

nora® floorcoverings
made of rubber -
leading worldwide

**Solutions for
electrostatic
safety**



PVC-free

nora®

nora® floorcoverings for electrostatic safety

as protection against electrostatic discharges in ESD-sensitive areas and areas with explosion hazards.

Freudenberg has more than 50 years of experience with the fascinating material rubber and today is the market leader worldwide for rubber floorcoverings. These floorcoverings have already been successfully installed in more than 120 countries. The most varied industrial objects are proof of these floorcoverings' benefits.

norament® and noraplan® rubber floorcoverings convince by their:

- low tendency to charge
- permanent electrostatic conductivity, even in low relative humidities
- extraordinary wear-resistance
- largely chemical resistance to most acids and alkalis
- free of PVC, plasticizers (phthalates) and halogens (e.g. chlorine)
- outstanding fire-protection properties
- easy and economic cleaning
- no coating required
- no joint-sealing required



Certified:
DIN EN ISO 14001



EMAS
VERIFIED
ENVIRONMENTAL
MANAGEMENT

Register no.:
DE-153-00016

Regular
quality tests
by



The Blue Angel
is the worldwide
most successful label for
environment-oriented products.



Awarded for all **noraplan®**
standard floorcoverings and for all
norament® 925 floorcoverings
and stairtreads.



Certified
pursuant to ISO
9001



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Electrostatics

Generation of electrostatic charges

Electrostatic charges are generated because of friction and separation of two materials coming into contact with each other (triboelectric charge) or due to an electrical field influencing a body (influence). The amount of the charge depends on the material's tendency to charge and the relative humidity of the ambient air.

Electrostatic discharges

The most famous occurrences of electrostatic discharges (ElectroStatic Discharge – ESD) are lightning discharges during thunderstorms. If electrostatic charges in industrial and commercial objects are not dissipated in a controlled way, this may lead to interferences and damages as e.g.

- damage to or destruction of electronic component parts and assemblies
- function losses of electronic devices
- malfunctions of electronically controlled production processes
- faulty displays at measuring instruments
- explosions in areas with explosion hazards

In order to avoid incalculable risks and costs, adequate measures are to be taken to protect against electrostatic discharges. In this respect, the floorcovering with electrostatic properties plays an important role. This floorcovering must be bonded conductively and must be grounded to offer appropriate protection. Persons must also wear conductive shoes.

nora[®] floorcoverings with electrostatically conductive "el" and dissipative "al" properties offer the following benefits, depending on the individual product:

- protection of electronic component parts and devices
- protection of persons against electric shock
- protection against explosions

Among the numerous available floorcoverings and floors with electrostatic properties, only electrostatically conductive and dissipative **nora**[®] floorcoverings offer the benefit of a **minimum tendency to charge**.



Benefits of nora® floorcoverings with regard to tendency to charge – Body voltage generation

Problem:

When walking on a floorcovering, electrostatic charges at the body are produced because of separation processes between shoes and floorcovering. The amount of the body charge above all depends on the material of the shoes and the floorcovering.

