

ROTRONIC APPLICATION NOTE

Application note: N° F019

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Tobacco

Facts & figures:

There are over 1 billion smokers in the world.

Approximately 10 million cigarettes are purchased a minute...

5 trillion cigarettes are produced on an annual basis

Tobacco taxes are a major source of income for almost every government in the world.



Chewing tobacco

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Tobacco in general

Tobacco is a plant that grows natively in North and South America, where tobacco began growing around 6'000 B.C.. Tobacco was then cultivated as early as 1 B.C. by the American Indians.

China's tobacco market, which is the largest in the world by

far (38% of the cigarettes smoked globally), is one of the few markets served directly by domestic industry. Of the 3.5 trillion cigarettes smoked outside of China, about half are smoked by only ten countries: Russia, the USA, Japan, Indonesia, Ukraine, Turkey, India,

Tobacco plantations and manufacturing process

Tobacco is cultivated over an area extending from the tropics and subtropics to temperate latitudes such as the Mediterranean. Tobacco is a valuable crop for countries such as Cuba, India, China and the United States.

Leaf tobacco consists of the dried and fermented leaves of the tobacco plant of the nightshade (Solanaceae) family. Tobacco is an annual plant with 20 to 30 leaves growing up to 60cm in size depending on variety and environmental conditions.

The two major tobaccos sold today are Virginia tobacco (*Nicotiana tabacum* L.) and wild tobacco (*Nicotiana rustica* L.). *Nicotiana tabacum* L. is a blend of Oriental, Asian and American tobaccos.

The first step in tobacco proc-

essing is the harvesting of the tobacco leaves.

The next step is curing and fermentation which constitutes the crucial tobacco ripening processes. Curing allows for the slow oxidation and degradation of carotenoids. This allows for the agricultural product to take on properties that are usually attributed to the "smoothness" of the smoke.

When curing is concerned, a distinction is drawn between natural curing (sun or air) and artificial curing (fire or hot air). During the curing process relative humidity is very important (See the tobacco curing schedule on page 2). Sometimes after curing a further drying process is required in order to adjust the moisture content to about 10-12%.

The next step is fermentation:



Cigarettes

Brazil, Korea and Italy.

The other main manufacturing sites are the USA, Brazil, Egypt, Japan and belong to either one of the top 4 multinationals: Philip Morris International, British American Tobacco, Japan Tobacco and Imperial Tobacco.

there are also two possibilities, one being natural and the alternative being chamber fermentation.

The final stage of the production process is the aging where the content of the aromatic substances are markedly increased.

In order to have the best quality tobacco leaves for further processing, the leaves should have a moisture content between 12-16%, so an ambient relative humidity of 60 to 68% rh is required to maintain equilibrium. If lower than 60%rh, the tobacco leaves will be losing moisture, weight and quality.

Any temperatures over 25°C will affect the tobacco leaves in a bad way and will reduce the quality of the tobacco and will promote post fermentation.

Why the need to measure the relative humidity and CO₂?



Tobacco plants



Tobacco leaves drying



Tobacco ready to be put into cigarettes

Storage & transport

Tobacco is stored between all phases of processing and if the tobacco is not stored at the correct temperature and humidity, then the quality of the tobacco won't reach expectations.

If tobacco becomes heated, then it may dry out and the aromatic substances contained in it are volatilised. The tobacco acquires then a hay like, bitter, sharp flavour. It may become hard and brittle, meaning that the leaves break under the slightest mechanical stress and eventually end up as powder. During storage and transport, a temperature below 24°C is always recommended. As the moisture content of the tobacco leaves is very important (and varies between the different tobaccos) the relative

humidity level must be monitored during storage and transport.

Moisture content levels:

- Oriental tobacco: 12-14%
- Virginia tobacco: 10-13%
- Virginia & Burley: 10-12%

In order to maintain these moisture levels an equilibrium relative humidity level between 60 and 70% is required.

Tobacco leaves are highly hygroscopic, so if the relative humidity is excessive, the tobacco absorbs so much water vapour that it becomes a nutrient medium for moulds. Mould, mustiness, mildew stains and a musty odour reduce the quality of the tobacco. Depending on the mould, white, grey, green or

black spots are visible on the tobacco leaves.

