HT SERIES

Radial Heat Conduction - HT12X

The Armfield Radial Heat Conduction accessory has been designed to demonstrate the application of the Fourier rate equation to simple steady-state conduction radially through the wall of a tube.

HT12X in Operation

Hardware description

The arrangement, using a solid metal disk with temperature measurements at different radii and heat flow radially outward from the centre to the periphery, enables the temperature distribution and flow of heat by radial conduction to be investigated.

For the HT12X the heater power and the cooling water flow rate are regulated by PID controlled via the HT10X armBUS computer software.

- The accessory comprises a solid disk of material, which is heated at the centre and cooled at the periphery to create a radial temperature difference with corresponding radial flow of heat by conduction
- Six K-type thermocouples are positioned at different radii in the heated disk to indicate the temperature gradient from the central heated core to the periphery of the disk
- The radial distance between each thermocouple in the disk is 10mm
- Quick-release connections facilitate rapid connection of the cooling tube to a cold water supply
- Heater is voltage or PID controlled allowing for the temperature set-point to be achieved rapidly and maintained within 0.1°C
- The HT10X service unit provides the accessory with the cooling water system:
  - A pressure regulator is incorporated to minimise the effect of fluctuations in the supply pressure
  - The cooling water flow rate is measured by a turbine type flow sensor
  - A control valve on the HT10X service unit allows the flow of cooling water to be varied, if required, over the operating range of 0-1.5 L/min. The valve can be PID controlled for improved supply pressure disturbance reduction

Experimental capabilities

- Understanding the use of the Fourier rate equation in determining rate of heat flow through solid materials
- Measuring the temperature distribution for steady-state conduction of energy through the wall of a cylinder (radial energy flow)
- Determining the constant of proportionality (thermal conductivity k) of the disk material

HT12X exercise and calculations screen

Quick release connectors fitted to all accessories that require water cooling (non drip)

HT12X mimic and control screen

Requirements

HT 10X

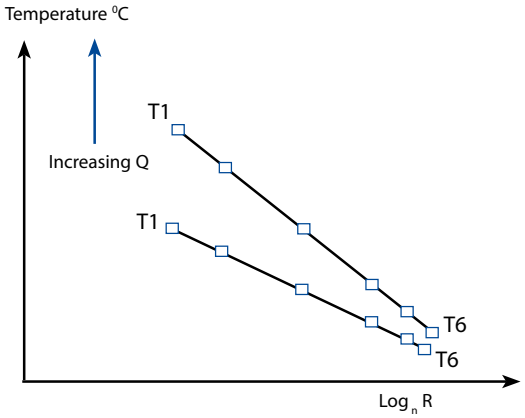
Scale

All electrical requirements and Cold water supply are obtained from the HT10X service unit

Ordering specification

A small-scale accessory designed to introduce students to the principles of radial heat conduction, and to allow the conductivity of a solid brass disk to be measured:

- Comprised of a brass disk which with a PID controlled heating section heated at the centre and a cooling water tube attached to the periphery to create a radial temperature difference with corresponding radial flow of heat by conduction
- Conduction disk 110mm diameter and 3.2mm thick
- Heater power must be variable up to 100 Watts
- Six K-type thermocouples positioned at different radii in the heated disk to indicate the temperature gradient from the central heated core to the periphery of the disk.
- PID Controller of water flow rate variable up to 1.5 L/min



Temperature distribution for radial conduction through the wall of a cylinder

Essential accessories

HT10X Computer-Controlled Heat Transfer Service Unit

Overall dimensions

Length	0.35m
Width	0.18m
Height	0.19m
Packed and crated shipping specifications	
Volume	0.05m^3
Gross weight	6kg

Ordering codes

HT12X

Issue: 1
URL: http://www.armfield.co.uk/ht10x
Applications
Me ChE CE IP