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Experiment No. (2)

a. Name of Experiment:

Thermal Conductivity

b. Purposes of Experiment:

1. Determination of thermal conductivity "k" of different materials using T.ccc equipment.
2. Study the effect of different power electrical on thermal conductivity.
3. Study the effect of cross sectional area.

Theory of Experiment:

Thermal conductivity:-
Thermal conductivity is the ability of material to conduct heat. It appears primarily in Fourier's law for heat conduction. Heat transfer across materials of high thermal conductivity occurs at higher rate than across materials of low thermal conductivity. Correspondingly materials of low thermal conductivity are used as thermal insulation.

Thermal conductivity is influence by several factor such as temperature materials phase, material structure, electrical conductivity.

c. Description of Instrument:

Tccc equipment
The Tccc equipment that used to calculate the thermal conductivity of the different materials is shown in below figure. It consists of three differential parts:
A is the region where the contact resistance is located. It has 4 temperature readings and an insulation cover that avoids the radial transmission of heat favoring the linear transmission.
B: is is the comportment where the specimen readings is placed, a Brass cylinder of 10 mm, stainless Steel cylinder of 25 mm and a Brass cylinder of 25 mm.

C, is the cooling region using circulated water.
From the figure it can be seen the linear element has 11 temperature readings that will allow us to obtain temperature profile in each pattern.

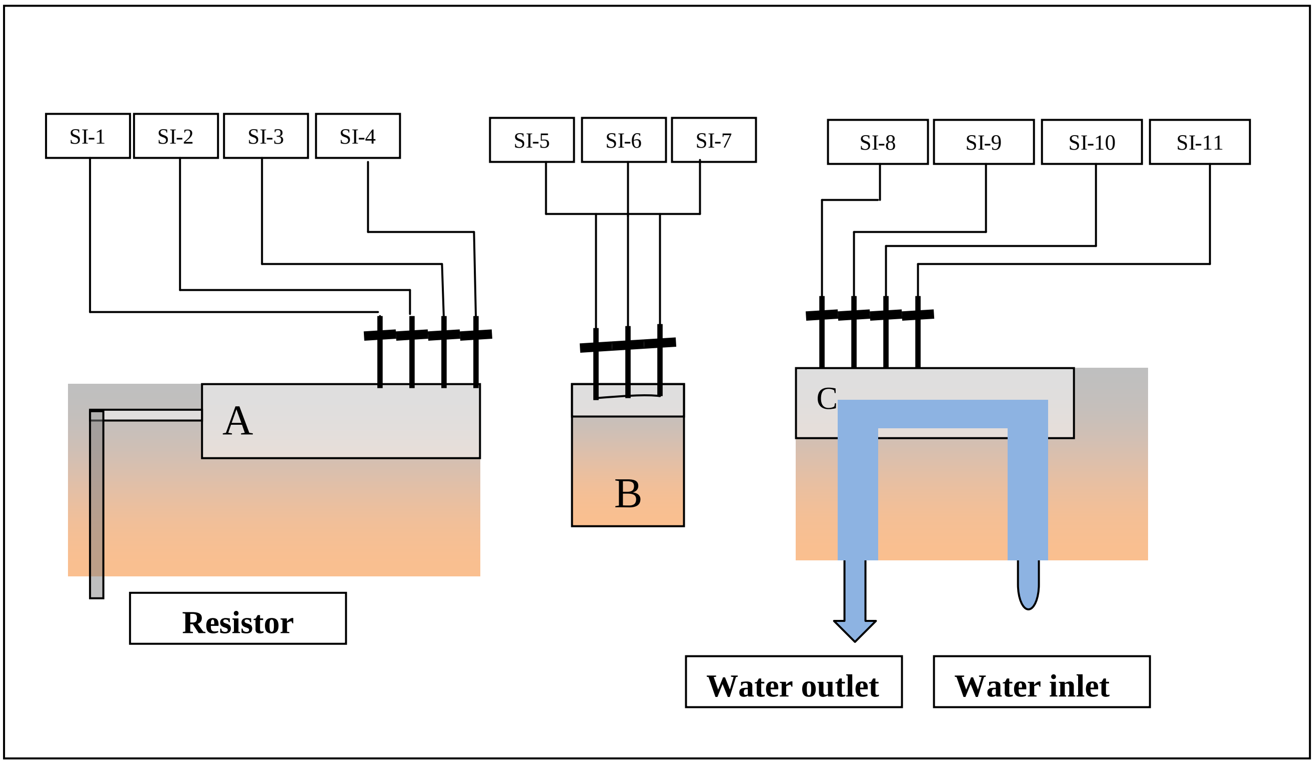

Fig (1) Tccc equipment

d. Procedure:

For a proper practice development, follow these steps:

1. Connect the SACED program Tccc .
2. Verify that all the temperature sensors and that the heating resistance have been connected and also that the accessory is in line with the fixed conduction cylinders.
3. Make a water flow to circulate through the cooling system.
4. Fix a power for the heating resistance of 50% with the power controller. You can know the power consumption in the resistance by viewing the wattmeter measurement SW-1. You should wait until ST-1 reaches an stable value, and then, start the experiment.
5. Wait until the system stays constant and no temperature variations are produced in the sensors.
6. Repeat the previous steps for power 70%.
7. Complete the following table:

D(mm)	Power%	Q(W)	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}
10	50												
	70												
25	50												
	70												

e. Calculations:

From the data at above table you can determine the thermal conductivity of specimen by using the Fourier's law

$$k = \frac{Q\Delta x}{A\Delta T}$$

Q: rate of heat transfer.(w)
A: cross sectional area of material $= \frac{\pi}{4} D^2$. (m^2)

Δx=distance between the two points of temperature sampling= (m)
ΔT= temperature variation at a distance Δx= (T_5- T_7), Δ°C= Δk

And then drawing the relationship between temperatures and axial distance for specimen as the following: