Carbex inside

SLOT INSULATION NMN 410 (NPN 410)

Slot insulation NMN 411 is an insulating laminate consisting of three layers of polyester with calendered aramid paper (Nomex) on both sides. An ideal material for slot insulation in electric motors and generators for applications with high working temperatures, NMN 411 is also used for transformers and other electrical applications.

- ***Thickness range 140 – 740 µm***
- ***Available in widths up to ca 900 mm, cut and trimmed widths and punched parts available on request***
- ***Very good dielectric and mechanical properties and high resistance to chemicals and solvents***
- ***Approved for insulation class F (+155°C) or for insulation systems which comply with IEC norms up to +180°C***

PRODUCT INFORMATION

Slot insulation NMN 410 (NPN 410) is a three-ply insulating laminate material consisting of polyester film with calendered aramid paper (Nomex) on both sides. The structure provides a combination of good dielectric, mechanical, temperature and chemical properties.

Typical applications

Electric insulation material used primarily as slot insulation in electric motors and generators, but also as insulation in dry transformers and other electrical apparatus.

Properties

- Approved for insulation Class F (+155°C) or for insulation systems which comply with IEC norms up to +180°C
- Withstands short-term temperature peaks up to +200°C without major impact on the breakdown voltage or dielectric resistance
- Very suitable for rational production of Class F motors
- Very good adhesion to impregnation varnishes despite the material's smooth structure
- The polyester film's good dielectric and mechanical properties combined with the aramid paper's (Nomex) high resistance to chemicals, solvents and high temperatures result in a very high class insulation material.
- Very good durability
- Can be punched or cut

Composition

- NMN 410 (NPN 410) is composed of a central layer of polyester film surrounded by a layer of calendered aramid paper (Nomex) on both sides. An adhesive bonds the laminate into a unit whilst retaining inherent properties even when used in the material's higher temperature range.
  The product is manufactured in four variants with varying thicknesses of polyester film as the middle layer. See technical data.
- NMN 410 - 5 with Nomex layer thickness of 2 x 50 µm. Normally of calendered Nomex Type 464.
- NMN 410 - 8 with Nomex layer thickness of 2 x 80 µm. Normally of calendered Nomex Type 416.
- NMN 410 - 13 with Nomex layer thickness of 2 x 130 µm. Normally of calendered Nomex Type 416.
- NMN 410 - 18 with Nomex layer thickness of 2 x 180 µm. Normally of calendered Nomex Type 410.

Colour

- Usually pale white

Dimensions

- NMN 410 (NPN 410) manufactured in thicknesses 140 – 740 µm.
- Can be slit to desired widths up to max. 900mm
- Can be punched or cut to desired form or shape. In the case of die-cutting a die tool is required (tools available at low costs)

Packaging

- Standard packaging width ca 900 mm depending on item in rolls of ca 25-30kg* (depending on item, certain thicknesses are held in stock, see item list)
- Standard packaging normal width ca 450 mm depending on item in rolls of ca 6kg alt. ca 15 kg*
  (certain thicknesses are held in stock, see item list)
- Other slit-to-width dimensions MOQ in kg on request
- Punched/Die-cut items: MOQ amount on agreement (With die tool or cut)

* Other weights on request

Product information for which Carbex bears no responsibility is provided by the manufacturer.

SLOT INSULATION NMN 410 (NPN 410)

Item Number	Type /Grade	Dimensions			Weight ca (kg)/ rulle	Weight g/m² (nom.)	Length ca (m)/ roll	Stock item (usually)
		Thickness mm	Width (ca mm)	Internal diam (mm)				
030600175	NMN 410-5 / 2/1.5/2	0.15 +/-15%	450	76	5	162	69	X
030600017	NMN 410-5 / 2/2/2	0.17 +/- 15%	450	76	15	170	196	
030600020	NMN 410-5 / 2/3/2	0,20 +/- 15%	450	76	6	217	61	X
030600025	NMN 410-5 / 2/5/2	0.24 +/- 15%	450	76	6	270	49	X
030600030	NMN 410-5 / 2/7.5/2	0.30 +/- 15%	450	76	6	360	37	X
030600035	NMN 410-5 / 2/10/2	0.36 +/- 10%	450	76	6	450	30	
030609017	NMN 410-5 / 2/2/2	0.17 +/- 15%	914	76	30	170	193	
030609020	NMN 410-5 / 2/3/2	0.20 +/- 15%	900	76	30	217	154	
030609025	NMN 410-5 / 2/5/2	0.24 +/- 15%	914	76	30	270	122	
030609030	NMN 410-5 / 2/7.5/2	0.30 +/- 15%	914	76	30	360	91	
030599024	NMN 410-8 / 3/3/3	0.24 +/- 15%	914	76	30	255	129	

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SLOT INSULATION NMN 410 (NPN 410)

