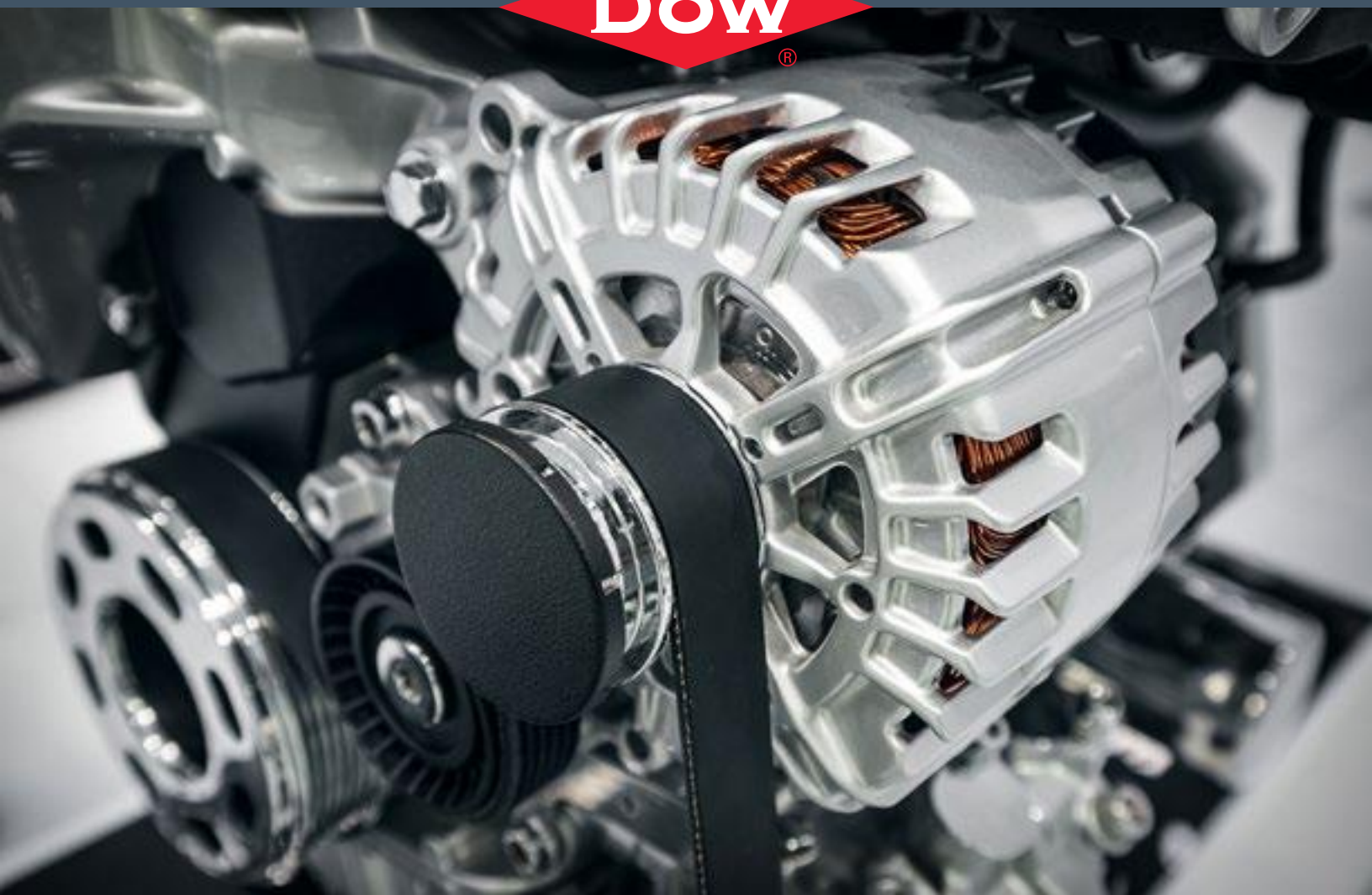
NORDEL™ EPDM

Handling guide and FDA status



Many grades of NORDEL™ EPDM are available commercially. These EPDM products (ethylene, propylene, and ethylidene norbornene monomer) are members of the broad family of ethylene propylene diene terpolymer products offered by Dow.

