

Thermohall

SECURE SAFE FAST FLEXIBLE ECONOMICAL ECO-FRIENDLY
The most innovative insulated membrane structures in the world



The Norwegian Armed Forces are major Thermohall customers, both in Norway and on foreign assignments



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HILDING POLSKA

Hilding Polska is a subsidiary of Hilding Anders, which is one of the five largest mattress manufacturers in the world. Hilding Polska is located in Poland and in early 2001 demand for Hilding's products increased considerably.

The existing area of their permanent buildings was soon shown to be too small and at the start of 2002 planning commenced on what had to be a rapid expansion. The alternatives were a conventional extension of the existing building or the Thermohall from Rubb.

Rubb's Thermohall was a natural choice, offering the fastest building method, financial advantages and, not least, because we had a fully developed financing concept designed for industrial customers. That enabled an immediate start to be made.

This solution involved a certain amount of risk in dealing with the Polish building authorities, since this kind of solution was unknown and untried in Eastern Europe. Thanks to our technical documentation, the approval procedure could be carried through effectively. Investors and management at the Polish factory were well satisfied with their choice of solution.

That we were also chosen as a partner in a low cost country like Poland shows just how cost effective this building method is.

REFERENCES



UMOE MANDAL

Umoe Mandal was awarded the contract for refitting and maintaining the Norwegian frigates.

This assignment demanded a great deal of space and was also a job that had to be done in parallel with other ongoing projects. It was planned for surface treatment and finishing to be performed in the open air, with a covering based on temporary tent structures.

This was an inexpensive alternative, but the method had obvious disadvantages regarding implementation and quality.

Rubb made a presentation to UMOE based on their strict requirements for functionality. These included lifting devices, remote controlled roof hatches of 40 square metres each for dismantling rigging on the frigates, building insulation and a 20 metre wall height.

The building was hired for the first year, but a purchase option was soon taken up by the management in Mandal when they discovered how functional the Thermohall is.



BORG HAVN IN FREDRIKSTAD

In 2004, Borg Havn began the procurement procedure for the purchase of new permanent warehousing at the port. They carried out a survey, so as to be sure of choosing the right solution to cover present and future warehouse hotel needs for the region.

The site at Borg Havn was an old landfill, which meant that foundation work would be an important planning consideration. Piling and heavyweight foundation solutions were soon found to be unreasonably expensive. Our project department soon came up with the idea of building a Thermohall using concrete paving and a floating foundation as a flooring solution.

This made it possible to reduce building costs considerably, since this type of building permits a certain amount of settling, to which the Thermohall, with its adjustable base plates, is uniquely suited.

Another advantage of the Thermohall is that maintenance costs were substantially lower, since the tensile fabric structure is flexible and can tolerate external stresses without being damaged. The investment costs of a Thermohall were also lower than for other types of building. That made the choice very easy, and the warehouse has proved to work very well.



REFERENCES

KONGSBERG – AN ADVANCED TECHNOLOGY CORPORATION

Kongsberg is an international, knowledge-based corporation with more than 5200 employees in some 25 countries. Kongsberg supplies high-technology systems and solutions to customers engaged in the oil and gas industry, the merchant marine, and the defence and aerospace industries.

REFERENCES



“The result perfectly matches our need for permanent solutions and short build times”



An industrial area developing rapidly and with a need for rapid solutions.

Industry in Kongsberg was in a period of rapid expansion at the beginning of 2000. The buildings at Kongsberg Næringspark had not been designed for the storage of sensitive products needing stable temperatures and were in any case poorly suited to meet industrial needs.