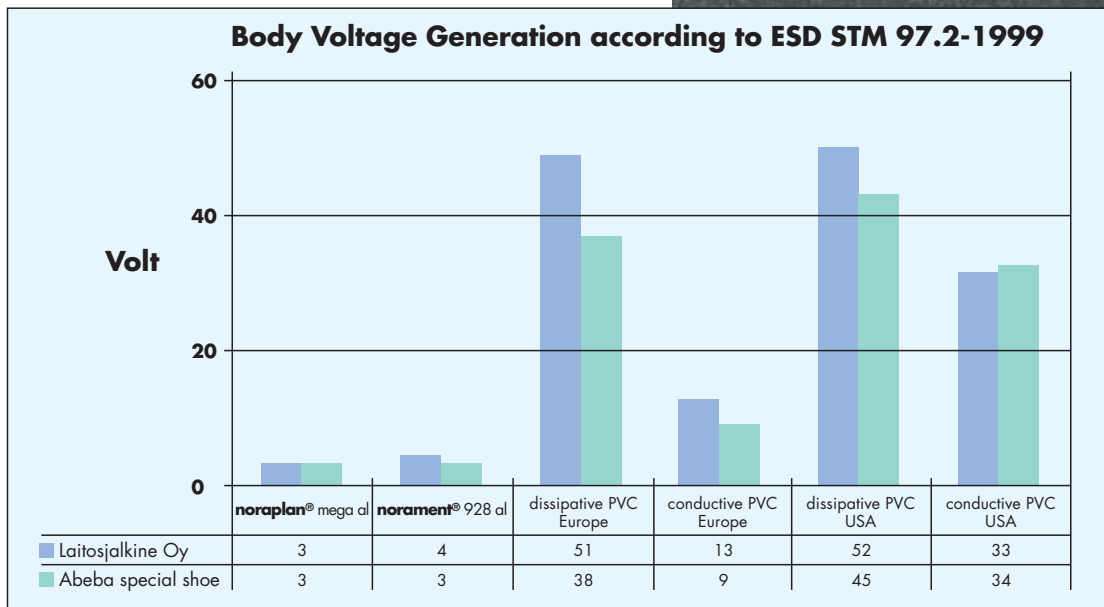
Result:

Charge voltages of several thousands of Volts may be generated which are not harmful to men because of their low energy. They, however, pose a risk to electronic component parts and devices and may also trigger explosions in areas with explosion hazards.

Solutions with nora® floorcoverings:

Rubber has a natural low tendency to charge. When walking on electrostatically dissipative and conductive nora® floorcoverings with conductive shoes, only a few Volts are generated at the body.

As illustrated by the graphics below, nora® floorcoverings show the lowest and thus the best values by far when compared with other floorcoverings.



Notes on the graphics:

- The average charge voltages are presented, measured according to the standard test method ESD STM 97.2-1999 applicable in the USA.
- The test person was wearing the following conductive shoes: Laitosjalkine Oy shoes ($R \sim 10^5$ Ohm), Abeba special shoes ($R \sim 10^6$ Ohm).
- The test was performed by an independent test institute in July 2000.

Benefits of nora® floorcoverings with regard to the discharge of electrostatic charges

Problem:

It is not only by walking on floorcoverings that the body of a person may be charged but also by sitting on non-grounded chairs or by wearing clothing not suitable for ESD (insulating clothing).

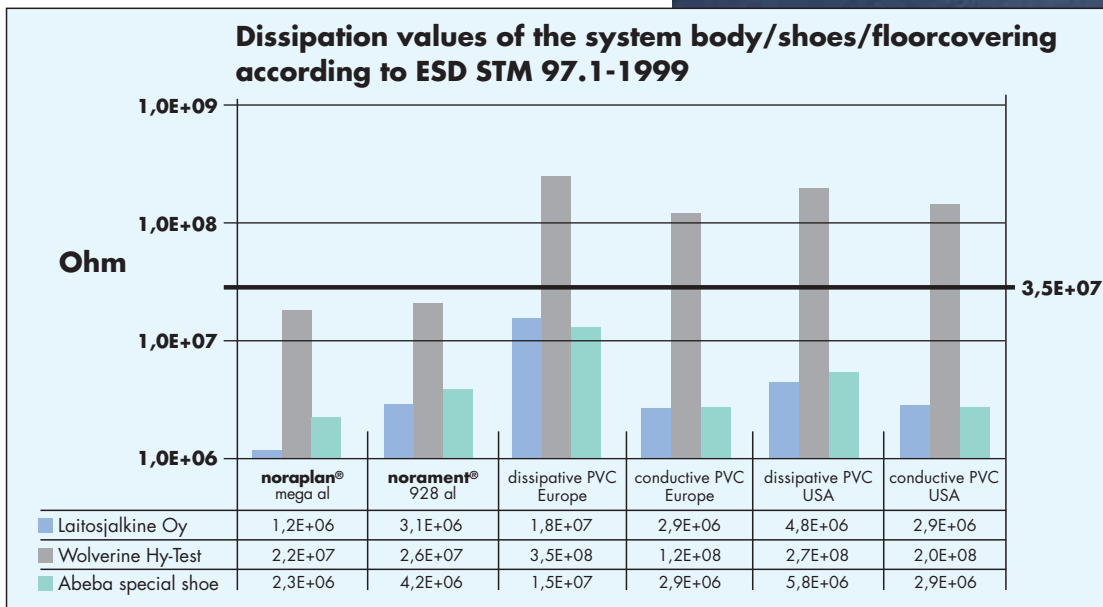
Result:

