INSULATION COMPONENTS

High density precompressed Figeholm Elboard®
Board, laminates and components
ABB Figeholm, founded in 1931 and acquired by ABB in 1973, is specialized in producing insulation materials for power transformers with the trademark Figeholm Elboard®. Figeholm Elboard® is a cellulose based insulation material, more commonly known as pressboard. The Figeholm Elboard® is produced on a paper mill machine with cellulose pulp as commodity in a process similar to paper and cardboard production. The difference for the pressboard is the final process step, in which the wet board is pressed and dried in a special designed hot-press. The excellent characteristics of the Figeholm Elboard® in the transformer insulation application are obtained by our state of the art production process. Our special pulp recipe, the even distribution of cellulose fibers in our pressboard and the final pressing step ensures that the Figeholm Elboard® has practically equal mechanical properties in all directions, as well as an outstanding manufacturability for our customers’ further processing.
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Environment
FSC® quality

Figeholm Elboard® is produced by locally grown premium cellulose from slow growing pine and spruce wood. The Scandinavian wood gives long and strong fibres. Mechanical strength comes from the strong fibres themselves and from adhesion between them. There is no filler material and no bonding agents are added. By choosing local suppliers, we also achieve short transports.

Our goal is to minimize our impact on the environment as much as possible. Therefore, we use FSC-certified raw material in our production. We maintain full control over the process from fibre to finished components. Our production process are purified to well below Environmental Authority approved maxima. FSC-certified suppliers, combined with our environmentally adapted production facility gives us a unique position among board suppliers.
FSC® certification provides a credible link between responsible production and consumption of forest products, enabling consumers and businesses to make purchasing decisions that benefit people and the environment as well as providing ongoing business value. The Forest Stewardship Council A.C. is an independent organisation that has been working more than 20 years with responsible forest production and environmental awareness. The FSC®’s rules safeguards endangered animals and plants, the grounds future ability to carry forest, safe and sound working conditions and maintaining the indigenous rights.

Source: www.fsc.org/about-fsc.html
Supply Chain
A well-controlled process

The best combination of electrical and mechanical strength is obtained with unbleached sulphate pulp made from pine and spruce grown in Scandinavian forests. Figeholm deals with a few selected mills known for their ability to produce raw material of stable quality and very low electrolytic impurity content. Figeholm Elboard® is made from pure cellulose fibres only. There is no filler material and no bonding agents are added. Mechanical strength comes from the fibres themselves and from the adhesion between them. The pulp is dispersed in clean water and refined to suitable fibre length, composition and bonding ability. A thin web of fibres is taken up from the diluted suspension in specifically designed formers, on to the wire mesh of a forming roll. From the roll the web is transferred to an endless felt. The wet webs are wound in many layers onto a large collecting cylinder. When the required thickness is achieved a knife blade is used to remove the thick web and a larger sheet is created. Then drying is performed under compression at an elevated temperature in a hydraulic day-light press. Before cut to our standard sizes and packed in to sea worthy packages, all Figeholm Elboard® HD passing through our highly modern X-ray equipment ray and carefully inspected by the human eye on both sides.
Fiber directions
Modern short formers are installed to adjust formation and strength properties in different directions. The fiber layers are picked up underneath an endless felt.

Process Control
The whole process from pulp to finished product are monitored by advanced computerized control system.
Pre-compressed High Density Board
Figeholm Elboard® HD

Figeholm Elboard is developed for applications where maximum rigidity and tensile or flexural strength is required. Its excellent electrical properties make it the right choice in High and Ultra High voltage applications. Figeholm Elboard has the outstanding mechanical properties required to provide the appropriate level of protection in the event of short-circuiting. This in combination with excellent oil-impregnability intensifies the electro-mechanical properties and makes it an insulation material in World Class hard to find elsewhere.

Figeholm Elboard HD is the right material e.g. for spacers in windings, subjected to compression by electromagnetic forces from through-fault over-current. Figeholm Elboard has superior ageing properties and dimensional stability. This makes it the perfect choice for all types of cylinders, barrier systems and strips in large power transformers.

Pre-compressed HD is manufactured according to IEC standards. It is a Class A 105°C material and can be provided in thicknesses 1-8 mm.

A pure board
The basis for a reliable board production process is the choice of raw material. A long term cooperation with only a few carefully selected and well maintained mills with the latest pulp technology enable Figeholm Elboard to be a top quality supplier. High tech control systems enable operators to produce the pulp according to Figeholm high demands and specifications. Even though all production people involved in the pulp manufacturing are well aware of Figeholm Elboards high demands and importance of a metal free pulp and measure are taken to prevent any metal to enter the production. There is a need for metal removing equipment to assure that the board is free of contamination. In Figeholm this is assured by mechanical and magnetic traps in the process, we also have a centrifugal cleaning plant and machine screens. Each manufactured sheet of Elboard are passing through our X-ray and carefully inspected by the human eye on both sides.

