An Alternative Calorimetric Approach for Power Loss Measurement of Ultra-efficient Power Electronics

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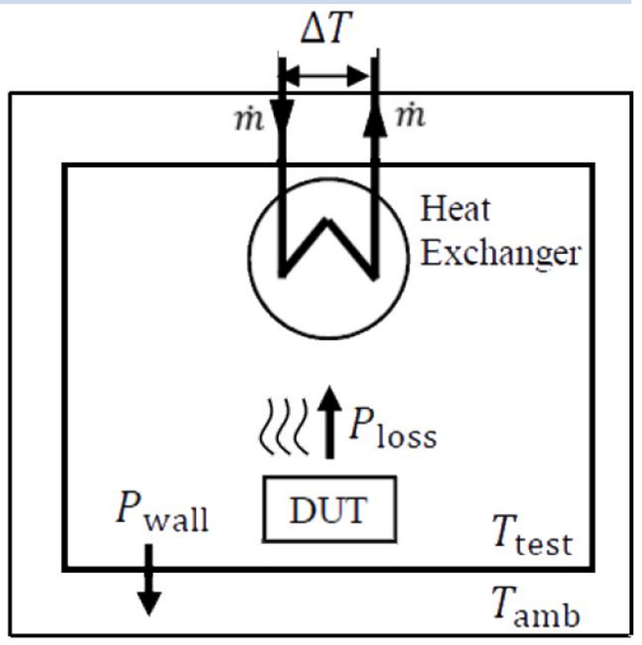
1. Introduction

- Modern power electronics are reaching efficiencies up to 99%
- More accuracy in measuring the power losses is needed
- Uncertainty level of 0.1% or better is required.
- Losses measurement Methods:
- Electrical:
  - Direct Wattmeter
- Calorimetry:
  - Using the generated heat

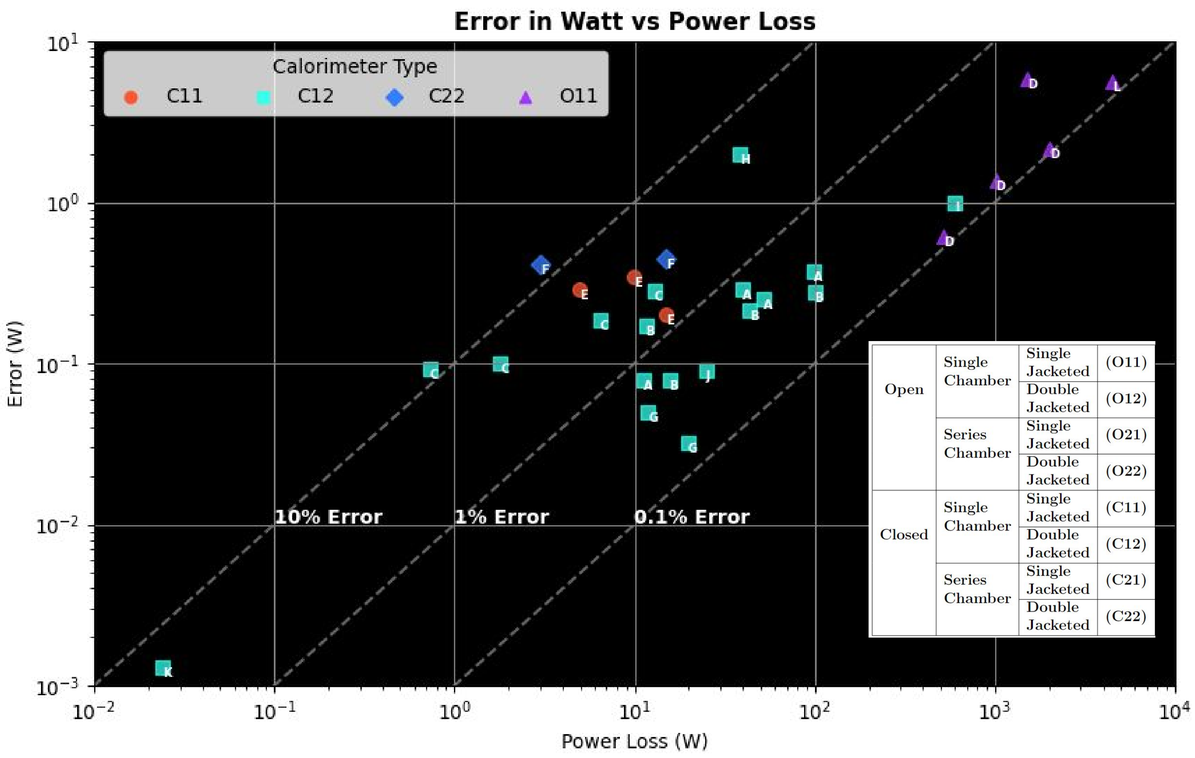
2. Basic Calorimeter

- Measure the heat flow
- Using a cooling mechanism to obtain steady state.
- $P_{loss} = c_p \cdot \dot{m} \cdot \Delta T$

Closed-type single-chamber double-jacketed calorimeter (C12)



