Pars Electrical Insulation Co.

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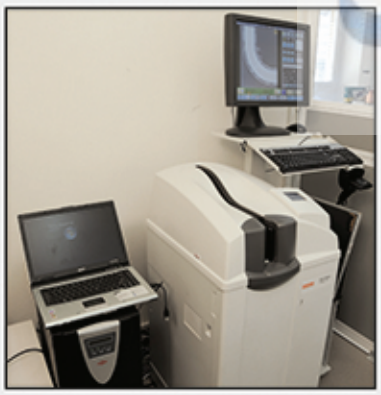
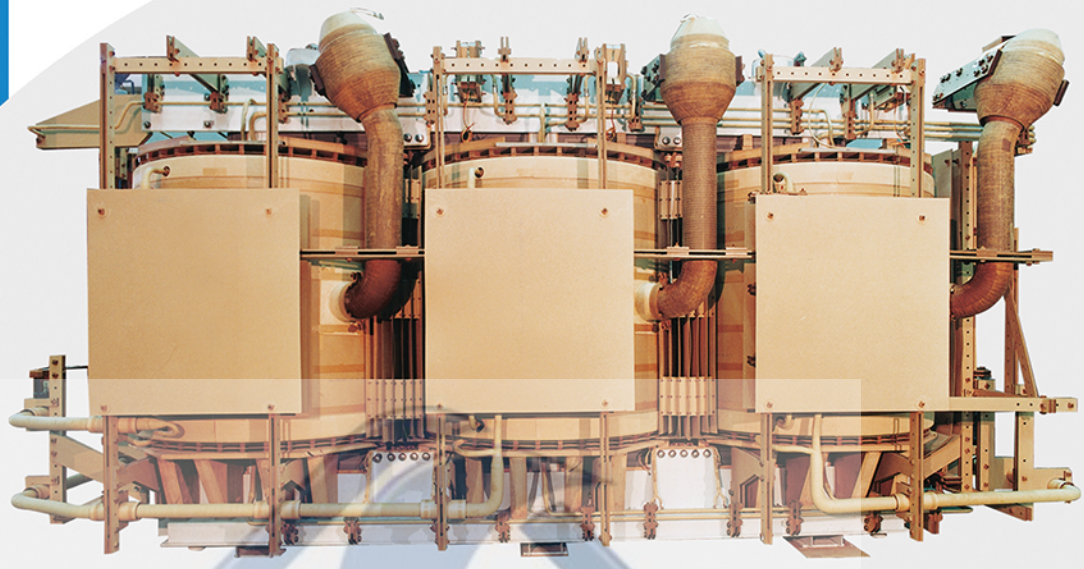
PEI is an internationally operating manufacturer of Power, Semi-Power, Distribution and Special transformers' insulating system components on the basis of **Transformerboard** (Pressboard & Press paper), **Transformer wood** (Laminated Compressed Wood), and **Special Insulation Papers**. Many well-known producers of electro-technical equipments and devices rely on the high quality of our products and get advantage of **over 35 years** of experience and modern technology of our company.

Our expertise in electrical insulation materials laid the foundation for an internationally reputed enterprise



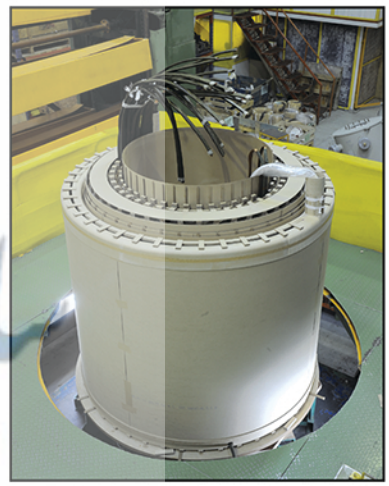


Insulating Materials and Components of Transformerboard

Components and insulating sheets of pressboard are used in oil-immersed Power, Semi-Power, and Distribution transformers primarily due to their high purity, mechanical strength, and optimal oil-impregnability.