A well controlled process
The efforts in time and money invested in Figeholms production process secures predictable board properties beyond international standards. The high level of technology also makes it possible to tailor make board for specific applications in transformers. Operators are well trained and are undergoing a certification programme. Their competence is maintained by an ongoing training, for example as in practical handling of developments of the board machine as well as basic training in the properties of cellulose fibres. Production shift teams are also a driving force in continuous improvement process. Working tools to secure and monitor a stable process is an advanced computerized control system and an extensive process information system. In-line sensors like fiber consistency, beating degree and laser measurement of sheet thickness gives a support to monitor the process. The capacity expansion project 2009 included amongst others a new 25 sheet daylight press. Now Figeholm have the highest production capacity of pressboard in one single production line.
02 Manufacturability
The pressboard are produced under a high level of cleanliness and has the perfect combination of mechanical/dielectric properties and thermal stability.

03 The pulp
Pressboard and insulation papers are produced from pure unbleached cellulose taken from long-fibred coniferous wood. High chemical purity is a key requirement.

04 Automation
When the wet thickness reaches the correct value, a knife cut off before the wet sheet leaves the making roll and are hanged in vertical before the hot press. The whole process is 100% automated.
Laminated High Density Board

Figeholm Elboard® HDLP / HDLC

When thicknesses of more than 8 mm are required, blocks are laminated together from several sheets of pre-compressed Figeholm Elboard®. Laminated blocks supplant natural wood and cross-laminated wood where enhanced dimensional stability, resistance against compression and superior electrical insulation properties are required. Figeholm Elboard® offer laminated blocks of two different qualities: HDLP and HDLC.

Figeholm Elboard® HDLP is built up by a special recipe of the Figeholm Elboard® HD and laminated with polyester resin in a dry process. Figeholm Elboard® HDLP is preferable to use where the highest material stresses occur due to that HDLP has superior flexural and mechanical strength in all fibre directions. Water diffusion and oil impregnation across the lamination is virtually impossible in this quality. Processing of large blocks of HDLP may therefore be facilitated by drilling diffusion holes through the material. Figeholm Elboard® HDLP can be produced and processed up to a maximum size of 4,100x3,100mm with a maximum thickness of 200mm.

Figeholm Elboard® HDLC is built up by a special recipe of the Figeholm Elboard® HD and laminated with a special developed Casein glue (water based). Of the two qualities HDLC has somewhat lower mechanical strength. The original moisture content are higher compared to HDLP when delivered. Diffusion of moisture and oil impregnation across the lamination is possible, making the final process easier. Figeholm Elboard® HDLC is preferable to use where the highest electrical stresses occur in the transformer, since the casein glue possesses dielectric properties similar to transformer oil thus evening out the electric fields. Figeholm Elboard® HDLC can be produced and processed up to a maximum size of 4,100x3,100mm and a maximum thickness of 200mm.

Figeholm Elboard® HDLP is preferable to use where the highest material stresses occur due to that HDLP has superior flexural and mechanical strength in all fibre directions.
Figeholm Elboard® HDLC offers the best dielectric properties and is preferable to use where the highest electrical stresses occur in the transformer. The casein glue possesses dielectric properties similar to transformer oil, thus evening out the electric fields.

L-Beams HDLC laminate can also be made in beams with the shape of an L, this simplifies the construction of the fittings for clampings (Cleats and Leads). The L-beams can be made up to a length of 4000mm and thickness range of 6-20mm.
Components
Insulation kits

From ABB Figeholm as well as our kit-centers we can offer kits, components and products which covers the entire range of insulation requirements in a transformer.

Our product range includes everything from Winding kits and Active Part kits to loose Components all made of Figeholm Elboard®. With the latest technology in hardware, software and machinery together with our highly skilled and experienced operators we can offer the most complex configurations. Our CNC machines are fully dimensioned to achieve maximum material utilization and tolerances. Advanced Press rings and machined components made from Figeholm Elboard® are used in Transformers from small power up to UHVDC transformers. Components and Kits are made to order, and together with our engineers we always strive to meet the leading edge of production technology and quality. There is no doubt that our Kits and Components made of Figeholm Elboard® go beyond international standard in this respect.

Advanced Press rings and machined components made from Figeholm Elboard® are used in Transformers from small power up to UHVDC transformers.
02 Tooling
Our tools for milling are developed together with our suppliers to have the perfect shape and combination of minerals for best possible performance.

03 Cleats and Leads
We can offer a variety of fittings according to customer demands and design suitable for supporting and securing the systems of leads running between the windings and the tap-changers and bushings.

04 Quality equipment’s
Equipment’s, software and hardware, are under constant improvements to meet the future needs and to perform the best quality possible.
Local presence
Insulation Business World Wide

The world’s perspective is becoming increasingly global. With the use of telephone, internet and fast transportation we reach each other quickly, distances are decreasing. Meanwhile the pace is increasing and within the industry forward planning times are becoming shorter. Flexibility and short lead times are expected standard of today. Figeholm Elboard is a quality product that is used worldwide within the transformer industry. Our ambition is to get as close to our customers as we can. We are continually expanding our service and local presence by establishing cooperation with agents and partners to extend our network of converters and distributors.

Some transformer production continues to be carried out in Europe, but new plants are being built locally in developing countries where there is a great need for electrical power. As a consequence, transformer suppliers have often located their factories in the same region, in a cluster-like fashion. For this reason, we have been positioning our organisation close to these production clusters.

Operational Excellence
Our operation’s knowledge base is constantly being faced with new challenges. Skill and experience are continually evolving and the relationship we have with our customers is an iterative process. The knowledge and experience being developed locally is anchored within the central organisation and exchanged between our operational units. That is how we are driving development of the industry’s knowledge.