An uncontrolled discharge of body charges may lead to damages of highly sensitive component parts and devices. Charge voltages as low as 10 V are sufficient to do this. There also exists the risk that explosions are triggered in areas with explosion hazards.

Solutions with nora® floorcoverings:

In order to provide for a controlled discharge of a person's body the entire system consisting of person, shoes, and floorcovering must be considered. With nora® floorcoverings, the requirement not to exceed an earth leakage resistance of 3.5×10^7 Ohm in the entire system is permanently complied with. These requirements are defined in the international standard IEC 61340-5-1 (tab. 1, note 2) and the American standard test method ESD STM 97.1-1999.

As shown by the graphics below, nora® floorcoverings achieve excellent values in the entire system both when using electrostatically conductive and dissipative shoes.



Notes on the graphics:

- The average dissipation values are presented, measured according to the standard test method ESD STM 97,1-1999 applicable in the USA.
- The test person was wearing the following conductive or dissipative shoes: Laitosjalkine Oy shoes (R ~ 10^5 Ohm), Wolverine Hy-Test shoes (R ~ 10^7 Ohm), Abeba special shoes (R ~ 10^6 Ohm).
- The test was performed by an independent test institute in July 2000.

Benefits of nora® floorcoverings with permanent electrostatic conductivity

Problem:

The conductivity of many floorcoverings may be impaired during their period of use, e.g. by drifting plasticizers and an extremely low humidity (drying of the entire system).

Result:

The system no longer provides the required conductivity values to protect devices and persons against electrostatic discharges and to protect against explosions.

Solutions with nora® floorcoverings:

nora® floorcoverings do not contain any plasticizers and meet the stated electrostatic properties when properly installed (subfloor, adhesive, floorcovering system) and cleaned correspondingly through their entire life. For years we have been granting a comprehensive 10-year guarantee for the electrostatic properties of our **nora®** floorcoverings.

10
years
warranty

on the electrostatic properties as stated in our warranty conditions*.

*to be requested from our office



Benefits of nora® floorcoverings in cleaning and care

Problem:

If a floorcovering is not cleared and cared for properly, its electrostatic properties might not survive.

This may be due to:

- coating of the floorcovering
- permanent contamination with dirt

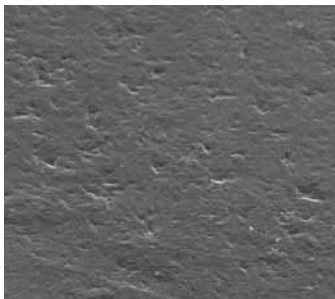
Result:

Discharge of electrostatic charges is no longer guaranteed because the permanent discharge through ground may be interrupted because of insulating layers (e.g. dirt, coatings) forming.

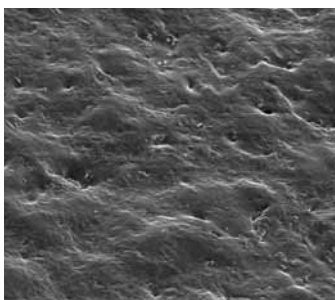
Solutions with nora® floorcoverings:

The extremely dense surface of nora® floorcoverings facilitates an easy and economic cleaning. Since they do not have to be coated, no

- impairment of the conductivity
- formation of pathways
- erosion or yellowing of the coating occurs.



