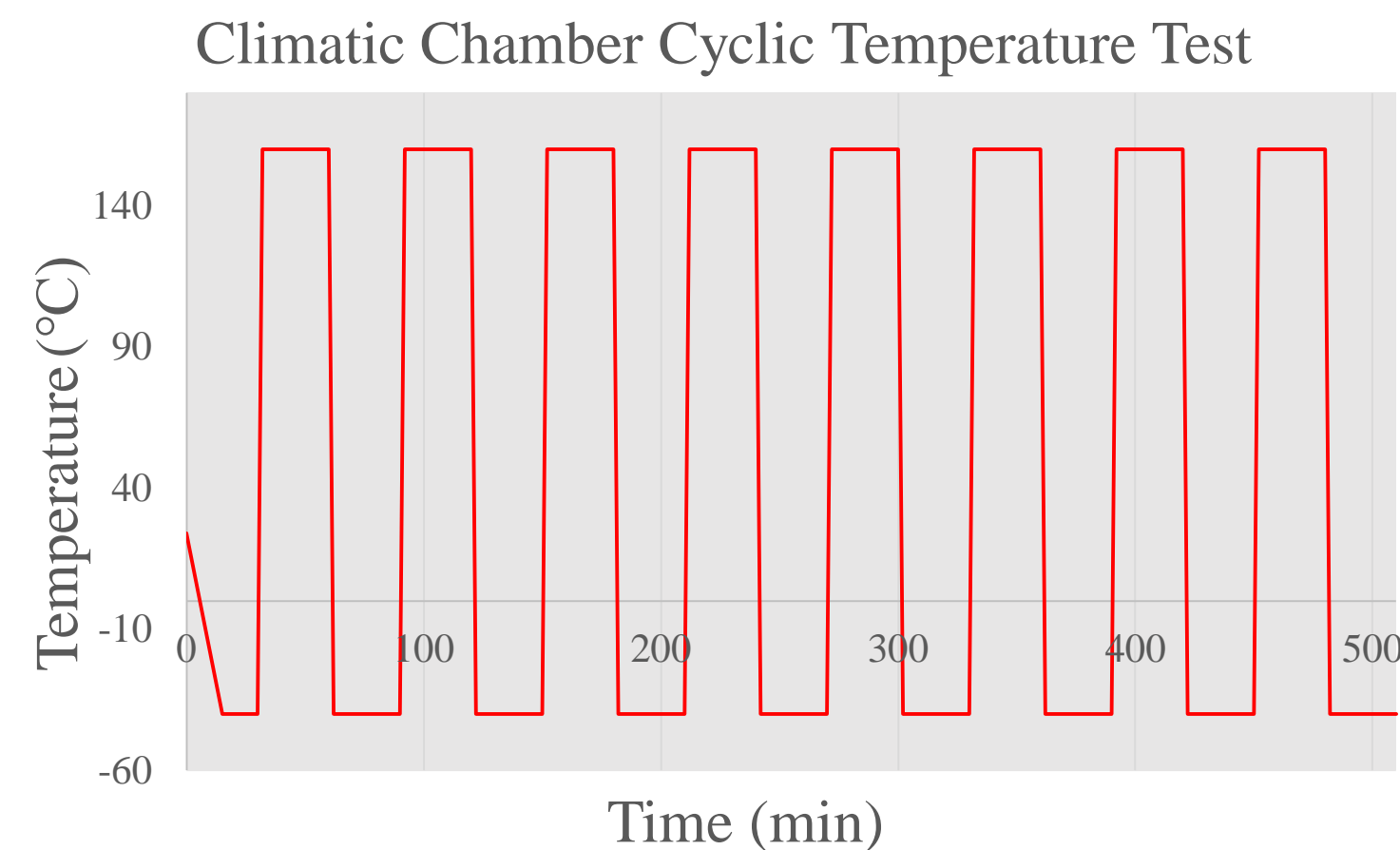


1. PROJECT BACKGROUND

Danfoss tests components for reliability before manufacturing and selling. Tests include:

- Extreme Temperature exposure (-40 °C to 160 °C)
- Humidity exposure (10-98%)
- Vibrational Tests