NORDEL™ EPDM products are made in a solution process and are sold in a bale form and as free flowing pellets. The surface of the pellets is coated with a partitioning agent (polyethylene dust or talc) for better handling properties.

Raw polymer handling

Some NORDEL™ EPDM products are supplied in pelletized form. Pouring or conveying pellets may cause static ignition hazards. In addition, the partitioning agent is combustible and can pose an explosion hazard when suspended in air dust. Do not permit dust to accumulate. Use proper grounding when transferring pellets to minimize risk of static ignition. Refer to the National Fire Protection Association (NFPA) RP77 “Recommended Practice on Static Electricity” for guidance in reducing the fire hazards associated with static electricity.

NORDEL™ EPDM resins are packaged in inclusion bags to allow the product to be added to the mixer without opening the bag if the polymer is mixed at sufficiently high temperature (e.g., >110°C [230°F]). This innovation helps to limit the amount of packaging waste and reduces the opportunity for contamination and housekeeping problems. Consult a Dow technical representative to determine the exact characteristics of the packaging available for the product you are interested in.

Some grades of NORDEL™ EPDM are supplied in compact bales for which static discharge normally is not a factor. Bales are also packaged using an inclusion film.

Before use, refer to the most current Safety Data Sheet (SDS), available from your Dow customer service representative.

Acute oral toxicity

Oral LD50 has not been determined. Based on tests conducted on similar products, it is understood that oral toxicity may be very low on a single dose basis.

Inhalation toxicity

The polymer contains traces of ethylidene norbornene (ENB) which may be released during storage and processing. ENB is moderately toxic with an LD50 of 732 ppm/4H (inhalation, mouse). Under normal storage and processing conditions with adequate ventilation and exhaust, the ACGIH TLV-C for ENB should not be reached[1]. Exposure to ENB vapors may cause irritation of the respiratory tract, with symptoms such as nasal discomfort and discharge, and coughing possibly accompanied by chest pains, headache, or dizziness. Eye contact with ENB vapor may be irritating.

Fumes may evolve during hot processing of compounds of NORDEL™ EPDM that may irritate eyes, nose, and throat. Polymer dust may cause irritation to the upper respiratory tract.

Nordel™ EPDM by DOW

NORDEL™ EPDM products are exceptionally clean

Skin contact

Skin absorption is unlikely due to the physical properties of NORDEL™ EPDM.

Thermal and oxidative degradation

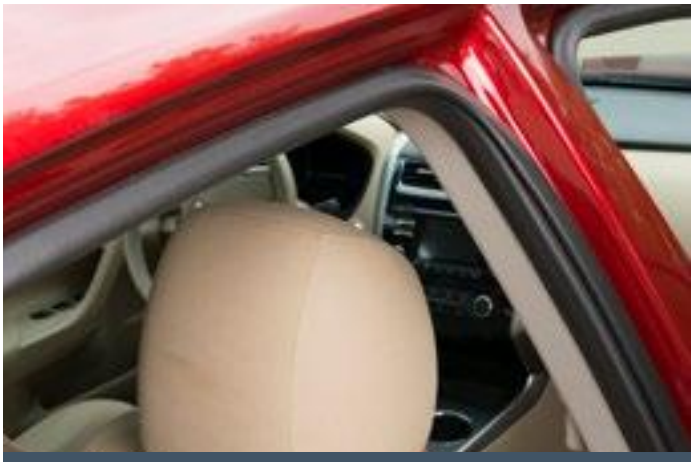
NORDEL™ EPDM products have been stabilized for normal operating and curing temperatures. Abnormally high temperatures, particularly in the presence of oxygen, can lead to degradation. The main decomposition products are anticipated to be carbon monoxide, carbon dioxide, organic fragments, and their oxidation products. Laboratory tests indicate that at a temperature of 170°C (338°F), an exothermic reaction will start in approximately 15 minutes. In the absence of oxygen, the product is stable to much higher temperatures, but temperatures greater than 200°C (392°F) should be avoided to prevent thermal decomposition.