Rubber surface
(1:100)



PVC surface
(1:100)



Areas of application of nora® floorcoverings



1. Production/assembly:



2. Computer rooms/server rooms:



3. Laboratories:



4. Clean rooms:

The requirements for floorcoverings in clean rooms are determined in ISO 14644-4. **nora**® floorcoverings with electrostatic properties are suitable for use in clean rooms and the related, usual conditions of use according to this guideline.

Electrostatically dissipative and conductive **nora**® floorcoverings were certified by the Fraunhofer Institute for Production Engineering and Automation (IPA) for use in clean rooms. The floorcoverings are suitable for the high demands of the clean-air classes ISO Class 3 according to DIN EN ISO 14644-1. This classification shows that they are suitable for high-sensitive clean rooms in many industries. We will be glad to send you the relevant test certificates of the Fraunhofer Institute for Production Engineering and Automation (IPA) on request.



5. Areas with explosion hazards (EX areas):

In areas with explosion hazards, avoidance of ignition risks as a result of static electricity is of utmost importance. Areas with explosion hazards may be classified into:

- areas where explosive atmospheres exist
 - combustible gasses, vapors, and mists
 - combustible dirt
- areas where explosive substances are handled



Uncontrolled electrostatic discharges may trigger explosions in these areas. A measure to prevent these risks is to use electrostatically dissipative or conductive **nora**[®] floorings which in addition do not generate any significant additional electrostatic charges (see p. 6) when being walked on.

The demands on floorcoverings in the above mentioned areas are listed in the table on page 18.





Electrostatically conductive floorcoverings – floorcoverings nora® “el”

offer protection against electrostatic discharges

- for electronic component parts, assemblies, and devices
- in areas with explosion hazards (e.g. handling of explosive substances)



norament® 927 el grano



noraplan® duo el

10 years **warranty** on the electrostatic properties as stated in our warranty conditions*.

*to be requested from our office

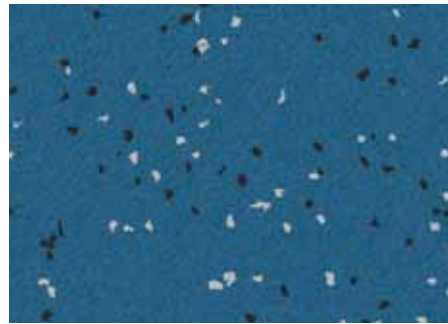
Electrostatically dissipative floorcoverings – floorcoverings nora® “al”

- offer protection against electrostatic discharges
- for electronic component parts, assemblies, and devices
 - in areas with explosion hazards (explosive atmospheres)

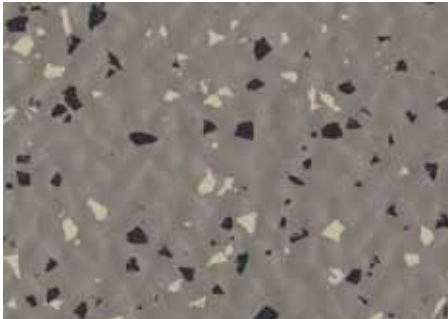
In addition, they **protect persons against electric shock** (insulation resistance $R \geq 5 \times 10^4$ Ohm according to VDE 0100/Teil 610 or CENELEC HD 384.6.61 S2:2003).



