

NOMEX® PRESSBOARD

TECHNICAL DATA SHEET

Wherever there's a need for electrical insulation, there's usually a NOMEX® brand product to fill it. In its various forms, NOMEX® products have the right balance of properties for use in transformers, motors, generators and other electrical equipment.

As one of the newer members of the family of NOMEX® products, its increased thickness and rigidity set NOMEX® brand pressboard apart from the other forms of NOMEX®. Like NOMEX® paper, however, it has a high level of electrical, chemical and mechanical integrity which is derived from the NOMEX® polymer itself.

NOMEX® pressboard is comprised of hundreds of layers of NOMEX® floc and fibrils pressed together in board form. The result is a rigid, yet resilient material with excellent thermal stability and dielectric strength. No other material provides the outstanding thermal and electrical properties with the design flexibility that you can get with NOMEX® pressboard. It can be used for a range of applications, such as spacers and barriers in both liquid-filled and dry-type transformers, and as end-laminations in motors.

Enhanced properties of NOMEX® pressboard

The electrical and mechanical properties of NOMEX® pressboard generally exceed those of most existing boards, including cellulose and many advanced composite laminates used today. NOMEX® pressboard also retains these excellent properties over extended periods of time.

In transformers, the premium mechanical properties of NOMEX® ensures tight windings, and hence produces coils capable of withstanding short circuit, overloads, and vibrations after many years of service. The mechanical toughness of NOMEX® pressboard also reduces shop failures and repairs.

Of particular importance in liquid-filled transformers, NOMEX® pressboard and paper, do not give off any by-products until exposed to temperatures of 350°C or more. This is a major advantage, considering that water given off by cellulose when exposed to temperatures slightly above normal operating conditions is believed to be the main cause for the rapid deterioration of the cellulose-oil insulation system under those conditions.

Like most types of NOMEX® papers, Underwriters Laboratories (UL) have also rated all three types of NOMEX® pressboard for ten years continuous use at 220°C. Additionally, UL has designated NOMEX® pressboard with a 94V-0 rating (equivalent to FV0 rating according to IEC 707), the highest attainable "flame-resistance" rating in this norm.

Due to the relatively low moisture absorption of NOMEX® pressboard, the use of NOMEX® in liquid-filled transformers has significantly reduced dry-out time prior to oil impregnation in several cases.

Applications and benefits of NOMEX® pressboard

The availability of NOMEX® in paper form only until the mid-1980s, made it difficult before that time to obtain structural insulating components made of NOMEX®. With the introduction of NOMEX® pressboard, this problem was overcome, and it then became possible to fabricate parts made from NOMEX® pressboard, such as: radial and axial spacers, spacer sticks, barriers, core tubes and end-laminations.

NOMEX® pressboard in liquid-filled transformers

Once NOMEX® pressboard was introduced, it was only a matter of time before it found its way into liquid-filled transformers. Today, NOMEX® pressboard is used in small pole-mounted liquid-filled transformers, traction transformers and even in medium-power to power (up to 120 MVA) transformers.

Recent experience in liquid-filled transformers has shown that use of NOMEX® brand pressboard for spacers and barriers, and NOMEX® paper as conductor insulation can enable up to a 25% reduction in weight for a given kVA output. Minimizing weight like this, has found application in mobile substations and locomotive traction transformers.

Alternately, the use of NOMEX® pressboard and paper in liquid-filled transformers allows for up to 50% higher kVA rating for a given size and weight at some increase in load losses. This feature enables capacity expansion in areas where transformer weight or size has been predetermined, such as pole-top transformers (pole weight limit) or mobile substations (on-the-road load restrictions). In the latter case, the adoption of NOMEX® pressboard and paper has allowed for these units to be designed with operating capabilities larger than ever before.

The outstanding 220°C thermal rating of NOMEX® pressboard and paper means the aging of these two materials is essentially nonexistent, even with conductor temperature rises 30°C higher than normal practice. Operation at higher temperatures without loss-of-life provides a dual functioning capability for a transformer enhanced with NOMEX®. The unit can be sized closer to the load requirements and still handle emergency situations without deterioration of the insulation. This emergency capability can reduce the cost associated with redundancy planning. The higher temperature capability also enables more freedom during substation planning for future expansion.

NOMEX® pressboard in dry-type transformers

In dry-type transformers, NOMEX® offers the possibility of manufacturing a one- or two-piece formed component for an insulating part, which traditionally, would need to be fabricated from several different materials. The NOMEX® pressboard in this case not only provides a simplification in the manufacturing process, but also brings its high temperature capability, excellent abrasion resistance and increased mechanical stability which eliminates damage from vibration.