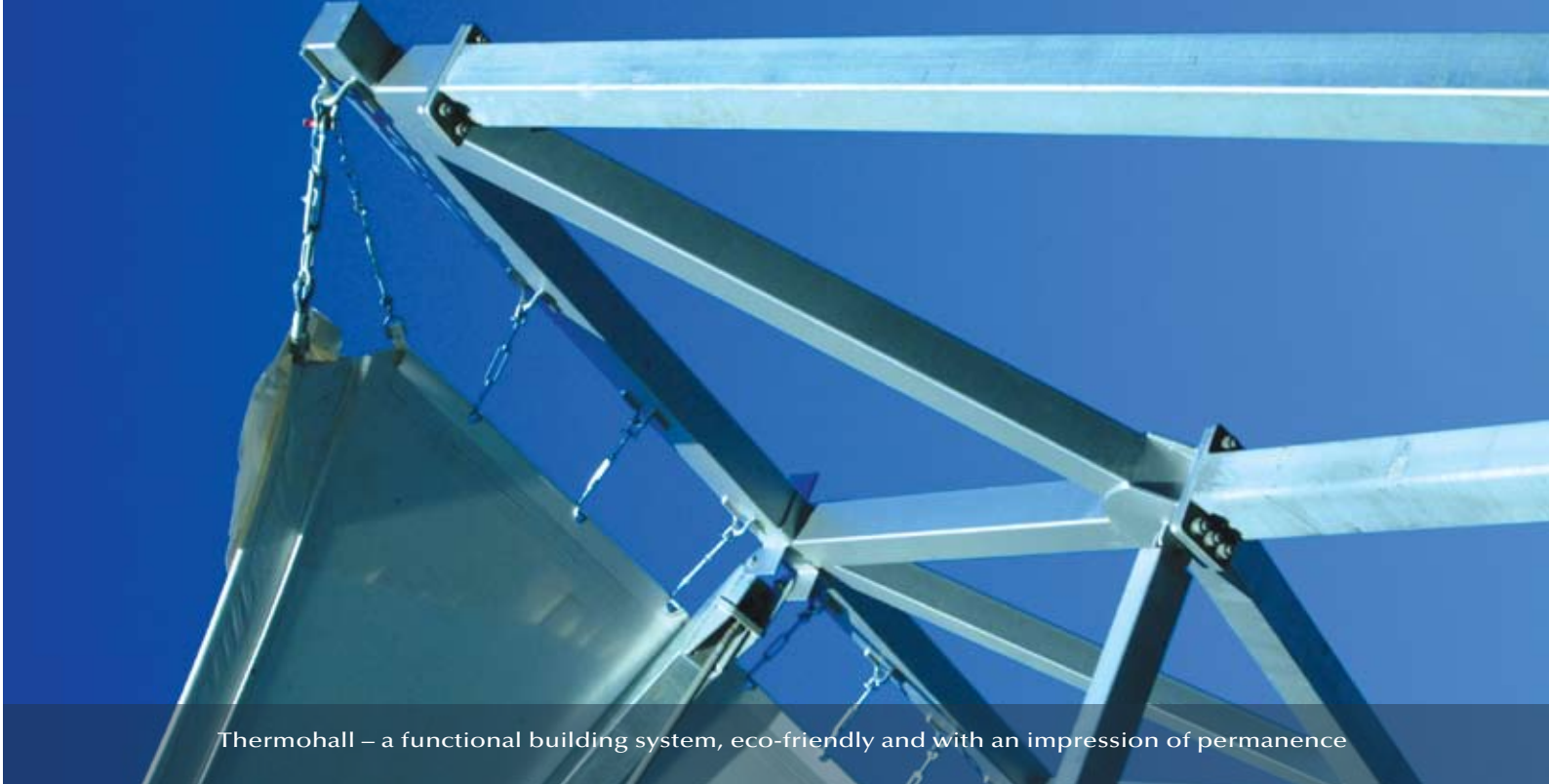
To cover these urgent needs, Kongsberg Næringspark began searching the market for building solutions that were heated, ventilated, light, with a minimum 20 metre span without columns and with lock and alarm systems.

Building time could not be more than 3 months, since the

products couldn't be kept outdoors. Uncertainty as for how long there would be a demand for this solution, required that the structure be hired to begin with and moveable when the next stage of building was commenced.

A pilot project was commenced with a Thermohall of 1,000 square metres. Experience from this project was so positive that over the next three years 14 halls were built. Some of these will be in use for several years, while others were intended to have a shorter lifetime.

Users and management at Kongsberg have found Thermohall to be a very satisfactory solution, both as a conventional building and a temporary one.



Thermohall – a functional building system, eco-friendly and with an impression of permanence

We live in a rapidly changing world. Environmental choices will decide our future. This is reflected in the building industry and our focus on flexible structures.

We have therefore developed a completely new insulation system for our halls.

Development of the Thermohall started several years ago, with the goal of a new and eco-friendly insulation system. Thermohall is now fully developed and patented, with a number of improvements, not least its unique insulation system which opens up for completely new applications. In addition, our building system offers great energy and environmental savings. Naturally our insulation is based on the strongest polyvinyl chloride fabric on the market. In relation to its volume and weight, this fabric is the world's strongest building material. The materials are fully recyclable.

Market reaction to our new membrane construction has been extremely positive and we have already supplied many Thermohalls to locations exposed to extreme weather, such as Hydro Statoil at Snøhvit and Aker Stord at Aukra.

In recent years the Thermohall has also been used for sports, storage and production buildings, totaling about 150,000 square metres.

