PHE & TUBULAR HEAT EXCHANGER INTEGRITY TESTS

THE FACTS ABOUT THE METHODS

There are 5 known test methods used globally:

1. Hexteq — This is a method that has been developed by EIT International. The exchanger is filled with mains water on both sides of the section, one side is lightly pressurised to 3 bar from mains water, the other side emits ultrasound, detecting leakage in micro-litres, then over 5 minutes test, shows defect size from outside without dismantling.

2. Helium, This method has been tried by many companies - The exchanger is filled with pressurized helium on one side and the other side has air flowing through a gas sniffer, as the helium leaks through a defect into recipient side, the alarm detects presence of helium, unable to measure the defect size. Laboratory tests prove liquid severely limits sensitivity.

3. Conductivity, This method was developed by Testex - The exchanger is filled with water on both sides and using high pressure pump systems, one side is heated to 30 °C and conductive salts are added, the other side detects conductivity changes in presence of a leak, unable to measure defect size, salts must be filtered to avoid blockage.

4. Pressurised Dyes, The exchanger is filled with different coloured dyes on both sides, one side is pressurised and the other side has a spectrometer that detects colour changes in the event of a leak, sensitivity is reduced with larger heat exchangers, unable to measure defect size, possibility of dye contaminants remaining in the exchanger.

5. Unbalanced Pressure test, This is a method used for many years before more sensitive systems developed, a leak is assumed by pressure drops/rises, this will detect larger defects only, so not really acceptable for micro defects in the food processing industry.

HEAT EXCHANGER TESTING QUICK GUIDE TESTS	*Hexteq*	Other
GPS records assist traceability, is it used?	✓	✗
Can sensitivity be reduced by size of exchanger?	✗	✓
Does this test affect environment?	✗	✓
Is mains power necessary?	✗	✓
Can this test display defect size?	✓	✗
Can this test display liquid contamination volume?	✓	✗
Would it be easy to test from both sides of a section?	✓	✗
Could a hole be missed due to surface tension of gas test?	✗	✓
Could a hole be missed due to crystallization of salt/dye?	✗	✓
Would it be possible to test without draining Glycol/coolants?	✓	✗

UNIVERSITY VALIDATION OF HEXTEQ SYSTEM FOR COCA COLA U.S.A.

A number of validation tests were carried out using minute pinholes of just a few microns at one side of an industry standard plate heat exchanger (inlet), and the Hexteq Sensor Transmitter was attached to the other side of the plate heat exchanger (outlet), creating the worst possible scenario for defect detection and sizing of the pinholes accurately.

Defect sizes were accurately measured using a scanning electron microscope, before and after testing. At 3 bar pressure differential (the recommended minimum in accordance with Hexteq procedure manual), the 25 micron hole for example showed very accurate measurements obtained by the Hexteq sensor transmitter which were then uploaded to a pc using software produced for this unit, and later viewed in graph format.

The University carried out a large number of tests proving the ability of Hexteq to not only detect defects in a heat exchanger, but also to accurately measure the defect size, therefore allowing the technician to monitor defect propagation. This is not possible with any other test equipment. It is widely known that some defects are not detectable with dye, so monitor and watch them grow with the Hexteq system.

Table taken from University validation report: (Sample)

Reference No	Hole Ø (µm)	Pressure (Bar)	Leakage (µl)	Hexteq hole calc.
00257	25	3	12.25	27.9
00258	25	3	10.19	25.5
00259	25	3	10.26	25.6

*

The Hexteq system is a portable test system designed to assess the integrity of PHE & Tubular heat exchangers and consists of three items of equipment. The inlet meter measures the real time inlet manifold pressure for the duration of the test. The flow rate measuring device measures the flow of fluid through the leak from the high pressure to the low pressure side of the heat exchanger. Water from the low pressure side is fed via a tube into the unit, initially filling an inlet pre-chamber. When the unit is primed with sufficient fluid, the water passes into a secondary measurement chamber which then fills to ensure sensors are below water level, to a set volume before automatically dumping the charge and restarting the fill cycle.
The sensitivity of the measuring system is such that the magnitude of this flow rate can be only a few microlitres per second, and is controlled by ultrasonic sensors internally.

Each test is controlled by the hand held test process controller and data acquisition unit. This component also collects the data from the measuring head and the pressure meter at the end of each test and calculates the flow rate, from which and estimation of the hole size is also made. The data acquisition unit can store data from up to 80 separate tests before requiring download.

All three items of electronic equipment are linked by wireless communication for data transfer and a GPS unit is also included to provide positional information for each individual test. At the end of a test programme the results are uploaded to a computer via a USB link for final processing.

Contact EIT International today, email: enquiries@eit-international.com