Transformerboard is being used to subdivide highly stressed oil channels into narrower gaps. The barriers are so arranged to be perpendicular to the electric field lines.

Insulation parts are fully impregnated, dimensionally stable, with very favorable dielectric properties and are manufactured with the best quality.



Transformer wood in Power Transformers is being used close to the ends of Windings for Clamping Rings, Clamping Segments, Blocks that transfer clamping forces to the windings, and Terminal Holders. They are exposed to **not much strong electric fields**.

Pressboard components, such as Angle Rings, Chimney Segments, and End Leads are chosen in a way to be able to adapt themselves with electric field conditions prevailing in the transformer. Especially in highly stressed areas, the dimensional stability and good dielectric features are of the great advantages.

Special forming and pressing procedures are employed in the manufacturing the pressboard components.

Especially in the event of **short-circuits**, the extreme compressibility of Pressboard & Laminated Compressed Wood offers the appropriate safety against the enormous mechanical stress in transformer.

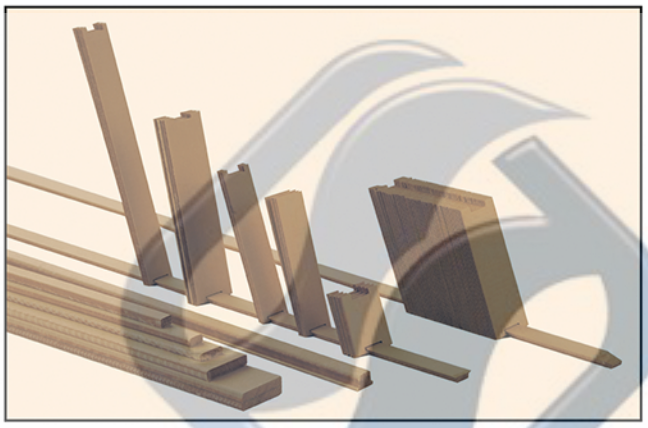
Oil-Impregnated Pressboard unites the mechanical and electrical characteristics and this combination cannot be achieved by any other insulating material.

Based on extremely good oil-impregnability, partial discharge free operation is assured.

Strips and Spacers

According to IEC 60641-1 type B 3.1

Rectangular strips are fitted in axial oil channels as spacers for the cylinders. Special strips are used between supporting cylinders and windings, which act as spacers between cylinder and winding (for cooling of winding) and make the radial spacers mechanically fixed.
Since the strips are exposed to strong electric fields, a tissue free surface and specific rounded edges strips are of great importance to maintain dielectric strength of the overall arrangement.

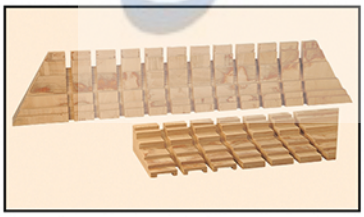


Spacers made of high density boards with high short- circuit strength are used in windings. They can be supplied in final milled states. Milled spacers and strips with rounded edges prevent damages to the wire insulation. In contrast to punched spacers, milled spacers release substantially less cellulose fiber to the oil, witch has a positive effect on the dielectric strength of the coolant.

Clamping Plates and Rings

According to IEC 61061

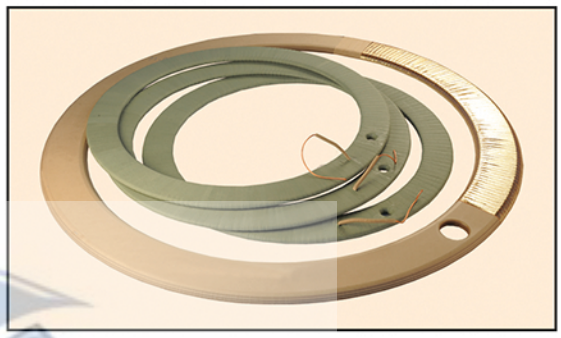
Clamping rings of transformer wood are designed to withstand high axial forces generated in the windings during short circuit.



