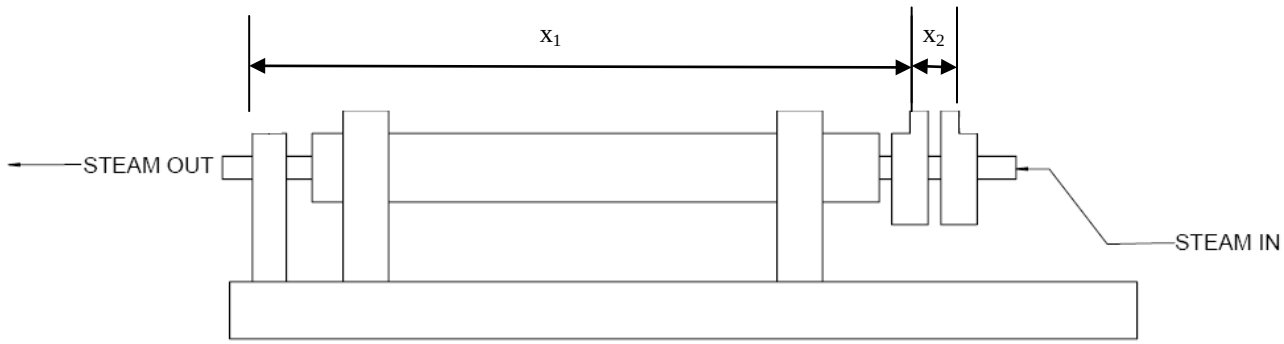
Linear Expansion of Metals

Abbreviated Report

Object: To determine the linear coefficients of expansion for several metals and compare the experimental values found with published mean values.

Apparatus:

Water boiler, measuring equipment, expansion test rigs.



Procedure:

1. Measure distance x_1 with a ruler
2. Measure distance x_2 with a micrometer
3. Measure and record the initial temperature of the tube ($T_{ambient}$)
4. Pass steam from the miniature boiler through the tube and wait approximately five minutes for the tube to expand
5. Re-measure the distance x_2 once the tube length has ceased increasing, and record it as x_3

Data: Record all lineal and temperature measurements taken on the data sheet provided.

Results: Complete the appropriate result sheet for the experiment, and include in your results sample calculations of how the coefficient of linear expansion was determined for the specimen that you tested.

Show calculated values of the coefficient of linear expansion only for the samples tested by other groups.

Using the relationships

$$x_1 + x_2 = L_o$$

and

$$x_1 + x_3 = L_o + \alpha L_o (T_{steam} - T_{ambient})$$

Rearrange the standard equation to find α for your experiment.

Determine differences between the experimental values found and published average values for the metals tested.

Comments: In this section, comment on the outcomes of the experiment and its significance.

Use the following leading questions as a guide:

1. What was the percentage error found between experimental and accepted values?
2. What caused any errors, and how could they be minimised?
3. What is the significance of thermal expansion and what implications does it have for engineering design?
4. When is it desirable to join two metals together that have different coefficients of linear expansion?

Results

	Stainless steel	Copper	Brass	Aluminium
X_1				
X_2				
X_3				
T_{steam}	100°C	100°C	100°C	100°C
$T_{ambient}$				
ΔT				

Comparative results

	Experimental α	Published α	Error	Error %
Stainless steel				
Copper				
Brass				
Aluminium				