



# Laws of Radiant Heat Transfer and Radiant Heat Exchange

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HT13

## HEAT TRANSFER AND THERMODYNAMICS

### HT13 Laws of Radiant Heat Transfer and Radiant Heat Exchange - Issue 6

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### Ordering Specification

- A small-scale accessory designed to introduce students to the basic laws of radiant heat transfer and radiant heat exchange
- A heat source with radiometer and a light source with light meter are used where appropriate to demonstrate the principles
- The heat source consists of a flat circular plate 100mm in diameter which incorporates a 216W electric heating element (operating at at 24V DC maximum)

- The light source consists of a 40W light bulb (operating at 24V DC maximum) mounted inside a housing with a glass diffuser
- The heat and light sources, instruments, filters and plates are mounted on an aluminium track with graduated scale, which is designed to stand on the benchtop and connect to the Heat Transfer Service Unit without the need for tools
- A comprehensive instruction manual describing how to carry out the laboratory teaching exercises in radiant heat transfer/exchange and their analysis as well as assembly, installation and commissioning is included

## Technical Details

The track consists of a rigid aluminium frame with twin horizontal rails, which incorporates sliding carriages to enable the positions of the instrumentation, filters and plates to be varied. The position of the carriages relative to the energy source can be measured using a graduated scale attached to the side of the track. The track is designed to stand on the benchtop alongside the HT10XC Heat Transfer Service Unit. The heat source consists of a flat copper plate, which is heated from the rear by an insulated electric heating element. It operates at low voltage for increased operator safety. The front of the plate is coated with a heat-resistant matte black paint, which provides a consistent emissivity close to unity. The surface temperature of the plate is measured by a thermocouple, which is attached to the front of the plate.

Radiation from the heated plate is measured using a heat radiation detector (radiometer), which can be positioned along the graduated track on a carriage. Metal plates with different surface finishes are supplied to demonstrate the effect of emissivity on radiation emitted and received. Two black plates, one grey plate and one polished plate are supplied together with a track-mounted carrier which positions the plates in front of the heat source. Each plate incorporates a thermocouple to indicate the surface temperature of the plate.

Two cork-coated metal plates are supplied that enable a vertical slot aperture of adjustable width to be created between the source and detector to demonstrate area factors. The light source consists of a lamp in a housing with a glass diffuser and operates at low voltage for increased operator safety. The source may be rotated through 180° and the angle measured using an integral scale. The power supplied to the lamp can be varied and measured on the HT10XC. The radiation from the light source is measured using a light meter which can be positioned along the graduated track on a carriage. Filter plates of varying opacity and thickness are supplied to demonstrate the laws of absorption.

## Experimental Capabilities

- Inverse-square law using the heat source and radiometer or light source and light meter
- Stefan-Boltzmann law using the heat source and radiometer
- Emissivity using the heat source, metal plates and radiometer
- Kirchoff's circuit laws using the heat source, metal plates and radiometer
- Area factors using the heat source, aperture and radiometer
- Lambert's cosine law using the light source (rotated) and light meter
- Lambert's law of absorption using the light source, filter plates and light meter

## Essential Armfield Equipment

HT10XC Computer Controlled Heat Transfer Service Unit

## Shipping Specification

Volume:	0.3m <sup>3</sup>
Gross weight:	12kg

## Overall Dimensions

Height:	0.44m
Width:	1.23m
Depth:	0.30m

## Ordering Codes

HT13