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## Case Study – Performance comparison of two heat pipes using Thermocouples

### Scope of study

There are two metal pipes manufactured by two different manufacturers and the performance of the same need to be evaluated and compared. While hot liquid passes through the pipes, the temperature at the outer surface need to be evaluated at various points including straight run, elbow, couples etc.

### Methodology

Both the pipes need to be tested at the same ambient conditions simultaneously. It was decided to use pipes of approximately 5 meter with two elbows and one coupler. The force of flow of liquid need to be same in both the cases. Hence flow regulator, flow meter and pressure monitor were fitted at the beginning of both the pipes.

### Instruments used

Picolog 1216 Data Logger – This data logger can take inputs from 16 Thermocouples and can be connected to a computer for live monitoring and recording.

Picolog Multichannel connector – This is for connecting 16 thermocouples to the Picolog data logger. The thermocouples are connected to various terminals and the serial port is plugged into the data logger.

Picolog Thermocouples – 16 nos.

Picolog software

### Tests carried out

8 Thermocouples each were connected to various points of each pipes. One of the thermocouples was inserted into the liquid through a special hole made for the purpose and sealed thereafter. The connection points were exactly identical for both the pipes. The hot liquid was continuously passed through both the pipes at same pressure and flow rate regulated through a flow regulator.

The readings were seen on screen through Picolog software and was parallelly being recorded.

The temperature of the liquid was changed every two hours. The test was carried out under various different temperature conditions of the liquid and under different ambient temperature conditions as per following table.



<u>Temperature of the liquid</u>	<u>Ambient Temperature</u>
15°C	33-37°C
25°C	40 - 42 °C
35 °C	44-47 °C
50 °C	44-47 °C
75 °C	44-47 °C
100 °C	44-47 °C
80°C	25 °C (controlled condition)

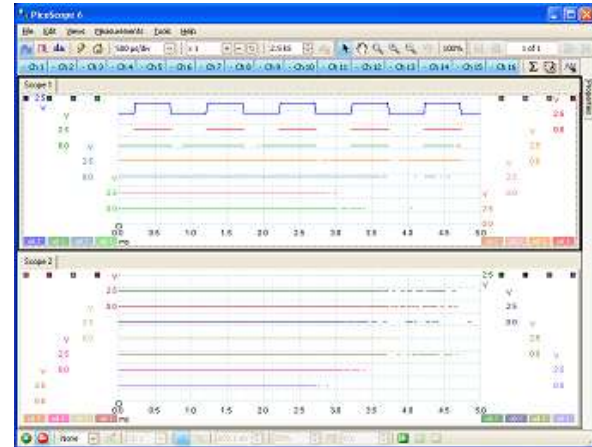
The whole test was completed in three days.

### Analysis

The data was analysed using Picoscope software. Evaluation criteria was that the surface temperature at all points should be as minimum as possible under all conditions. The graph of different thermocouples were individually compared.

Eg. the thermocouple of Elbows of pipe 1 & 2 were compared simultaneously along with corresponding thermocouples of the liquid temperature and ambient temperature as per following table

<u>Readings of Pipe 1</u>	<u>Readings of Pipe 2</u>
Thermocouple of Elbow of pipe 1	Thermocouple of Elbow of pipe 2
Liquid temperature of pipe 1	Liquid temperature of pipe 2
Ambient temperature of pipe 1	Ambient temperature of pipe 2



### Results

From the graphs it was obvious that Pipe 2 was having better performance than pipe 1. Apart from the graphs, the average values were calculated for each temperature range and compared.