Good dielectric properties also lead to reduced design clearances and less chance of partial discharge at the end of the winding assembly.
Numerous design shapes and configurations are offered.

Static Rings

Made of
Frame: **Transformerboard according to IEC 60641 - 1 Type B 3.1**
Metallization : **Cupper Strip**
Insulation : **Crepe Paper**
Metalized shield rings with a pressboard core are insulated with crepe paper wrapped in several layers after being covered with a special metal bandage.



Cylinders

According to IEC 60641 - 1 Type B 3.1
Due to its high mechanical strength, it is possible to use cylinders directly on the winding mandrel as supporting cylinders for coils, even for limited-rating transformers. These cylinders can be impregnated completely without difficulty. The danger of air or water insulations cannot be avoided with hard paper cylinders.
Although cylinders of TRANSFORMERBOARD behave similarly to soft paper insulation with regard to dielectric properties, they are dimensionally stable and can be loaded without mechanical problems.

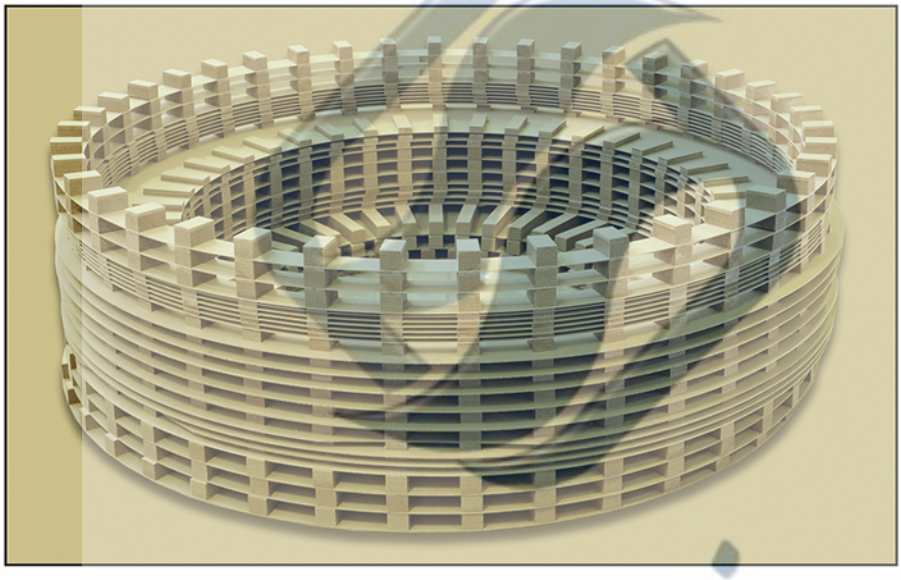
Clackband

Made of Transformerboard
- According to IEC 60641 - 1 Type B 3.1
Glued to Transformer Presspaper
- According to IEC 60641 - 1 type 2.1
In many cases, Clackband, Thermo-Flow or Ladders enable a particularly efficient winding construction. These can be quickly supplied in all required dimensions.