In the case of excessive heat and humidity, the fermentation process may start up again. In which case the temperature in storage may rise by up to 2°C per day. It is recommended to monitor the temperature giving the possibility to stop the fermentation process if required.

Like the raise in temperature due to the fermentation process, there is also a raise in the CO₂ levels.

Monitoring the CO₂ in the storage areas and during transport will also help see if the tobacco leaves are fermenting or not. Additionally if the CO₂ concentration is too high, lives could be put at a risk.

Smoke testing chambers & tobacco sample conditioning

There are many guidelines that need to be followed whilst manufacturing tobacco products, one of them being ISO 3402:1999 - Tobacco and tobacco products: atmospheres for conditioning and testing.

Each and every cigarette manufacturer needs to ensure compliance with market regulations and most of the times, a certain relative humidity level and a certain temperature level need to be maintained.

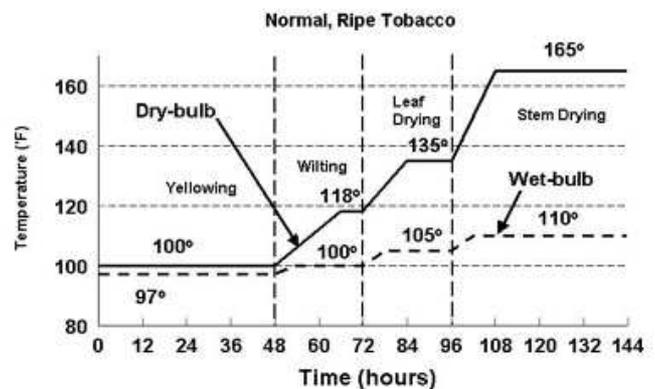
Many chamber manufactures offer a complete solution to the cigarette manufacturers: walk in chambers, reach in chambers and conditioners. These

chamber needs to have tight control in order to reply to the industry's norms. The guidelines require testing to be done at conditions that are 23.0°C and 60%rh ($\pm 2\%$ rh).

Some of the regulations involve measuring and reporting:

- Tar,
- Nicotine,
- Carbon monoxide,
- Other smoke emissions associated with tobacco-related diseases.

Tobacco curing schedule



In order to get the best quality dried tobacco, the tobacco curing schedule (in °F) must follow this trend.

What solutions can Rotronic offer?

Rotronic can offer a range of products that reply to all demands, that companies in the production process chain may have.

The range of products, from data loggers to transmitters can be found below.

With the storage and transport of tobacco, a relative humidity range of 60 to 70% rh is ideal.

With an accuracy of 0.8%rh on the top products, a sure control of atmosphere can be measured: maximising profits.



HygroLab C1

Rotronic products:

Humidity and temperature probes:

- **HC2-S**
Standard humidity sensor,
-50...100°C,
0...100%rh,
±0.8%rh and ±0.1K...
- **HC2-IM**
Chrome nickel steel Industrial probe,
-100...200°C,
0...100%rh,
±0.8%rh and ±0.1K...
- **HC2-AW**
Water activity probe,
-40...85°C,
0...1AW,
±0.008AW and ±0.1K...

Transmitters:

- **HF5 series**
For interchangeable probes,
2 or 3/4 wire configuration,
Various analogue and digital outputs,
Display,
All psychrometric calculations available...
- **CF5 series**
NDIR technology,
0...2'000 ppm
3/4 wire configuration,
Various analogue outputs,
Display...

Dataloggers:

- **HL-NT range**
For interchangeable probes
(up to 7 probes with docking station)
32MB flash card,
Display,
Conform to FDA21 CFR Part 11 and GAMP4



HF5 transmitter with a HC2-S probe

Water activity:

- **HygroLab C1**
4 probe inputs,
Display,
AW Quick function,
Storage options...



HL-NT data logger

Customer benefits:

Accuracy:

Choosing Rotronic gives you the best accuracy on the market.

Precise humidity measurements can be obtained: meaning that as soon as the required relative humidity level is reached, the tobacco can move onto the next process phase.

The quality of the tobacco leaves is defined partially by the moisture content of the leaves, dry leaves are brittle and can break making the

leaves unusable (especially for cigars). So as the humidity level is critical and defines the characteristics of the tobacco, then the more accurate the measurement, the better the end result!

Communication:

With all of the different communication methods, from RS-485, Wireless to Ethernet RJ45, Rotronic can provide the solution for each installation.

