ENERGY EFFICIENCY
CASE STUDY

Thermon **The Heat Tracing Specialists®**

ENERGY SAVINGS

Everywhere in the world we need to take care of the resources we are using and we try to limit the use of energy. Many governments are motivating companies to develop more reliable products that reduce wasted materials and energy consumption. For many years Thermon's mission is to enhance our customers' process operations by providing innovative and reliable solutions at the lowest total cost of ownership.

A commonly used conventional ambient sensing ON/OFF control, directly or acting through a load contactor if required, fully powers the heat training systems at all times when the ambient temperature drops below a set point of 5°C.
This way the system may typically be energized for 2000-3500 hours per year, depending on a global location. The required heat energy is actually needed below freezing point or in case of line sensing for frost protection when the maintained pipe temperature is deviating from the actual pipe temperature (say only 400-700 hours per year). As the installed load must be capable of compensating the heat losses at the minimum ambient design temperature, a significant amount of energy is wasted for most of the time.

What is the basis of a customer's decision to choose the most appropriate Frost Protection Control System?

The different ways of keeping the pipe above 5°C (frost protection) is accomplished by different (physical) devices or different control methods. Thermon performed research with the following control methods.

Test Setup			
Testing period: winter/spring 2013	Explanation Test Lines	Thermon Control Systems	Thermon Heating Cable
Test Line 1	Ambient sensing via mechanical ambient thermostat in air	ZP-Ambient	BSX 3-2-OJ
Test Line 2	Pipe sensing with a mechanical thermostat located on the pipe	ZT-C	BSX 3-2-OJ
Test Line 3	Pipe sensing with an electronic thermostat with a PT-100 sensor located on the pipe	ECM-C	BSX 3-2-OJ
Test Line 4	Ambient Proportional Control via PT-100 ambient sensor	APC TC	BSX 3-2-OJ

This test is being initiated by Thermon to investigate the performance of the various Control Systems. Our customers normally make their decision for an appropriate Control System following process and/or customer requirements based upon:

- Temperature control band (accurate switching)
- Power consumption
- Control method
- Product investment
- System maintenance costs
- Total cost of ownership

In line with these requirements Thermon performed the following 3 different measurements:

- A – Power consumption (Energy)
- B – Switch rating (Durability)
- C – Temperature process accuracy (Efficiency)

Four different types of control are mainly used in the market:

1. Controlled by a Ambient Sensing Thermostat
2. Pipe /line sensing controlled by a Mechanical Thermostat
3. Pipe /line sensing controlled by an Electronic Controller
4. Controlled by a CPU based control and monitoring system; with Ambient Proportional Control* (APC)

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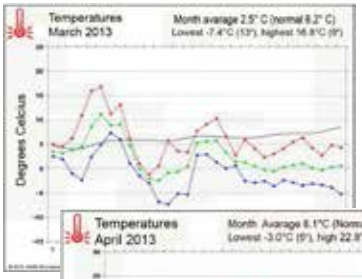
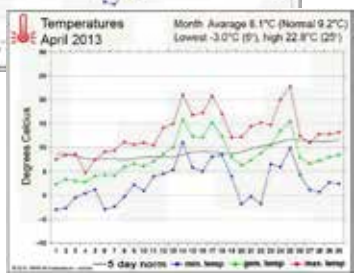
TEST SETUP PARAMETERS





Period of testing: Winter/spring 2013 - Used equipment:

1. Carbon steel 4”Sch.40-pipe, supported on both sides and closed with flanges on both sides. Installed heating cable was taken from the same reel, cut and installed in four equal lengths with one tracer per pipe. The layout of the heating cables on the pipe and placement of the sensors (either bulbs or RTD tips) are at the same position on the individual pipe according Thermon Installation methods.
2. For visualization of the heating circuit being powered, a Terminator Beacon ZE-B was installed at the end of each circuit.
3. A second cable (RSX 15-2-OJ) is installed for future (process tracing) testing.
4. The test facility is insulated using 50 mm Rockwool 810.
5. Electrical consumption meter: iME1z
6. Visual Trending software

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Conclusion

The main reason for this meaningful energy saving that has been recorded due to process flow conditions. The required heat tracing output is normally designed for the ‘worst-case’ scenario at non-flowing condition. Conventional ambient sensing thermostats apply full power at a given minimum ambient temperature and switch OFF the power at a higher set point (ambient) temperature, with no regard to the actual energy required on the pipe or heat losses through the insulation. The ECM is an electronic controller, having a Pt100 temperature sensor that monitors directly the temperature changes on the pipe surface (hence heat losses). If required, it will automatically switch and provide the required energy to match the heat losses.

Pipe sensing (ECM) rather than ambient air sensing is particularly suited in order to reduce the power consumption and applies the power to always deliver precisely the amount of heat to prevent the pipe temperature from dropping below the set point. Each process conditions might be different but this case study provides an accurate indication of the energy savings using the ECM-Controller (accurate switching in combination with line sensing). The ECM fully optimizes the systems heating requirements, resulting in significant energy savings, considerably reduced operating costs and accumulated power requirements.

The table below shows Thermon’s results of the benchmark testing with different types of thermostats. In this table the significant energy savings recorded are shown as the lowest power consumption compared to the 100% consumption of the ambient thermostat.

Energy Savings Results							
Test line	Equipment	Control band & Accuracy	Set point (°C)	Power consumption kWh	Pipe temp. Control band absolute (°C)	Pipe temp. Band width (°C)	% Power consumption (%)
3	**ECM**	**+3°C ±1°C**	**5**	**5**	**5 - 8**	**3**	**19**
4	APC-TC	APC* ±1°C	5	6	8 - 13	5	22
2	ZT-C	7% / -1 K to +7 K	5	15	13 - 19	6	56
1	ZP-Ambient	Open at >+11,7°C ± 2,8°C Closed at <+3,3°C ± 3,3°C	5	27	7 - 33	26	100

Explanation columns

Control band & Accuracy = *Theoretical values of control equipment*
Power consumption = *Total of complete test period of 40 days*
Control band absolute = *Minimum and maximum temperature the equipment did switched*
Pipe temp. band width = *Value between minimum and maximum pipe temperature*

Terminator ECM Electronic Control Module

With this conclusion in mind, our Research and Development department has optimized the new “State of the Art” Reliable and Sustainable Electronic Heat Tracing Controller” called ECM (Electronic Control Module).

The Thermon ECM Controller is contributing sustainability with accurate switching that will guarantee to limit the time the system is switched on. For this reason Thermon initialized a test to investigate the performance of the various available controls in the market for Winterization Applications. With this research we have proven our initial idea that local Electronic Control (accurate switching) will provide the lowest power consumption possible for this application. Next to the significant energy saving, the design and execution of the ECM-Controller is utilized to reduce the quantity of components needed in a heat tracing installation, as well as a reduction in heat tracing circuits by its high amperage switch rating. This will reduce maintenance cost and will provide reliable solution to control your heat tracing systems.

For more information visit us at WWW.THERMON.COM

Reliable Sustainable Multifunctional

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