norament® 928 al



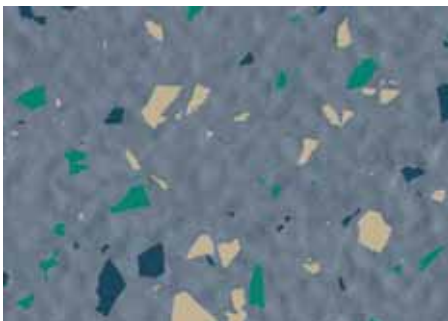
noraplan® stone al



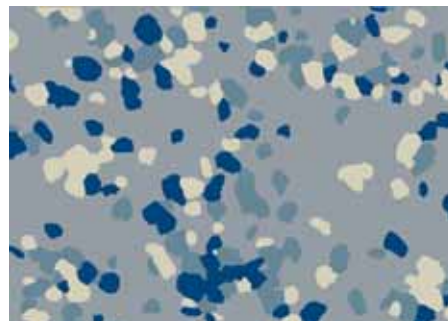
norament® 928 al grano



noraplan® mega al



norament® 928 al lago



noraplan® plus al

Technical information

on the electrostatic properties of nora® products*

Standards/guidelines	nora® el floorcoverings		nora® al floorcoverings	
	noraplan® duo el	norament® 927 el grano	noraplan® stone al noraplan® mega al noraplan® plus al	norament® 928 al grano norament® 928 al lago
ESD STM 97.2-1999 Charge voltage	10 V**	< 10 V**	< 10 V**	< 10 V**
IEC 61340-4-1:2003 Resistance to protective earth	< 10 ⁶ Ohm	< 10 ⁶ Ohm	10 ⁶ - 9 x 10 ⁷ Ohm***	10 ⁶ - 9 x 10 ⁷ Ohm***
ESD STM7.1-2001 Resistance to EPA earth	< 10 ⁶ Ohm	< 10 ⁶ Ohm	10 ⁶ - 9 x 10 ⁷ Ohm***	10 ⁶ - 9 x 10 ⁷ Ohm***
IEC 61340-5-1:2001 Resistance to EPA earth	< 10 ⁶ Ohm	< 10 ⁶ Ohm	–	–
IEC 61340-5-1:2001, Tabl. 1, note 2 Resistance to EPA earth	–	–	≤ 3,5 x 10 ⁷ Ohm****	≤ 3,5 x 10 ⁷ Ohm****
ESD STM 97.1-1999 Earth leakage resistance	–	–	≤ 3,5 x 10 ⁷ Ohm****	≤ 3,5 x 10 ⁷ Ohm****
EN 1081:1998 Earth leakage resistance	< 10 ⁶ Ohm	< 10 ⁶ Ohm	10 ⁶ - 9 x 10 ⁷ Ohm	10 ⁶ - 9 x 10 ⁷ Ohm
VDE 0100/T.610 Insulation resistance	–	–	≥ 5 x 10 ⁴ Ohm	≥ 5 x 10 ⁴ Ohm
ASTM F 150:1998 Resistance to earth	< 10 ⁶ Ohm	< 10 ⁶ Ohm	10 ⁶ - 10 ⁸ Ohm	10 ⁶ - 10 ⁸ Ohm
ASTM F 150:1998 Surface resistance	< 10 ⁶ Ohm	< 10 ⁶ Ohm	10 ⁶ - 5 x 10 ⁸ Ohm	10 ⁶ - 5 x 10 ⁸ Ohm

* The values stated apply for installations according to our recommendations for electrostatically conductive and dissipative floorcoverings and subject to the adhesive manufacturer's data. The adhesive used must meet a resistance of $R < 3 \times 10^5$ Ohm permanently according to EN 13 415.