Possibility of fire when blending EPDM polymers

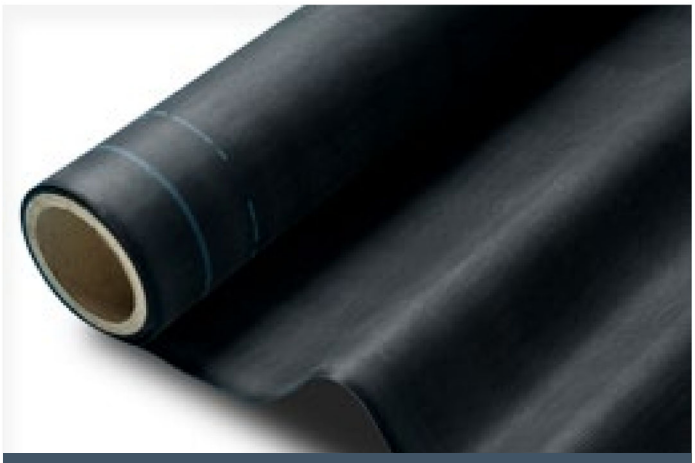
EPDM polymers may evolve low-molecular weight polymer fragments or other volatiles. If ventilation in the mixer is poor, combustible vapor could accumulate in the air space of an internal mixer during mastication or blending. The possibility of fire exists if ventilation in the mixer is poor and higher than recommended temperatures are reached in the mixer. The potential for a fire is minimized by maintaining mixing temperatures below 199°C (390°F), by providing good ventilation in the mixer and the processing area, and by maintaining good static control.

Storage and handling

The quality of EPDM products may be affected by exposure to artificial or natural light that contains ultraviolet (UV) radiation. These rubber polymers should be stored indoors in their original packaging and out of direct sunlight. If it is necessary to remove part of the contents of the package, protect the remaining product with a light-blocking material. NORDEL™ EPDM are best stored under low humidity conditions, away from direct sunlight and other sources of UV radiation, and at temperatures between 10°C and 21°C (50°F and 70°F). Extended storage and/or exposure to a source of UV radiation may cause the polymer to cross-link and form gels. The Mooney viscosity measurement is a good indicator of storage stability.



Durable products for weatherstripping, seals and gaskets



Protective compounds for roofing membranes

Warehouse stacking

Various available packaging options have different stacking requirements: Flexible Intermediate Bulk Containers (FIBCs) can be stacked only one high. The free flowing pellet products, packaged 40 bags to a pallet and stretch wrapped, also can only be stacked one high. Bulk boxes of semi-crystalline NORDEL™ EPDM can be stacked three high.

Amorphous products (or palletized product that is partially compacted) packaged in boxes can be stacked two high (see photo below).

Compounding of NORDEL™ EPDM

The pellet versions of NORDEL™ EPDM products require slightly higher fill factors at the beginning of the mixing cycle, as the effective bulk density of the compound is lower vs. bale rubber. Fill factors in the range of 75-80 percent are found to be suitable for single pass mixing. Ram pressure is also important, as efficient packing of the material is necessary in the mixing chamber at the beginning of the mixing cycle. A 5 bar ram pressure is generally found to be suitable. The mixer body temperature should be 70°C (158°F) or higher to be above the low temperature melting peak (typically 50°C-60°C [122°F-140°F]) for semi-crystalline polymer. Loading RPM should be low, followed by high RPM for the actual mix cycle. Upside down mixing is typically recommended. Faster mixing is possible with the pelletized NORDEL™ EPDM.

Compounding ingredients

Many compounding ingredients and techniques (e.g., mixing time, temperature) are employed during conversion of NORDEL™ EPDM to end-products. These may alter the toxicity as well as the handling precautions for the product during intermediate stages or in its finished form. Even when no danger from individual compounding ingredients exists, there is no assurance that a combination of these ingredients will be equally non-hazardous. Consequently, it is the responsibility of each user to determine whether techniques, processes, and additives comply with government regulations and are safe with respect to both employees and customers.