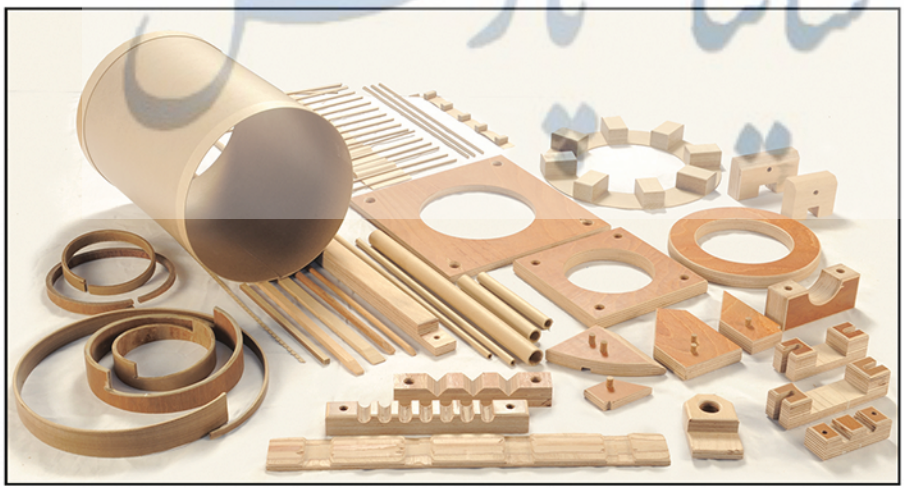
Spacer Rings

According to IEC 60641 - 1 Type B 3.1

These insulation assemblies made of sheets of insulation materials, with spacers to channel the oil flow and as dielectric barriers at the ends of windings in axial long oil gaps. They also contribute in clamping of the winding by clamping rings.



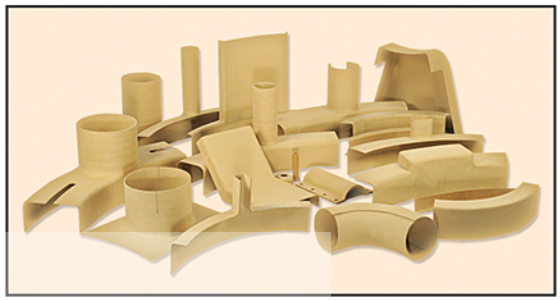
Distribution Transformer Insulation Components



The kit of this parts prepared in accordance with customer's technical data.

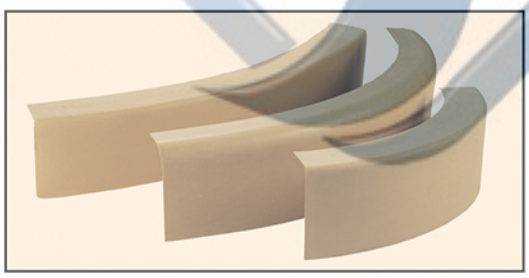
Shaped and Molded components

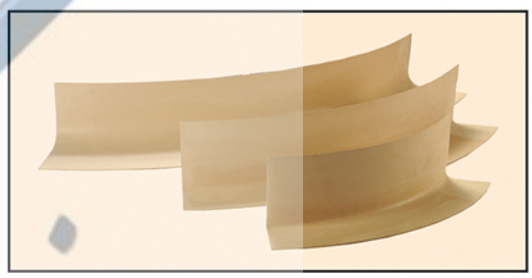
According to IEC 60641 - 1 Type B 4.1
Made of Transformerboard
Molded insulation components which are produced in a wet molding process are used in high Voltage windings to complete the insulation system. These components are manufactured According to customer drawings in various shapes and sizes.



Angle Rings & Caps

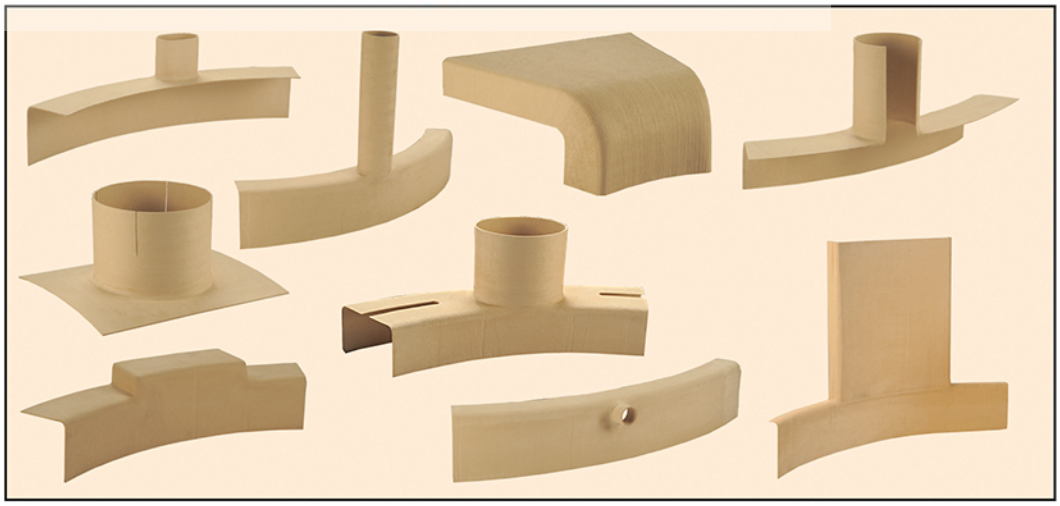
Made of Transformerboard
The use of angle rings and caps of Transformerboard relieves the electrical stress on adjacent oil channels and increases the partial discharge inception voltage. They are dimensionally stable and thus can be quickly and safely installed as a 360° component. The radii can be chosen so that they correspond as closely as possible to the electric field pattern.