These test can last up to 71 days and can have any combination of the above 3 mentioned



2. OBJECTIVES

In order to meet the customer needs, the project must accomplish the following objectives:

- Display a live feed of the current testing component to determine if any components have failed
- Maintain operation of the recording device over the full duration of the test
- Eliminate any condensation or dew on the camera lens
- Allow easy maneuverability, to change angle of recording in between tests
- Be inexpensive in comparison to similar products



3. SELECTED DESIGN

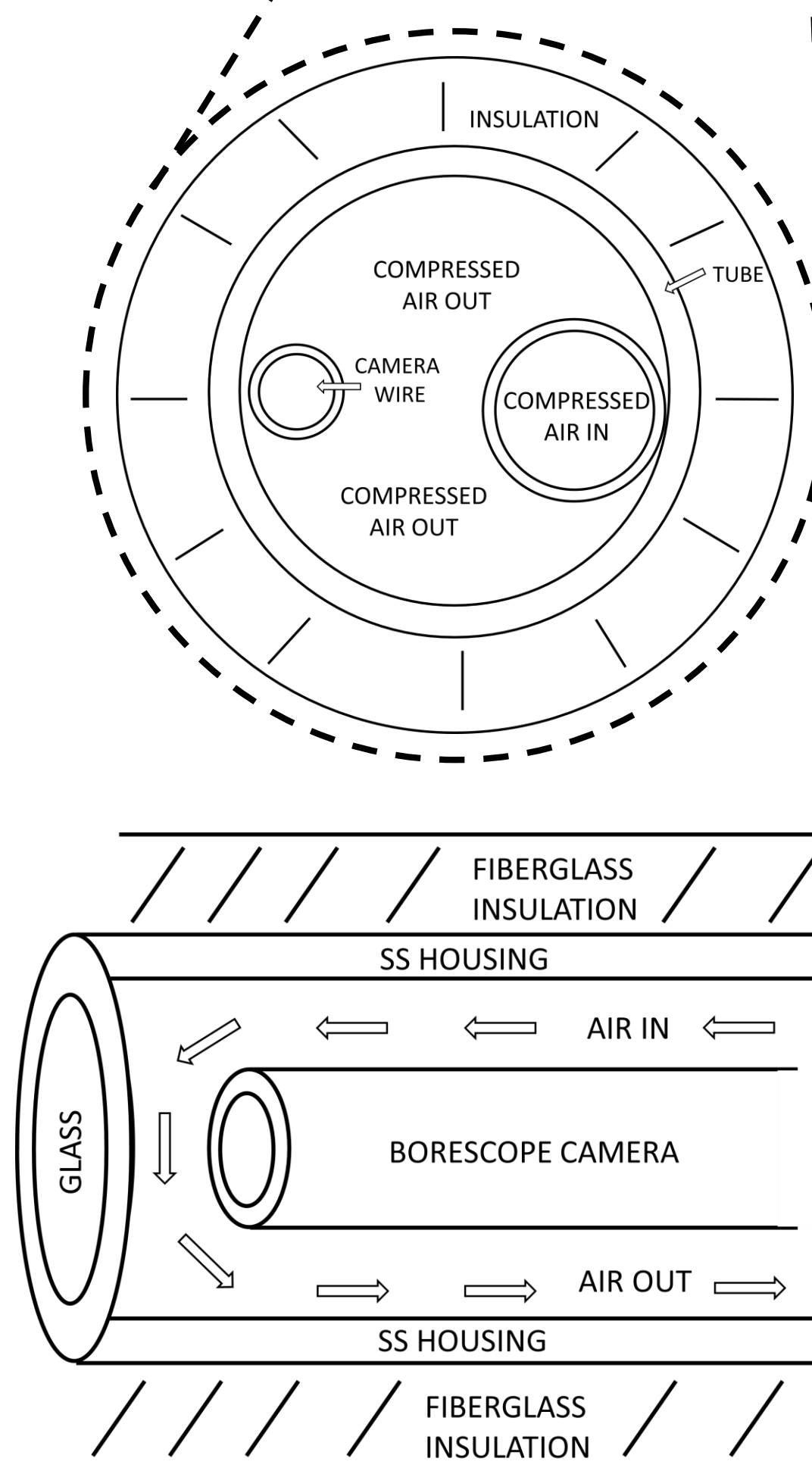
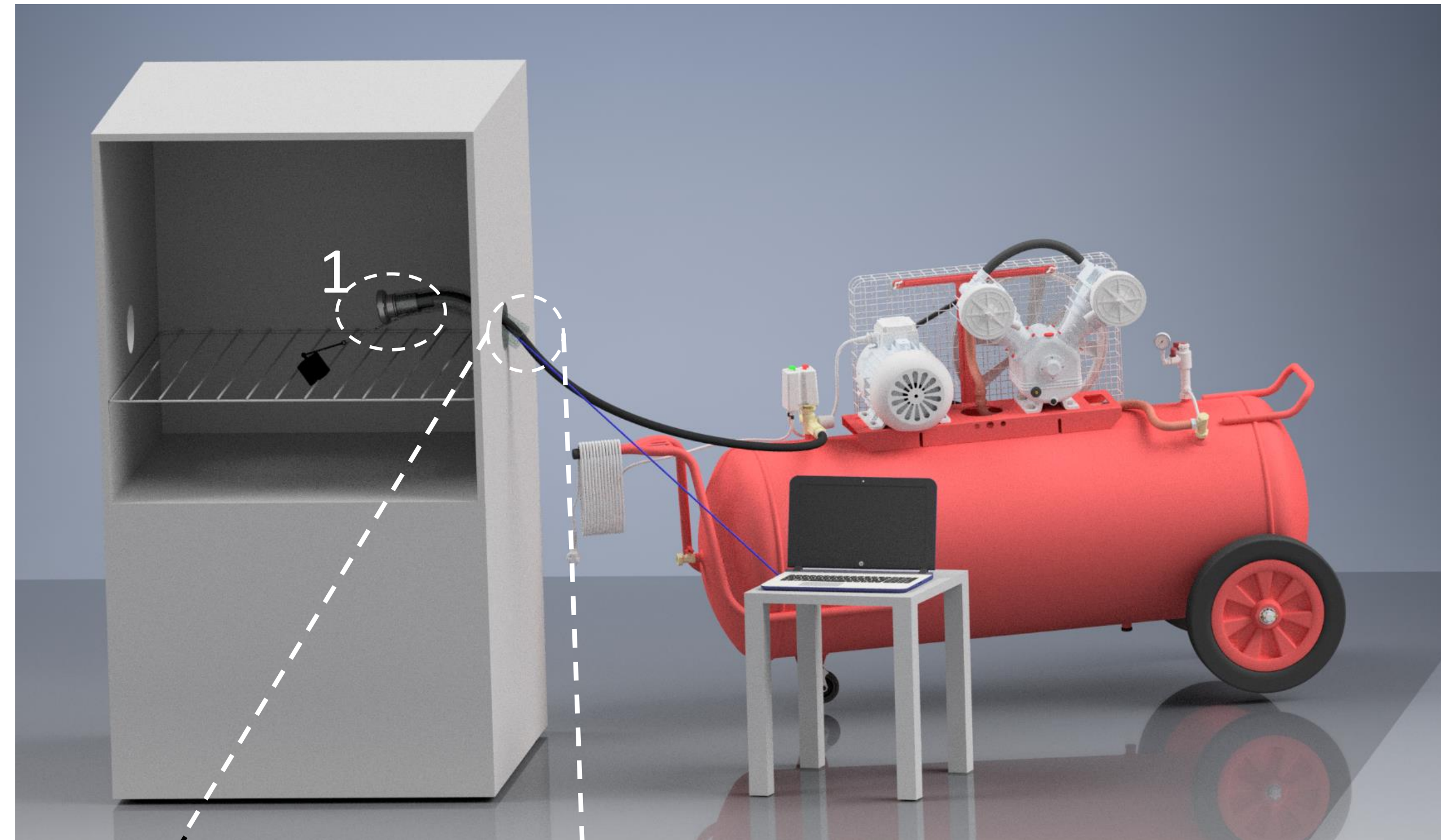