Compounding ingredients, including peroxides, solvents, talc, carbon black, and lead-based curing agents used with NORDEL™ EPDM to prepare finished products may present hazards in handling and use. Before proceeding with any compounding work, always consult and follow all label directions, handling precautions, and Safety Data Sheets (SDSs) from the suppliers of all ingredients.

Available in bale form, as well as free flowing pellets

Improve yields through excellent processing

NORDEL™ EPDM in applications regulated by the Food and Drug Administration (FDA)

FDA overview information in this section is provided as a convenience to the reader. The current Code of Federal Regulations should be consulted to ensure that all requirements for pertinent food contact application(s) are met. It is the responsibility of the article manufacturer to establish FDA compliance of the article to be used in Food Contact Service.

Many NORDEL™ EPDM products are compliant with one or more of the following FDA Regulations with use restrictions as defined in the regulations (see table 1, page 6):

- 21 CFR 177.2600 – "Rubber articles intended for repeated use"
- 21 CFR 177.1520 – "Olefin polymers"
- 21 CFR 175.105 – "Adhesives"
- 21 CFR 177.1210 – "Closures with sealing gaskets for food containers"

If a food contact application is targeted, please consult a technical representative regarding the FDA compliance status of the NORDEL™ EPDM product for your application.

Articles intended for food contact

Reference: 21 CFR 177.2600 – Rubber articles intended for repeated use.

This regulation defines the polymers and compounding ingredients that can be used in vulcanized rubber articles intended for repeated use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food subject to provisions of the regulation.

There are limitations on the amount of certain compounding ingredients, as follows:

Accelerators – Total is not to exceed 1.5 percent by weight of rubber product.

Retarders – Total is not to exceed 10 percent by weight of rubber product.

Activators – Total is not to exceed 5 percent by weight of rubber product, except magnesium oxide, which may be used at higher levels.

Antioxidants and antiozonants – Total is not to exceed 5 percent by weight of rubber product.

Plasticizers – Total is not to exceed 30 percent by weight of rubber product unless otherwise specified.

Filler – No maximum is given except for carbon black. Channel process or furnace combustion process, total carbon black is not to exceed 50 percent by weight of rubber product; furnace combustion black content is not to exceed 10 percent by weight of rubber products intended for use in contact with milk or edible oils.

Colorants – Are to be used in accordance with 21 CFR 178.3297.

Lubricants – Total is not to exceed 2 percent by weight of rubber product.

Emulsifiers – No maximum is given.

Sulfur – No maximum is given.

Olefin polymers

Reference: 21 CFR 177.1520 – Olefin polymers.

Olefin copolymers complying with this regulation may be used as articles, or components of articles, intended for use in contact with food subject to provisions of the regulation.

NORDEL™ EPDM products containing not more than 5 wt% of total polymer units derived by copolymerization with 5-ethylidene-2-norbornene, with a minimum viscosity average molecular weight of 120,000, with a minimum Mooney viscosity of 35 and density of .85-.90 (see table 1, page 6), may contact foods of types identified in 21 CFR 176.170(c), table 1 under types I, II, III, IV –B, VI, VII, VIII and IX. (See table 2, page 6, for types of raw and processed foods that can come into contact with NORDEL™ EPDM grades compliant with 21 CFR 177.1520.)