The Thermohall should not be compared with traditional tensile fabric halls that are insulated using a double thickness of fabric. Experience shows that the air between the

two layers is never still, so that the insulating effect is very poor. There is also a build up of condensation between the layers that can cause water to run out across the floor of the hall.

How the membrane fabric for Thermohall is made

The membrane structure of the Thermohall consists of an insulated fabric, using an outer layer of 1,000 gsm made of a polyester thread coated with PVC and with a self-cleaning film of varnish to protect the PVC fabric. Then soft PVC fabric cassettes are welded onto the back of the outer fabric. The 650 gsm inner fabric is white and has the same self-cleaning film of varnish on the inside. This makes the fabric a good reflector of light.

The membrane structure of the Thermohall is filled with glass wool insulation mats and completely resealed to prevent moisture from entering.

Thermohall's membrane structure offers high structural integrity and is highly resistant to stretching and tearing. Even in extreme weather conditions there is little or no movement in the fabric and so it will not deform.

Thermohall's membrane structure is mechanically fastened to the outside of the galvanised support structure to maximise valuable interior space in the hall.

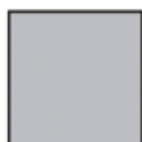
Thermohall's membrane structure offers very good insulation efficiency without the cold bridges that may lead to heat loss in corners and fastenings.

Thermohall's membrane structure is unique and achieves a

Thermohalls are supplied in a wide range of colours. By designing your hall in colours you can match its environment.



001 White
RAL-1013



991 Light Grey
RAL-7047



965 Medium Grey
RAL-7004



980 Dark Grey
RAL-7005



050 Silver
RAL-9006



800 Black
RAL-9005



442 Green
RAL-6001



664 Blue
RAL-5002



116 Red
RAL-3005



The best way to insulate is to use insulation

u-value of approx. 0.38 in type U10 and approx 0.72 in type U5. Compare this with the old double fabric principle that has a theoretical u-value of about 2.7.

Thermohall's membrane structure gives enormous energy and environmental savings.

The u-value, or heat transmission coefficient, is a measurement that is used to state the heat insulation property of a building section. The u-value is measured in W/m^2K and states the amount of heat per unit of time that passes through a square metre of the structure with a temperature difference of one degree between the two sides of the structure.

Heat/insulation

Our Thermohall is supplied with a free span in all sizes and with two insulation types, U5 and U10. We also offer various heat sources, such as oil or gas fired hot air systems, radiant heating, heat pumps, electric fan heaters and with optional air mixer in the roof to distribute heat in the building.

Damp

Thermohall has outstanding drainage properties, is water repellent and absorbs neither damp nor odour. All our Thermohalls are safe against damp intrusion. Naturally we supply our Thermohalls with simple or advanced ventilation systems that provide a good and economical interior climate. All heated halls have an overpressure that pushes the damp air out. It is a property of all our Thermohalls that all membranes from inner to outer fabric are completely watertight and will not allow any damp to penetrate the insulation.

Fire/sound insulation

Technical regulations and guidelines lay down requirements for both sound and fire insulation. Our patented insulating fabric absorbs sound and has excellent noise reducing properties, which are much appreciated those of our customers who are located in industrial areas or near roads or airports.

In addition to the fabric's unique strength, it is long lasting, requires little (if any) maintenance and achieves

fire classification B-S3-D0 in the Euroclass system – we can deliver B-S2-D0 on request.

This is a test method for membranes that is required throughout the EU and is carried out in Norway by SINTEF NBL, Norwegian Fire Research Laboratory. The tests (NS-EN 11925-2 and NS-EN 13823) cover fire properties, formation of droplets on burning and smoke production.

The test results showed normal smoke development, no generation of droplets or particles and that the fabric is not able to burn unless in contact with an external source of fire. These are the fabrics we use in our patented sandwich fabric.

Security and guarantees

The hall has minimal maintenance costs and in the event of any damage to the fabric it can be repaired without any great cost. We can also offer optimum service concepts. By signing a Service and Maintenance Agreement with insurance you will receive: up to 15 years guarantee on the hall, reduced loss of value on the hall, technical maintenance and 24 hour follow up.

Environment

Our patented insulating fabric is part of a natural cycle. The insulation consists mainly of glass, which is an excellent material for recycling. It can be melted time and time again without loss of quality. Join this positive cycle and be environmentally aware with Thermohall. This is environmental protection in practice.

For the sake of the future we must preserve energy and cause less pollution. Good, correctly chosen insulation can combine personal interests and advantages such as reduced heating costs and a stable year round inside temperature.

The requirements of the authorities

We developed the Thermohall on the basis of the requirements laid down in the Planning and Building Act. All the halls are supplied with column-free spans. The halls are designed for wind and snow loads in accordance with Norwegian Standard 3491.



From needle and thread to one of the 50 most innovative buildings of this century

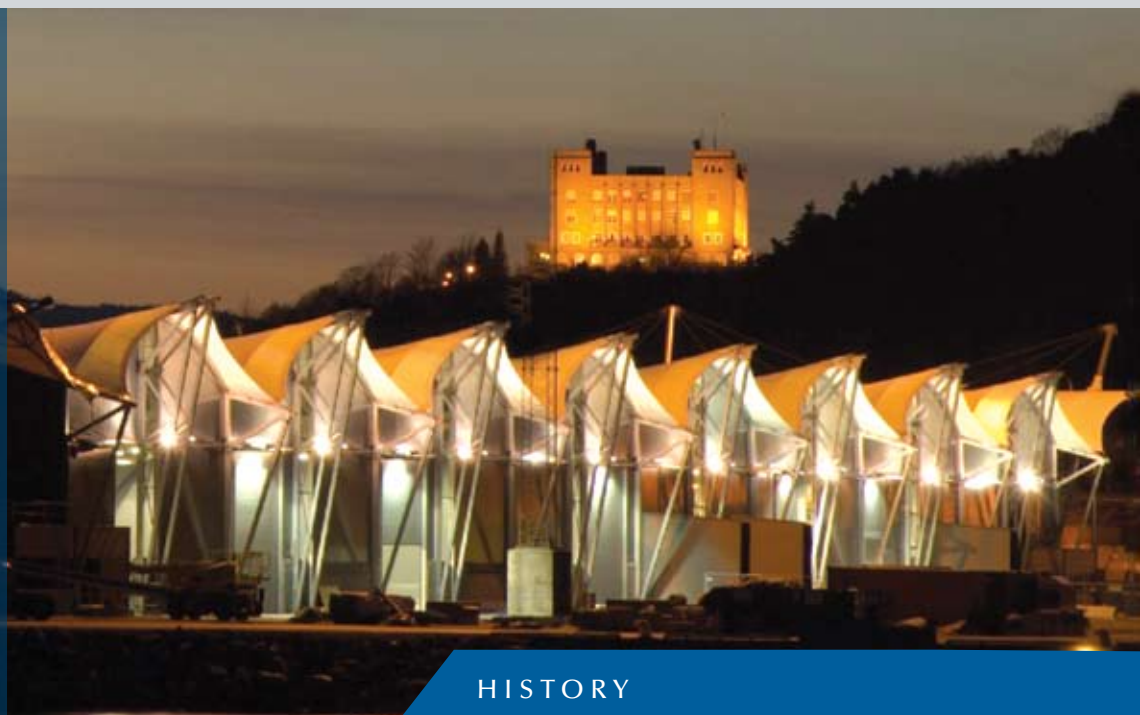
FROM SADDLE MAKER TO RUBB BUILDINGS – OUR 100 YEAR TRADITION IS YOUR SECURITY

From those modest beginnings with needle and thread in Kristiania, we have developed into one of Scandinavia's leading companies in tailoring customer solutions. Today Rubb is a modern company, focusing on development, construction and delivery of temporary and permanent building solutions. We are the first to use the latest in

modern technology. But we have managed to retain our good, "old fashioned" craftsmanship and pride in our work. With us, you get not only the product you are looking for, but a complete solution that will serve you well for many years to come. The Rubb Group consists 7 companies, manufacturing in 5 countries.

Pictured below is Oslo Port Authority's new cold storage building at Kneppeskjær pier. The building was announced as a turnkey contract in which combining architecture with function was an important criterion. Together with the architect Ninni Gøranson of Niels Torp Arkitekter AS, we devised the project with which we entered the bidding. We were not the cheapest, but because of the blend of quality and aesthetics, we were chosen as turnkey contractor. The building contains about 8,000 square metres of cold storage and about 1,000 square metres of offices. We were able to break ground on 15 November and after extensive foundation, pipe and concrete work we started steel work on 10 January and handed over the storage area on 20 February, with the entire project including offices completed by 1 May.

"An expert jury has selected 50 of the most innovative and/or most successful buildings of the new century from a purely architectural perspective. The warehouse at Kneppeskjær pier was one of them. The building is therefore included in an exhibition at the national museum of art, architecture and design."



HISTORY

Oslo School of Architecture has chosen to include this project as an example as part of a 2 year bachelor degree course