Figure 1: Air Flow Depiction

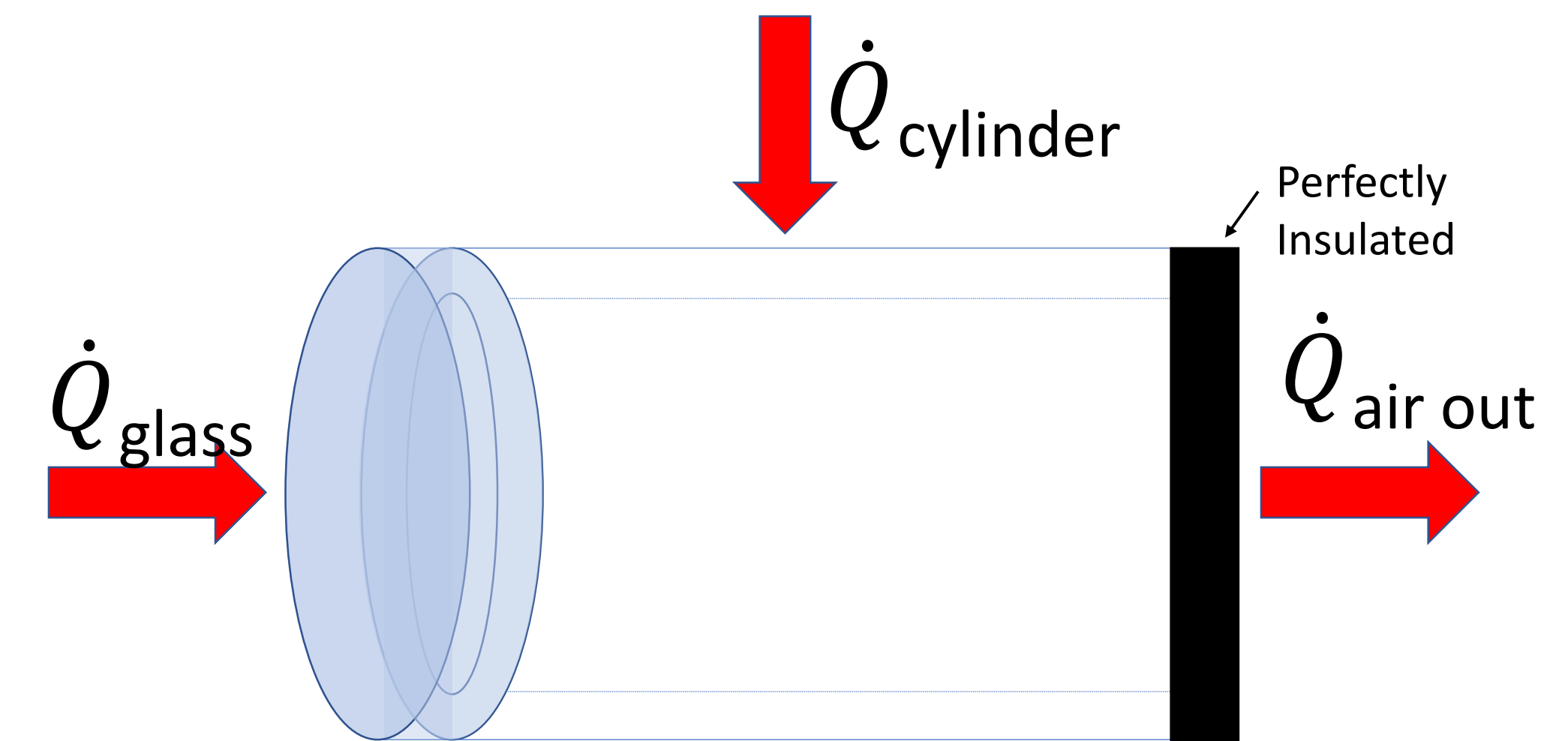
Our selected design consists of using compressed air to cool/heat a USB borescope camera enclosed inside a stainless steel housing that is surrounded by insulation to minimize heat transfer. Any heat that is transferred past this layer of insulation will be removed or replenished by dry compressed air that is constantly circulating inside the housing (Figure 1).