Table 1: Summary of FDA compliance by NORDEL™ EPDM grade[1, 2]

Product grade	21 CFR 177.2600	21 CFR 177.1520[3]	21 CFR 175.105[4]	21 CFR 177.1210
NORDEL™ 3640	Yes	Yes	Yes	Yes
NORDEL™ 3720P	Yes	No	Yes	No
NORDEL™ 3722P	Yes	No	Yes	No
NORDEL™ 3745P	Yes	Yes	Yes	Yes
NORDEL™ 3760P	Yes	Yes	Yes	Yes
NORDEL™ 3765 XFL	Yes	Yes	Yes	Yes
NORDEL™ 4520	Yes	No	Yes	No
NORDEL™ 4570	Yes	Yes	Yes	Yes
NORDEL™ 4640	Yes	Yes	Yes	Yes
NORDEL™ 4725P	Yes	No	Yes	No
NORDEL™ 4760P	Yes	Yes	Yes	Yes
NORDEL™ 4770P	Yes	Yes	Yes	Yes
NORDEL™ 4785HM	Yes	Yes	Yes	Yes
NORDEL™ 4820P	Yes	Yes[5]	Yes	No
NORDEL™ 5565	No	No	Yes	No
NORDEL™ 6530 XFC	No	No	Yes	No
NORDEL™ 6555 OE	No	No	Yes	No
NORDEL™ 6565 XFC	No	No	Yes	No
XUS 51110.00[6]	Yes	Yes	Yes	Yes

[1] Review current Code of Federal Regulations for specific details pertaining to food contact requirements.
[2] Prefix designation: XUS = developmental product. Suffix designations: XFC = extra fast cure; XFL = extra filler loading; XFM = extra fast mixing; OE = oil extended; P or HM = pellet form.
[3] Can be used in contact with all foods except water in oil emulsions, high or low fat, and low moisture fats and oil.
[4] Adhesives only.
[5] Compliant as a blend component in compliant polymers at levels up to 25% for conditions of use E through G.
[6] Developmental EPDM.

Table 2: NORDEL™ EPDM – Polyolefin blends: contact with raw and processed foods[1]

Types of foods	Description	Contact permitted?
I	Non-acid, aqueous product; may contain salt or sugar or both (pH above 5.0)	Yes
II	Acid, aqueous products; may contain salt or sugar or both, and including oil-in-water emulsions of low-fat or high-fat content	Yes
III	Aqueous, acid, or non-acid products containing free oil or fat; may contain salt, and including water-in-oil emulsions of low-fat or high-fat content	Yes
IV	Dairy products and modifications: A. Water-in-oil emulsions, high- or low-fat	No
	B. Oil-in-water emulsions, high- or low-fat	Yes
V	Low moisture fats and oils	No
VI	Beverages: A. Containing up to 8% of alcohol	Yes
	B. Non-alcoholic	Yes
	C. Containing more than 8% of alcohol	Yes
VII	Bakery products other than those included under types VIII and IX of this table: A. Moist bakery products with surface containing free fat or oil	Yes
	B. Moist bakery products with surface containing no free fat or oil	Yes
VIII	Dry solids with surface containing no free fat or oil (no end test required)	Yes
IX	Dry solids with surface containing free fat or oil	Yes

[1] Food classification from 21 CFR 176.170(c) (See table 1, above)

Components of adhesives

Reference: 21 CFR 175.105 – Adhesives.

This regulation includes substances that may be used as components of adhesives which may be used as components of articles intended for packaging, transporting, or holding food. In such uses, the adhesives must either be separated from the food by a functional barrier or be subject to the additional limitations outlined in 21 CFR 175.105 (a) 2 (i-ii). The NORDEL™ EPDM products that may be used as components of adhesives in compliance with this regulation are listed in table 1 (see page 6).

Closures

Reference: 21 CFR 177.1210 – Closures with sealing gaskets for food containers.

This regulation includes substances that may be used as closure sealing gaskets on containers intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food subject to provisions of the regulation.

NORDEL™ EPDM products containing not more than 5 wt% of total polymer units derived by copolymerization with 5-ethylidene-2-norbornene, with a minimum viscosity average molecular weight of 120,000 and with a minimum Mooney viscosity of 35 (see table 1, page 6) may be used in contact with food as a closure sealing gasket subject to provisions of 21 CFR 177.1210.

NOTE: Information in this section provides an overview of the FDA Regulations pertaining to food contact. For specifics, refer to the actual, current Code of Federal Regulations.

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