Technical data

NMN 410 / NPN 410

The properties in this data sheet are typical values which can vary slightly between different manufacturers'

Properties	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Unit m.m.
NMN 410 / NPN 410 -X	5	5	5	5	5	5	5	5	5	5	
Nominal thickness	140	150	170	200	220	240	300	360	420	470	µm
Mechanical											
Thickness tolerance	15	15	15	15	15	15	15	10	10	10	+/- %
Thickness Nomex (x 2)	50	50	50	50	50	50	50	50	50	50	µm
Thickness polyester film	23	36	50	75	100	125	190	250	300	350	µm
Name/thickness (Grade)	2/1/2	2/1.5/2	2/2/2	2/3/2	2/4/2	2/5/2	2/7.5/2	2/10/2	2/12/2	2/14/2	N/M/N
Weight/m² (nom.)	140	162	170	217	240	270	360	450	520	580	g/m²
ca Area / kg	7.1	6.2	5.9	4.6	4.2	3.7	2.8	2.2	1.9	1.7	m²/kg
Weight tolerance	12	12	12	12	12	12	12	12	12	12	%
Tensile strength MD	100	150	160	185	190	225	280	330	380	410	N/10mm (min)
Tensile strength XD	80	110	120	150	150	200	220	300	320	370	N/10mm (min)
Elongation MD	15	15	15	15	15	15	15	15	15	15	% (min)
Elongation XD	20	20	25	20	25	25	25	25	25	25	% (min)
Shrinkage MD	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	% (max)
Shrinkage XD	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	% (max)
Thermal											
Electrical insulation class	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	klass /°C
Electrical											
Dielectric strength	6	7	9	11	12	14	16	20	21	23	kV (min)

Properties	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Unit m.m.
NMN 410 / NPN 410 -X	8	8	8	8	8	8	8	8	8	8	
Nominal thickness	190	200	220	240	270	300	360	420	480	530	µm
Mechanical											
Thickness tolerance	15	15	15	15	15	15	15	10	10	10	+/- %
Thickness Nomex (x 2)	80	80	80	80	80	80	80	80	80	80	µm
Thickness polyester film	23	36	50	75	100	125	190	250	300	350	µm
Name/thickness (Grade)	3/1/3	3/1.5/3	3/2/3	3/3/3	3/4/3	3/5/3	3/7.5/3	3/10/3	3/12/3	3/14/3	N/M/N
Weight/m² (nom.)	194	212	220	255	302	325	420	500	570	652	g/m²
ca Area / kg	5.1	4.7	4.5	3.9	3.3	3.1	2.4	2.0	1.75	1.5	m²/kg
Weight tolerance	12	12	12	12	12	12	12	12	12	12	%
Tensile strength MD	160	180	200	270	270	300	330	380	430	450	N/10mm (min)
Tensile strength XD	100	140	170	190	240	250	300	300	375	420	N/10mm (min)
Elongation MD	20	20	15	15	20	20	20	20	20	20	% (min)
Elongation XD	20	20	20	20	20	20	25	25	25	25	% (min)
Shrinkage MD	2	2	1.5	1.5	2	2	2	2	2	2	% (max)
Shrinkage XD	2	2	1,5	1.5	2	2	2	2	2	2	% (max)
Thermal											
Electrical insulation class	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	klass /°C
Electrical											
Dielectric strength	7	8	9	12	13	15	20	23	25	28	kV (min)

Properties	Value	Value	Value	Value	Value	Value	Value	Value	Unit m.m.
NMN 410 / NPN 410 -X	13	13	13	13	13	13	13	18	
Nominal thickness	330	360	380	410	470	530	630	730	µm
Mechanical									
Thickness tolerance	15	15	15	15	15	15	10	10	+/- %
Thickness Nomex (x 2)	130	130	130	130	130	130	130	180	µm
Thickness polyester film	50	75	100	125	190	190	350	350	µm
Name/thickness (Grade)	5/2/5	5/3/5	5/4/5	5/5/5	5/7.5/5	5/10/5	5/14/5	7/14/7	N/M/N
Weight/m² (nom.)	330	365	400	435	525	610	730	861	g/m²
ca Area / kg	3.0	2.75	2.5	2.3	1.9	1.65	1.4	1.16	m²/kg
Weight tolerance	12	12	12	12	12	12	12	12	%
Tensile strength MD	200	220	250	300	320	400	550	750	N/10mm (min)
Tensile strength XD								525	N/10mm (min)
Elongation MD	7	7	7	7	15	15	15	15	% (min)
Elongation XD									% (min)
Shrinkage MD	2	2	2	2	2	2	2	2	% (max)
Shrinkage XD	2	2	2	2	2	2	2	2	% (max)
Thermal									
Electrical insulation class	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	F / 155	klass /°C
Electrical									
Dielectric strength	10	13	14	16	20	20	20	24	kV (min)

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