This design maintains camera operating temperatures through forced convection and expels the used air outside the chamber. The desired air flow can be adjusted via a regulator depending upon the chamber test conditions. Dry air is necessary, to eliminate any moisture inside the enclosure which could pose risk of damage to electronics.

4. HEAT TRANSFER ANALYSIS

Assumptions:

- Back of housing is perfectly insulated
- Temperature of air in is at ambient temperature
- Temperature of air out = Temperature inside enclosure

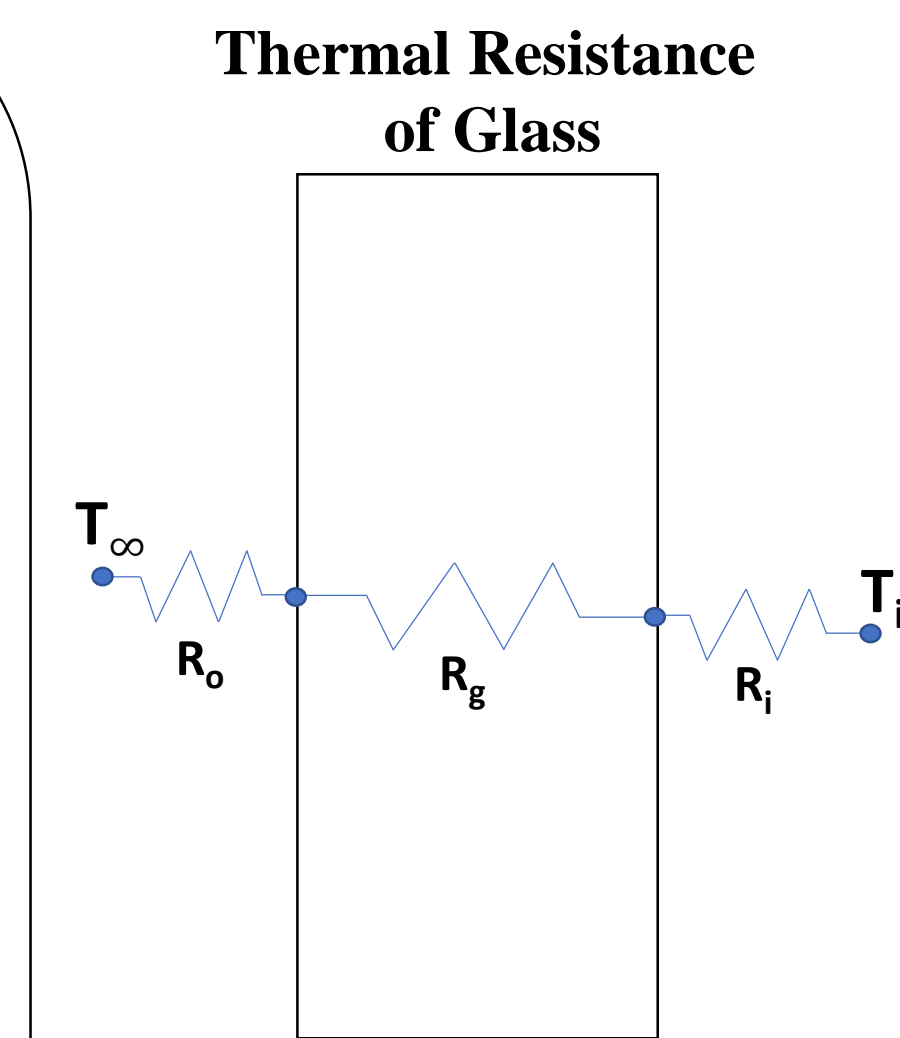


$$\dot{Q}_{glass} + \dot{Q}_{cylinder} = \dot{Q}_{air out}$$

$$\dot{Q}_{air out} = \dot{m}c_p(T_{air in} - T_{air out})$$

$$\dot{Q}_{cylinder} = \frac{T_{\infty} - T_i}{R_o + R_{insul} + R_{ss} + R_i}$$

$$\dot{Q}_{glass} = \frac{T_{\infty} - T_i}{R_o + R_g + R_i}$$



Thermal Resistance of Cylindrical Shell

