LINEAR EXPANSION APPARATUS - steam

Cat: HL2020-001 With dial indicator

GENERAL DESCRIPTION:

This unit is designed to demonstrate and measure linear expansion that occurs when metal is heated. Several tubes of different metals are supplied to provide comparisons in expansions.

Steam, which is supplied by the user, is passed through a metal tube of known length. As the tube increases in length, the change is measured on a large sensitive dial indicator.

The various metal tubes are easy and quick to load and the indicator can easily be zeroed before heat is applied. A thermometer socket is provided in the instrument to measure the actual temperature of the steam when accurate results are required.

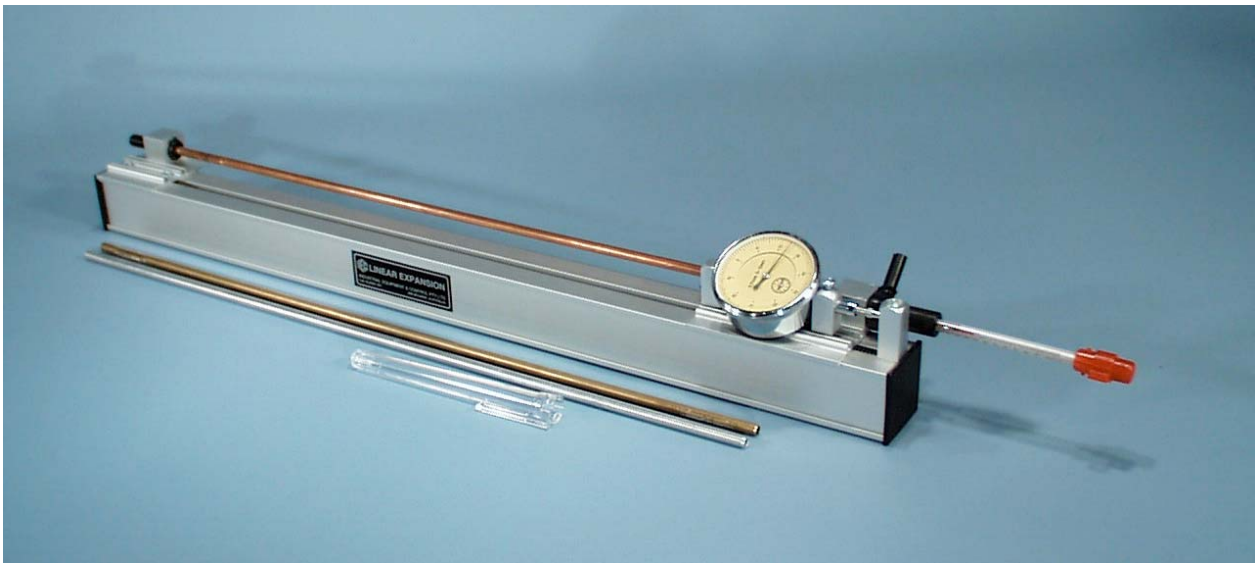
The experiment involves the heating of the metal tube from ambient temperature to the temperature of the steam and measuring the change in length due to the heating. The dial on the gauge is set to read zero at ambient temperature of the room and this is recorded as the 'initial temperature'.

The hose from steam generator can be connected to either end of the instrument so that the temperature of the steam either entering or leaving the metal tube can be measured by a glass thermometer. The average of these two temperatures is close to the exact temperature of the metal tube. In most cases, without measuring the steam at all, it is sufficiently accurate to assume that the temperature of the tube is about 96^{o}C.

Knowing the temperature rise, the expansion, the initial length of the tube and the material being heated, the coefficient of expansion for that material can be calculated.

Another metal tube may be loaded and the experiment repeated to compare the coefficients of expansion of different materials.

HL2020-001



Physical size: **Weight: kg**

Designed and manufactured in Australia by Industrial Equipment and Control Pty Ltd

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PERFORMING THE EXPERIMENT:

Metals provided: aluminium, brass, and copper. 500mm long.

The block that carries the indicator can be slid towards the end of the rail against spring pressure. As the block slides, the indicator can be seen to turn as it measures the sliding distance. Observe the socket on the sliding block and the fixed socket at the other end of the rail.

- Take the desired tube, open the distance between the sockets by gently sliding the block carrying the indicator against spring pressure towards the end of the rail. Place the tube into the sockets provided and gently release the sliding block so the tube is clamped between the sockets.
- Place a thermometer into the hole provided at the rear of the socket on the sliding block. Do not force or break the glass thermometer. When the thermometer is inserted into the path of the steam be careful not to bump or break the thermometer during the experiment.
- Be sure the tube is properly settled into the sockets by rotating the tube for a few seconds with the fingers. Zero the dial indicator by rotating the dial until the pointer is resting on zero on the dial. Take note of initial temperature.
- Using a suitable rubber hose, connect a source of steam to the small tube protruding from the socket. Allow the steam and water to run into a sink or a container from the other end of the instrument.
- Wait until the change in length has stabilised. Each division of the dial indicator is 0.01mm length. Note the change in length and note the temperature of the steam.
- Repeat the above procedure for each tube.
- Calculate the coefficient of expansion 'α ' for each material.

$\alpha = (Lt-L0) / (L0 \times \Delta t)$

where:

α = EXPANSION COEFFICIENT

L0 = INITIAL LENGTH OF METAL TUBE (mm)

Lt = FINAL LENGTH AT FINAL TEMPERATURE (mm)

Δt = CHANGE IN TEMPERATURE (IN ^{o}C)

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