Long term stability:

A long term stability with a drift under 1%rh per year (depending on the environment).

Calibration and adjustment:

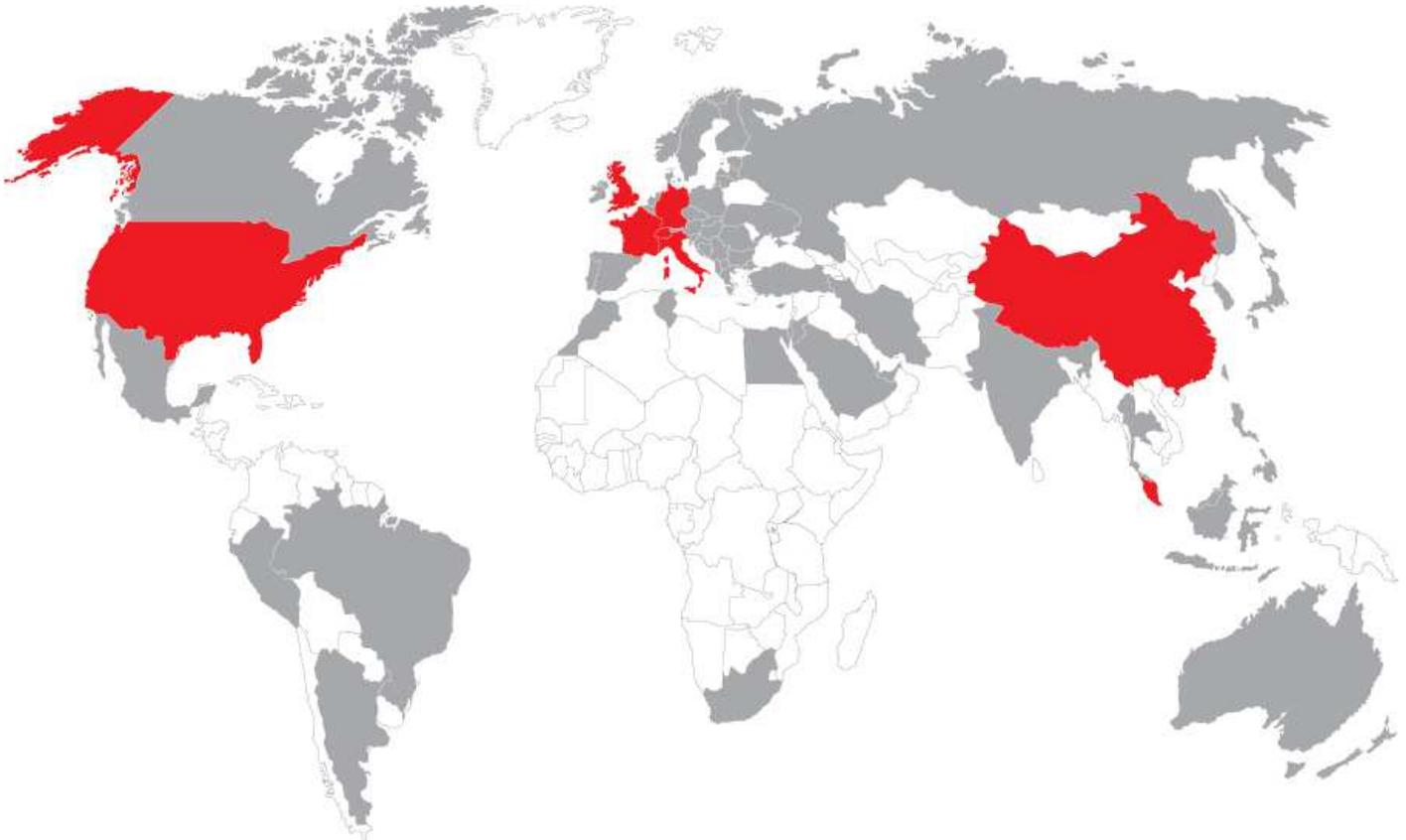
All of the Rotronic products are digital so the whole calibration procedure can be done via a PC, or directly from the device with the help of the Rotronic humidity standards. Rotronic can also offer an ISO-17025 calibration.



CF8 transmitter with alarms

Contact us:

Rotronic is represented in more than 40 countries around the world. An up to date list of all our partners is available at www.rotronic-humidity.com/international



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