Snout & Chimney Sectors

Made of Transformerboard
Snout & Chimney Sectors are required in high voltage windings to insulate the terminal leads (Center of top). The snouts and chimneys, which can be produced in any shapes or sizes, are combined without difficulty with angle rings and caps, with an optimized, scarfed overlap.



Lead Exit

Lead exits are special insulation systems used in large power transformers high voltage side to lead conductors through tank walls from the windings to the bushing in high safety factors.

Lead exit design is based on an electrode as a metal core insulated by high quality formed transformer board with several numbers of barriers. The number of barriers depends on maximum field stress in the oil gaps and it is designed with consideration of maximum safety factors.

Quality

PEI's quality management system acc. to **ISO 9001** was run in 2003. Now PEI is governed by Integrated Management System:

IMS

Since 2007 **Integrated Management System** has been followed in PEI. We are certified acc. To:

ISO 9001;2008: Quality management systems.

ISO 14001;2004: Environmental management systems.

OHSAS 18001;2007: Occupational health and safety management systems.

Through a process approach PEI develops, implements and improves the effectiveness of the quality system, to enhance the customers satisfacation by meeting customer requirements. Using appropriate training and education programs, PEI provides and improves the competency of the personnel. We are committed to the safety and health of personnel and also to prevent the pollution of the environment.


CERTIFICATE TÜV NORD

Management system as per OHSAS 18001 : 2007

PARS ELECTRICAL INSULATION Co.

Production of Insulating Components of Oil-Filled Transformers Including Power, Distribution and Special Transformers


CERTIFICATE TÜV NORD

Management system as per ISO 9001 : 2008

PARS ELECTRICAL INSULATION Co.

Production of Insulating Components of Oil-Filled Transformers Including Power, Distribution and Special Transformers


CERTIFICATE TÜV NORD

Management system as per ISO 14001 : 2004

PARS ELECTRICAL INSULATION Co.

Production of Insulating Components of Oil-Filled Transformers Including Power, Distribution and Special Transformers

Product Quality

Beyond Quality System, PEI ensures its products quality through these processes:

- **Incoming materials inspection**
- **Process quality control**
- **Laboratory**

- Incoming materials inspection

Although PEI's suppliers of raw materials are all qualified and assessed acc. to the procedure of suppliers evaluation, every incomming consignment is inspected visually and dimensionally and randomly sampled and sent to laboratory for test.

