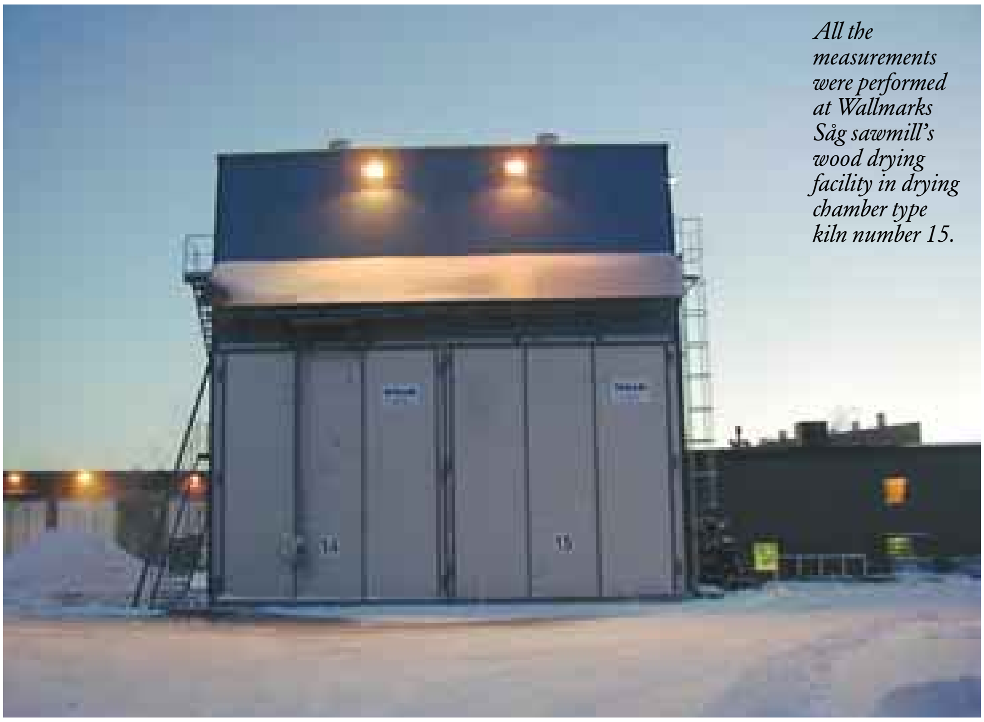
Ritva Siikamäki, MA
Editor-in-Chief
Vaisala Helsinki
Finland



All the measurements were performed at Wallmarks Såg sawmill's wood drying facility in drying chamber type kiln number 15.

Performance of HMP247 proven in

Humidity Measurement Test in Wood Dryer Chamber

The Swedish Institute for Wood Technology Research, Trätek, performed a comparison test on measurements in a wood drying kiln, pitting a Vaisala HUMICAP® Dewpoint Transmitter HMP247 against a psychrometer. The measurements were carried out during the normal drying process at a sawmill, studying several sources of error. The test showed that the HMP247 is well suited to this demanding application and operating environment. The reliable and accurate HMP247 provides ease of measurement in combination with a quick response time and long-term stability. The sensor probe's heating prevents problems with condensation in rapid temperature changes, which is essential in a condensing environment, like a wood drying kiln.

The test was performed on assignment from the Vaisala Malmö office to compare the properties of an electronic combined temperature and dewpoint meter with a psychrometer. The wood drying kilns constitute a demanding measurement environment in which accurate monitoring and control of humidity and temperature are crucial for optimal drying results and high-quality products. The psychrometer or wet and dry bulb thermometer is a conventional measurement instrument at wood drying facilities.

Test setup

The Swedish Institute for Wood Technology Research, Trätek, performed the comparison test. It is an expert body in the field, functioning as a collective research and development resource for the Swedish timber and wood manufacturing industries. The test was carried out in a chamber type of wood drying kiln at Wallmarks Såg sawmill in Sweden, which represents a more demanding environment than a continuous kiln. Three HMP247 units were tested and compared to measurements carried out with a psychrometer of Trätek's design with a very thin Pt-100 sensor manufactured by Pentronic (diameter 2.2 mm) and one with WSAB's standard Pt-100 sensors (diameter 8 mm). All the instruments were mounted in rust-free ducts in the measurement drum located on the loft of the compartment. The instruments were calibrated before the test period both for temperature and humidity measurements.

The test consisted of continuous temperature and relative humidity measurement in the wood dryer for 15 months. For details on test conditions, ➤

Placement of the sensors in the measurement drum's lock. Three Vaisala humidity probes, a Pentronic psychrometer and a WSAB psychrometer. The HMP247 Transmitters were installed in metal housing.

The measurement drum was located in the loft of the wood dryer compartment.

The lead-in holes of the sensors were insulated.

The wet bulb thermometer on the left is connected to the control system of the dryer and the one on the right is a psychrometer with a wet cloth.

Table 1. Environmental conditions during the test period, March 3, 2001 – July 9, 2002.