NOMEX® pressboard in rotating machines

The strength and resilience of NOMEX® pressboard help extend rotating equipment life in severe operating conditions. These conditions include severe shock and vibration seen in steel mill drives and railroad traction motors, as well as the abrasion caused by thermal expansion and centrifugal forces in stand-by gas turbine generators. Unlike reinforced composites, no abrasive particles are present in NOMEX® pressboard to interfere with the operation of moving parts.

NOMEX® pressboard products

Type 992

Type 992 is a low-density pressboard produced in two thicknesses 1.6 and 3.2 mm (63 and 125 mil) with a specific gravity of 0.5. This material's low density allows easy formation of complex shapes, and provides the highest saturability of the pressboard products with resins, varnishes or oil.

Type 993

Type 993 is a medium-density pressboard produced in thicknesses from 1.0 to 4.0 mm (40 to 160 mil) with specific gravities from 0.7 to 0.9. This material provides a balance of rigidity and conformability along with outstanding saturability and excellent electrical properties in oil.

Type 994

Type 994 is a densified version of Type 993, available in thicknesses from 1.0 to 9.6 mm (40 to 380 mil) with specific gravities from 1.1 to 1.2. It provides superior stability under compressive loads. Type 994 will also absorb oils and other fluids, but not as readily as Types 992 and 993.

This brief description only touches on the potential of insulation systems enhanced with NOMEX®. There are many areas of special needs where these concepts could be employed immediately, and other areas where a fundamental change in operating philosophy may be required. NOMEX® allows both the equipment manufacturer and the user a new degree of freedom in designing and specifying equipment to reduce overall investment. The result is to make electrical apparatus and power delivery systems more cost effective while achieving much higher levels of reliability.

PRODUCT AVAILABILITY¹⁾

Type 992

Nominal Thickness		Density (g/cm ³)	Basis Weight ²⁾		Width		Length		Area	
(mm)	(mil)		(g/m ²)	(oz/yd ²)	(mm)	(inches)	(mm)	(inches)	(m ²)	(yd ²)
1.6	63	0.52	810	24	1067	42	1041	41	1.11	1.33
3.2	125		0.53	1630	48	1067	42	2108	83	2.25
					1600	63	1575	62	2.52	3.02
					1600	63	2108	83	3.37	4.04
					1600	63	3150	124	5.04	6.04
					2108	83	3200	126	6.75	8.08

Type 993

Nominal Thickness		Density (g/cm ³)	Basis Weight ²⁾		Width		Length		Area	
(mm)	(mil)		(g/m ²)	(oz/yd ²)	(mm)	(inches)	(mm)	(inches)	(m ²)	(yd ²)
1.0	40	0.70	720	21	1067	42	1041	41	1.11	1.33
1.5	60	0.73	1050	31	1067	42	2108	83	2.25	2.69
2.0	80	0.76	1530	45	1067	42	3150	124	3.36	4.02
2.4	95	0.77	1770	52	1600	63	1245	49	1.99	2.39
3.0	120	0.82	2270	67	1600	63	1575	62	2.52	3.02
4.0	160	0.87	3410	101	1600	63	2108	83	3.37	4.04
					1600	63	3150	124	5.04	6.04
					3200	126	2108	83	6.75	8.08
					3200	126	3150	124	10.08	12.07
					3200	126	6299	248	20.16	24.15

Type 994

Nominal Thickness		Density (g/cm ³)	Basis Weight ²⁾		Width		Length		Area	
(mm)	(mil)		(g/m ²)	(oz/yd ²)	(mm)	(inches)	(mm)	(inches)	(m ²)	(yd ²)
1.0	40	1.15	1148	34	355	14	813	32	0.29	0.35
1.5	60	1.15	1708	50	355	14	1003	39.5	0.36	0.43
2.0	80	1.15	2310	68	355	14	1168	46	0.42	0.50
3.0	120	1.15	3448	102						
3.2	125	1.15	3657	108						
4.0	160	1.14	4554	134						
4.8	190	1.15	5484	162						
5.0	200	1.14	5691	168						
6.0	240	1.13	6768	200						
6.4	250	1.13	7148	211						
7.0	275	1.15	8039	237						
8.0	315	1.13	9068	267						
9.6	380	1.15	11069	326						

¹⁾ Sheet sizes not available for all thicknesses, listed sizes are available on some of the products in that grade.

²⁾ Basis Weights include nominal moisture content.

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Product safety information is available upon request.

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