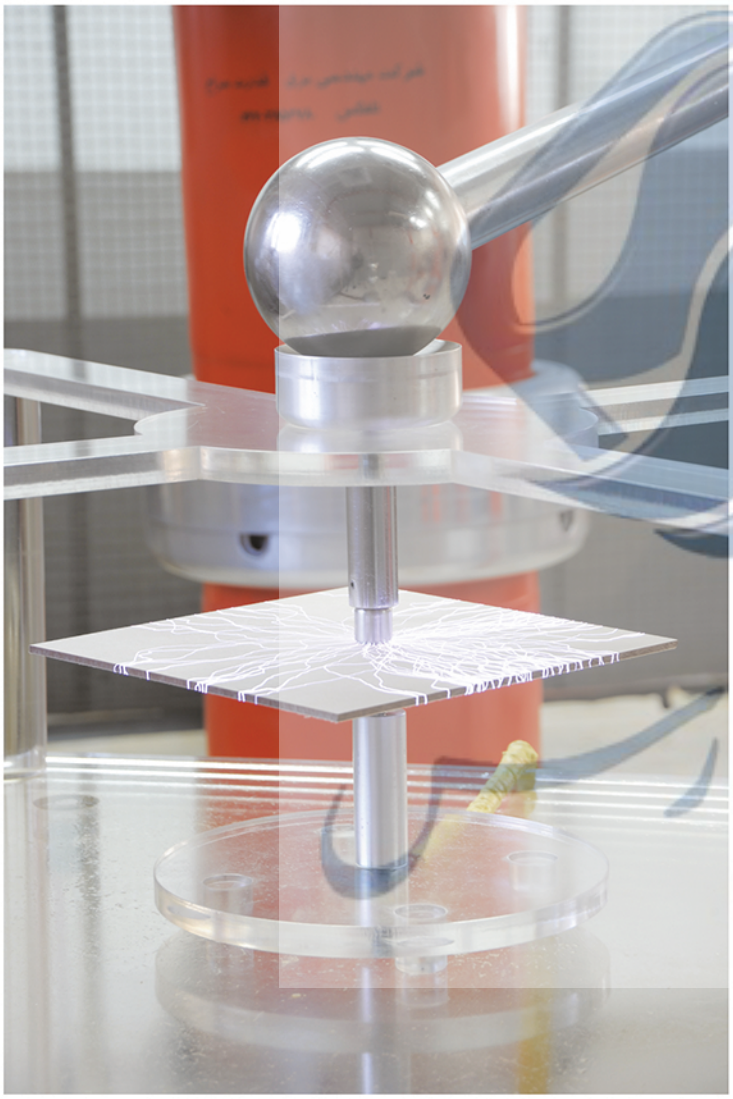
- Process quality control

Here in PEI production process is devided to machining, sheet-forming and hand-moulding lines. Dimensional and visual quality controls according to the corresponding check lists are performed in the determined steps of each production line. In the moulding production line the pH and conductivity of the water and pulp is regularly checked and the final products such as molded insulating parts and outlet systems 100 percent are checked with x-ray to ensure having no metal particles, voids or impurities. Other parameters like density, tensile strength and degree of polymerization are measured and monitored. Everywhere needed using metal detectors of up to 1000 mm width, we can detect any metal particle greater than 0.8 mm.

Laboratory

Presently we are able to perform more than 100 test methods based on international **IEC & ISO & ASTM** standards on the various products made of **six major solid insulating materials.**

Cellulose base	Pressboard and press paper	IEC 60641-3-1: 2008 ; B.3.1 A, B.4.1, P.4.1 A
	Cellulosic papers	IEC 60554-3-5: 1984 ; 5B.1-2H2
Laminates	Laminated Pressboard	IEC 60763-3-1: 2007 ; LB.3.1A-1, LB.3.1A-2
	Non-impregnated densified laminated wood	IEC 61061-3-1: 1998 ; C2R, P4R, C4R, T4R
Rigid Laminates	Industrial rigid laminated sheets based on thermosetting resins.	IEC 60893-3-4: 2003 ; PF CP 201, PF CP 202, PF CC 201, PF CC 202
	Industrial rigid round laminated tubes and rods based on thermosetting resins.	IEC 61212-3-1: 2003 ; PF CP 21, PF CP 22, EP GC 22, PF CP 41



These tests are classified in 4 groups:

- Physical & Chemical tests.
- Mechanical tests.
- Electrical tests.
- X-ray Radiography test.

We have the advantage of experienced and competent personnel and the state-of-the art laboratory technology in each field.

PEI laboratory always calibrated equipments traceable to the international standards, assuring the accuracy and precision of the results through regular quality control tests on the internal reference materials, holding up the inter-laboratory tests and participating in annual international proficiency tests.