** Tested with defined ESD shoes at 21 °C and 20 % rh.

*** when installed at 23 °C (± 2 °C) and ≥ 25 % rh

**** for the system floorcovering/conductive shoes ($R < 5 \times 10^6$ Ohm)

Special information

on nora® products in EX areas

Standards/ guidelines	Requirements		Recommended measuring methods to determine the resistance	Recommendations nora® floorcovering
	explosive atmosphere	handling of ex- plosive substances		
CENELEC Technical Report (Europe)	a) $R_E < 10^8$ Ohm	b) $R_E < 10^6$ Ohm	IEC 61340-4-1	a) all dissipative nora® floorcoverings all conductive nora® floorcoverings noraplan® duo el norament® 927 el grano
BGR 132 (Germany)	a) $R_E < 10^8$ Ohm	b) $R_E < 10^6$ Ohm	EN 1081 IEC 61340-4-1	
NF P 62-001 (France)	$R_D/R_E < 10^7$ Ohm	–	EN 1081	
NFPA 77 (US)	a) $R_E < 10^8$ Ohm (floor)	b) $R_E < 10^6$ Ohm (shoes + floor)	ASTM F 150 ESD STM 97.1	a) all dissipative nora® floorcoverings b) norament® 927 el grano (with shoes $R < 3 \times 10^5$ Ohm)
BS 5958, I & II (Great Britain)	a) $R_E < 10^8$ Ohm (shoes + floor)	b1) $R < 5 \times 10^4$ Ohm (floor) b2) $R_E < 10^6$ Ohm (shoes + floor)	BS 2050 BS 5958, I ESD STM 97.1	a) all dissipative nora® floorcoverings (with shoes $R < 5 \times 10^6$ Ohm) b1)** norament® 927 el grano b2) norament® 927 el grano (with shoes $R < 3 \times 10^5$ Ohm)

* The requirements and measuring methods stated only serve as reference values and may deviate from the above mentioned data depending on customer requirements and other influencing factors in the relevant object. The company does not assume any liability for the correctness of the above mentioned data in terms of content.

** The adhesive used must meet a resistance of $R < 5 \times 10^3$ Ohm permanently according to EN 13 415.

For further information on nora® products, please visit our website www.nora.com.



M

norastat®

Bench mats, shelf coverings, and floor runners with electrostatically conductive and dissipative properties

- extremely wear-resistant
- attractive designs
- smooth and embossed surfaces: easy to clean
- suitable for loose laying or bonding
- a.o. meet the international standards for determination of electric resistances



Our services for you:

Our team of highly-qualified experts is accompanying you from the beginning with regard to new construction as well as during renovation. Our experts are located in all important markets of the world to assist you. We offer comprehensive support in all phases of a project:

- planning
- tenders
- subfloor preparation
- installation
- cleaning and care

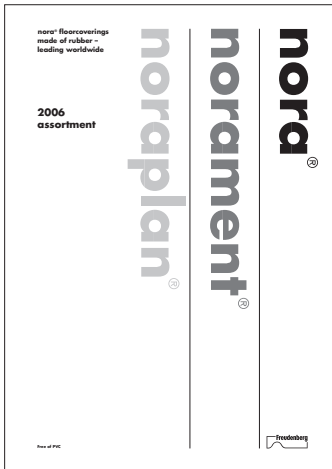
The numerous tests, examinations, and application-technical developments performed and made in our company and at site are an important part of our service package and guarantee the permanently high quality of our products. We maintain close contact with the most important materials suppliers worldwide. Together with these suppliers, we offer you optimum solutions.

A research laboratory accredited pursuant to DIN EN 45001 belonging to the Freudenberg group of companies assists us effectively in our endeavours.

Please visit our homepage:
www.nora.com

For detailed product information on **nora**[®] floorcoverings, please request your copy of:

- **assortment brochure**
- **industry brochure**
- **environmental brochure**



The headquarters of the Freudenberg group of companies: the plant in Weinheim

The Freudenberg group of companies

Freudenberg is a diversified family company specializing in seals and vibration control technology, nonwovens, household products, chemical specialties, building systems and IT services.

The Freudenberg Group employs some 30,000 people in 54 countries and posts sales of about Euro 4 billion.

Freudenberg Bausysteme is an independent company of the group and the world-wide leading supplier of rubber floorcoverings. A turnover of more than Euro 152 million is achieved by approx. 900 employees.

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Companies which rely on nora® floorcoverings

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BASF
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Beiersdorf
Berlin Chemie
BMW
Boehringer Ingelheim
BP Köln
Celanese
CONTI
DaimlerChrysler
Degussa
E.ON
Ford-Werke
Friedr. Flender
Gillette Deutschland
Grünenthal
Gruner + Jahr
Hella
Henkel
IBM
IHP
Infineon Technologies
König & Bauer
Kraft Foods Deutschland
Lampertz
Landesamt für Umweltschutz
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