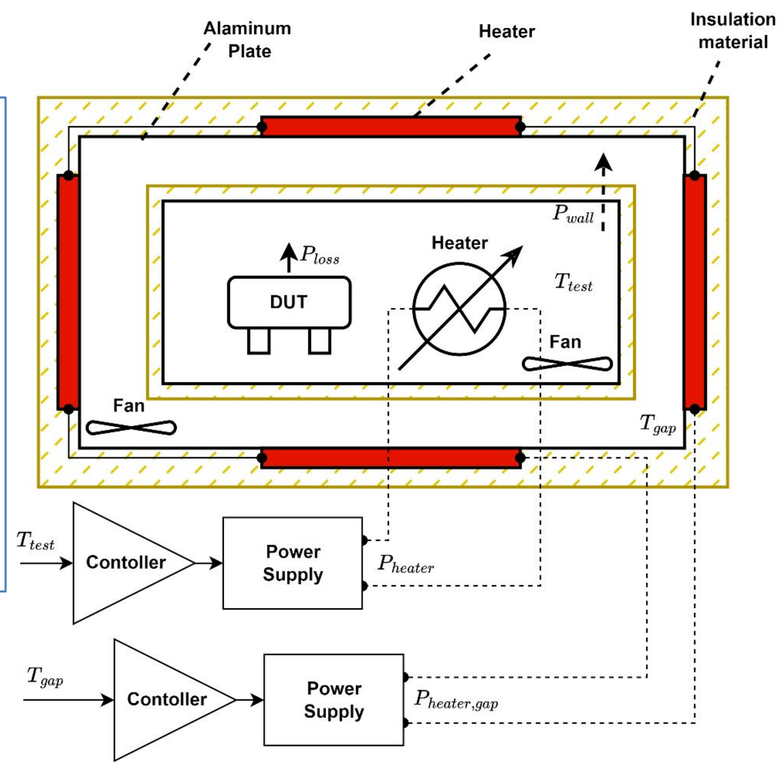
3. Categorization of Calorimeters

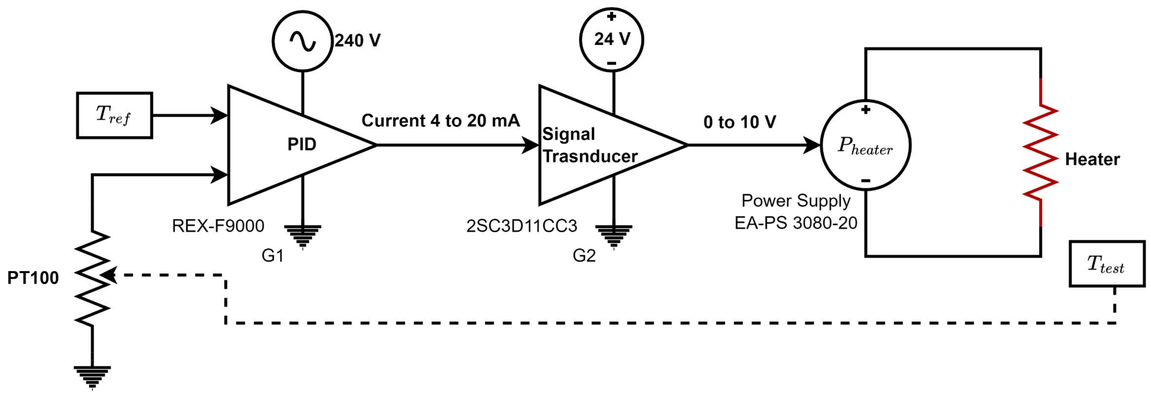


Open	Single Chamber	Single Jacketed	(O11)
		Double Jacketed	(O12)
	Series Chamber	Single Jacketed	(O21)
		Double Jacketed	(O22)
Closed	Single Chamber	Single Jacketed	(C11)
		Double Jacketed	(C12)
	Series Chamber	Single Jacketed	(C21)
		Double Jacketed	(C22)

4. Calorimeter, proposed design:

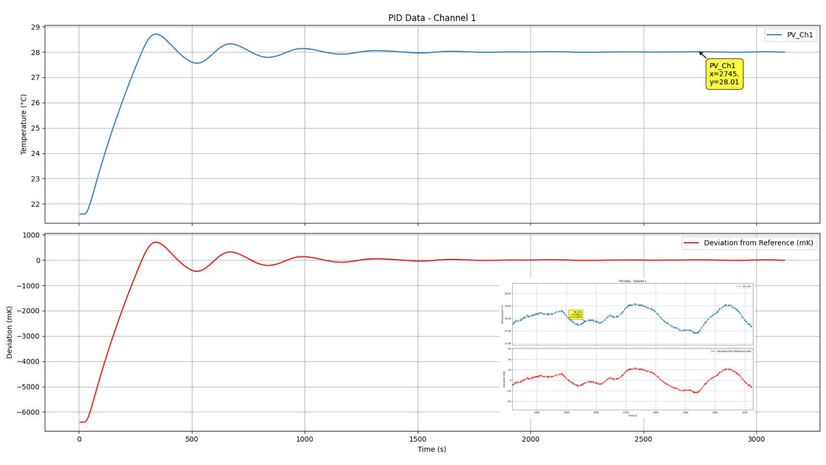
- C12
- Temperature regulated heater
- Achieving steady state
- Measuring the input power of the heater
- $P_{loss} = \Delta P_{DUT}$





5. Results:

Outer Chamber



Inner Chamber

- Regulating the temperature of the outer chamber
- ± 10mk Temperature variation

6. Conclusion and Future Work:

- Existing calorimetric methods are categorized and compared
- An alternative C12 design is proposed
- The temperature of the outer chamber is regulated.
- Temperature variation of ± 10mk is achieved
- Adding an active cooling element
- First test results and evaluation.

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