Extra-Standard Requirements

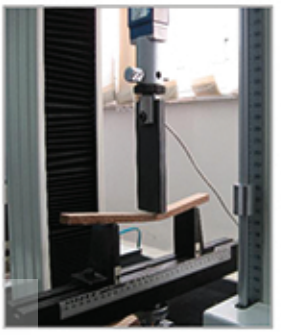
Partial Discharge free designs using high quality insulating materials is now a main feature in power industry. PEI's laboratory responses to this extra-standard requirement of its customers, performing accurate PD measurements on the PEI's insulation production. We also guarantee the life time of our cellulosic insulation products through monitoring their degree of polymerization during the aging tests.

Physical & Chemical tests:

- Dimensions
- Density
- Moisture content
- Shrinkage
- Conductivity of aqueous extract
- pH of aqueous extract
- Ash content
- Oil absorption
- Water absorption
- Degree of polymerization of cellulose

Mechanical Tests:

- Tensile properties
- Compressibility
- Compressive strength
- Plybond resistance
- Shearing strength
- Internal ply resistance
- Cohesion between layers
- Charpy Impact strength

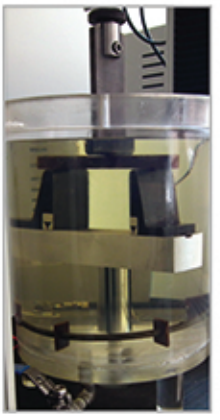


Preparation of the test samples:

- Preparations of the specimens for each material are done in accordance with related IEC standards.
- We use a trained operator for cutting and shaping test pieces with accurate dimensions with required tolerances.
- For conditioning the test samples we have the proper facilities for:
- Heating and drying the specimens at a residual pressure of not more than 1 kPa;
- Heating and drying the specimens in special forced air circulation oven or by natural circulation oven;
- Supply humidity and temperature of atmospheric conditions.

The laboratory's test equipments include:

- Two universal testing machines 150 KN and 20 KN utilized with their changeable jaws and fixtures provide the ability of testing any necessary mechanical parameter. More accurate measurements also are possible using 2 KN and 5 KN accessory load cells;
- Thanks to the computer connection of our universal testing machines, all tests are supported by computer control and test results can be analyzed computer aided by specialized applications and programs;
- Flexural strength can be performed at room temperature or in 90 °C oil before and after aging. This provides us possibility of survey and compare the heat treatment of our materials and the sustainability of them in the aged condition;
- Using 25 J charpy impact testing machine, the impact strength of various kind of composits or plastics can be measured.



Electrical tests:

In the **High Voltage Test Field** of PEI these tests can be performed acc. to relevant material standards and mentioned IECs in air and in oil:

- Electric strength- power frequencies: **IEC 60243-1, ASTM**
- Electric strength -1.2/50 µs impulse test: **IEC 60243-3**
- Partial discharge inception voltage : **IEC 60270**
- Insulation resistance: **IEC 60**

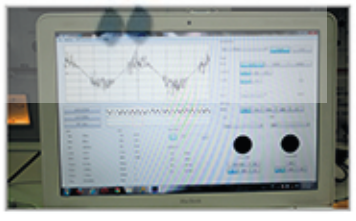
Conditioning of specimens:

For tests in oil specimens are dried in a vacuum oven with the temperature of 105 °C and 1 mbar final pressure, and then impregnated with 90 °C preheated oil under a pressure of not more than 2.5 mbar.

For tests in air, specimens are dried in ventilated or air forced ovens for standard specified time durations.

PEI high voltage test field is equipped with:

- ✔ Cascade test transformer– 200 kV , 50 mA HV measuring divider – 200 kV , 170 MΩ
- ✔ Breakdown test vessel for testing in oil/ heated oil/ air
- ✔ Dielectric strength tester – 15 kV , 40 mA
- ✔ Impulse generator (1.2/50) µs , 400 kV
- ✔ Digital MΩ Hi tester – 1000 Vdc , 4000 MΩ
- ✔ All types of electrodes acc. to or beyond IEC standards
- ✔ Vacuum oven- up to 200 °C and 1 mbar
- ✔ Partial discharge test setup



Radiography test:

100% of hand moulded insulating systems esp. high voltage outlet systems, are exposed to X-ray and checked to be free from metal particles, voids and any impurity.

- The smallest detectable heterogeneity
- Create image excellent with high resolution
- Dimensional control in inaccessible points
- Storage of images in a data base
- ability to recall the recorded images at any time

R & D

Research and development has always been PEI's precedence. We think to new solutions, to new products, to new production processes and develop our infrastructures to implement our plans.
As main infrastructural development, in 2010 PEI launched a project to expand the area and renew, replace, upgrade the machines and production line equipments in a new site of 10,000 m2 including the workshops, stores, laboratory and administration buildings.

Benefitting from experienced staff we try to always be in tune with the state-of-the-art technology. We response to the extra-standard requirements of our customers, profiting our high-tech reference laboratory. Innovation is PEI's life blood.

PEI's VISION

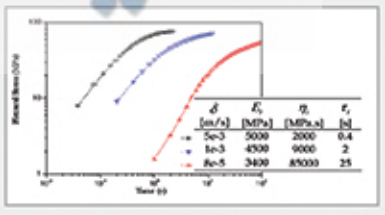
Is to be among five superior manufacturers of transformer solid insulating material.

PEI's MISSION

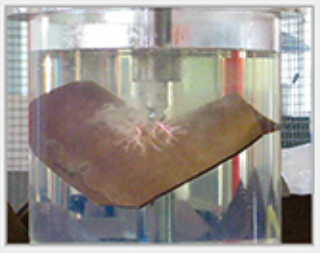
Is improving competitiveness characters to posses the regional and international markets.

Some Research:

- Introducing Pressboard as a **viscoelastic** material in the international polymer engineering societies.
- Semi-analytical study of forming wet pressboard under hot-moulding.
- Analysis of forming cellulose pulp through dewatering under vacuum.
- Introducing the material constants of the pressboard in its various forming processes.
- Study of the spring-back of cellulosic angle rings.



- Investigating the effect of the additive glue contaminations in the electrical behavior of the cellulosic shaped insulating parts.



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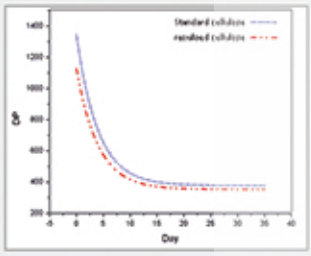
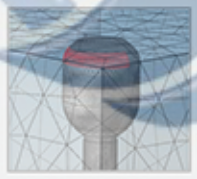
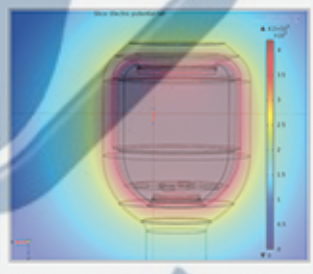
- Life time estimation of the cellulosic formed insulating parts produced by hand-moulding method through measuring the DP of cellulose and the 2-furfural of oil.



- Electrical field analysis of 400 kV high voltage outlet system of power transformers and its customization.





Other Projects:

- Study the effect of surrounding medium parameters such as moisture and temperature on the partial discharge behavior of the oil/paper insulating system.
- Study of the flexural behavior of two types of laminated pressboard in 90 °C oil.
- Study of the electrical creepage behavior of the pressboard.
- Study of the effect of the machine and cross-machine directions on the electrical creepage behavior of the pressboard.
- Study of the electrical creepage behavior of the laminated compressed wood.
- Study of the effect of the voltage rise rate on the results of the electric strength of the pressboard.
- Study of the methods of detecting foreign particles in the cellulosic molded insulating parts
- Design and manufacturing of the High Voltage Outlets (230-400) kV.

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