**Project Name:** Metu PowerLab Calorimeter Design

**Statement of Problem:** The electrical determination of power losses by measuring the input and output power can reach enough accuracy for DC-DC converter systems, if well calibrated voltage meters and shunt resistors are applied. However, it is difficult to determine the power in AC-systems, especially with harmonics, due to phase-errors in the electric measurement. In addition, the electromagnetic interference (EMI) of switched-mode power supplies can disturb the electric power measurement. (23P4-41\_02.pdf)

**Project Requirements**

* Accurate measurement.
* Fast measurement (under ~30 min).
* Ambient independent measurement.
* Consistency
* Working with the power range between ?W-?kW.

**Example Proposed Methods**

* Open Type Air Coolant

In this method DUT placed inside a container where measurement happen. A coolant gas usually air blown into container and power loss calculated by temperature difference at the inlet and outlet of gas. However, due to change in gas properties (density, humidity etc.) measurement error increases. In order to increase accuracy several precautions must be taken such as pre gas heater, gas humidity control and flow control/equalizer.

* Closed Type Singe-Cased

In this method DUT places inside a thermally sealed container where measurement happen. Power loss calculated via temperature difference between inside and outside of the container. However, since the container is losing power through its wall to air(environment) error increases with the uncertainty of the air properties. In order to increase accuracy, environment of the container must be carefully/homogenously observed.

* Closed Type Double-Cased

In this method DUT places inside a thermally sealed container but to control heat loss to environment it is also places controlled environment container. This method is solved the problem of second methods, and it increases accuracy.

**Remarks**

In all the method approach is the measure temperature difference between regions. However, since temperature of the region is not homogenous to improve accuracy, this problem must be taken into consideration. Usually thermal resistances of isolation materials around K.m/W, so watt measurement scale and thickness of the isolation material must be determined. According to max. working temperature of the DUT isolation material melting point must be taken into consideration. If there is a movement in the container (gas or fluid) surface friction should be taken into considered. For the gas or fluid temperature vs property change must be taken into considered.

**Solution Approach**

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