Dry bulb or actual temperature	+10 – +85 °C
Wet bulb temperature	+10 – +70 °C
Relative humidity	20 – 90 % RH
Ambient temperature, loft	-10 – +50°C
Air flow in measurement drum	3 – 6 m/s

please refer to table 1. The long-term stability of the instruments was monitored, and the response times and stability were compared. Additionally, the calibration procedure and maintenance requirements of the sensors were studied and compared. The comparison also covered system calibration and adjustment of humidity sensors.

During the test period spruce and pinewood were dried to 14% and 8% moisture quotient respectively. Some 40 batches of wood were dried during the test period. The measurement data was logged at 60-second intervals during the test. With response time tests, the interval was shortened to 10 seconds. Additionally, tests with a 1-second interval were also made, but were found to give only marginal differences. The control system of the drying chamber uses a 6-minute logging interval for the trend. During the drying phase, a fan reversing interval of 1 h was used, and during heating up and conditioning a 20-minute interval was used. With the measurement probes mounted in a separate cylinder outside the kiln compartment, the resin residue on the probes remained smaller than if mounted in the compartment itself. In the test configuration the regaining functionality of the HMP247, designed to minimize the effect of contaminants, was not activated.

Conclusions

In contrast to the psychrometer, which was difficult to place in an optimal location for taking measurements, the HMP247 could be easily placed in an optimal measurement position in the kiln. The probe design was found to be excellent for this installation, with no loss of measurement data due to the lead-in protective tube. Additionally, the use of the HMP247 was easy, and the sensor did not require cleaning during the test, while the psychrometer requires regular maintenance. The wet sock must be changed before every drying run to avoid the effect of contaminants. Since the psychrometer requires a water bath, the risk of freezing must be taken into account at facilities operating in cold climates. With the HMP247, no water supply was needed and there is no wet sock to be changed, which translates into ease of use. While the correct operation of the psychrometer requires adequate airflow (min. 2 m/s by the probe), this is not needed by the HMP247. The sensor probe's heating prevents problems with condensation in rapid temperature changes, which is essential in a condensing environment, like a wood drying kiln. This was clearly proven in the test and highlighted in the test results.

The wide operating temperature of the HMP247 (-40 – 180°C) is an asset in the wood drying application in which high-temperature kilns are increasing. During the test, the kiln temperature rose to 85°C at the most, well within the instrument's range. The fast response time of the HMP247 was clearly proven in the test and was stressed in the test report's conclusions as one of the benefits of the instrument.

As the temperature sensor of the HMP247 transmitter is separate, it can be easily controlled and calibrated. The display allows parameters to be easily checked without access to a control computer. The HMP247 has several output interfaces, including serial and analogue output options, which can be easily selected during operation. The HMP247 offers good long-term stability. Should a slight drift occur with the HMP247 in a wood drying kiln, no damage will be caused to the wood since the dryer atmosphere will be too humid rather than too dry. A corresponding situation with a psychrometer with a dried-up cloth would cause the wood to crack, as the atmosphere in the dryer would lose too much humidity. The HMP247 can be calibrated on-site using a separate calibration kit. The ease of use and stability provided by the Vaisala Dewpoint Transmitter HMP247 are of paramount importance at sawmills that often do not have specialized maintenance staff. ●

References:

Report by Trätek Nr. 2702/2002-08-29, Per-Anders Fjellström
Atmosphere measurements in a wood drying kiln with dewpoint transmitter and psychrometer (in Swedish), Trätek, Institutet för Träteknisk forskning, Sweden.

Accurate measurements essential in wood drying

A well-managed wood drying process is an essential part of sawn timber production. A multitude of drying methods are used, including continuous kilns and compartment kilns as well as drying framing. In a continuous kiln, also known as a channel kiln, several batches of wood move through the kiln. The temperature is lower and the RH higher at the green end than at the dry end or discharge end. A compartment or a batch kiln/chamber kiln operates with the entire batch of wood dried as a single unit, and has a uniform temperature and humidity throughout the kiln at a given time.

Wood type, drying quality and capacity are among the main factors determining the selection of kiln type. Currently channel kilns and high-temperature kilns are becoming more common, because their continuous operation and higher capacity better meets the needs of the sawmill industry.

Whatever the technology employed, the process faces the requirements set by the characteristics of wood as a material. The air temperature, humidity and other conditions in the drying facility must be continuously monitored and controlled. Optimal conditions during the process are the key to not only high-quality wood products but also to reduced emissions and energy consumption. In sawmill production, the wood drying stage is important because it typically consumes the most energy.

Wood is a porous material, i.e. it is hygroscopic, absorbing moisture to reach an equilibrium with the ambient environment. The mechanical properties of wood vary with the temperature, pressure and moisture content. In most applications the moisture in the wood cells must be removed to allow further processing and to protect wood from blue stain, fungi and mold, as well as from cracks and checks. The initial moisture content of green wood, i.e. freshly sawn timber, varies from 50 to 120%, depending on the species. When used as a construction material in, for instance, a normal temperate zone climate, the timber is dried to a moisture content of 18%, while for joinery and carpentry a moisture content of 10% to 15% is ideal. ●