# Proposed Flexible Ducting Test Methodology

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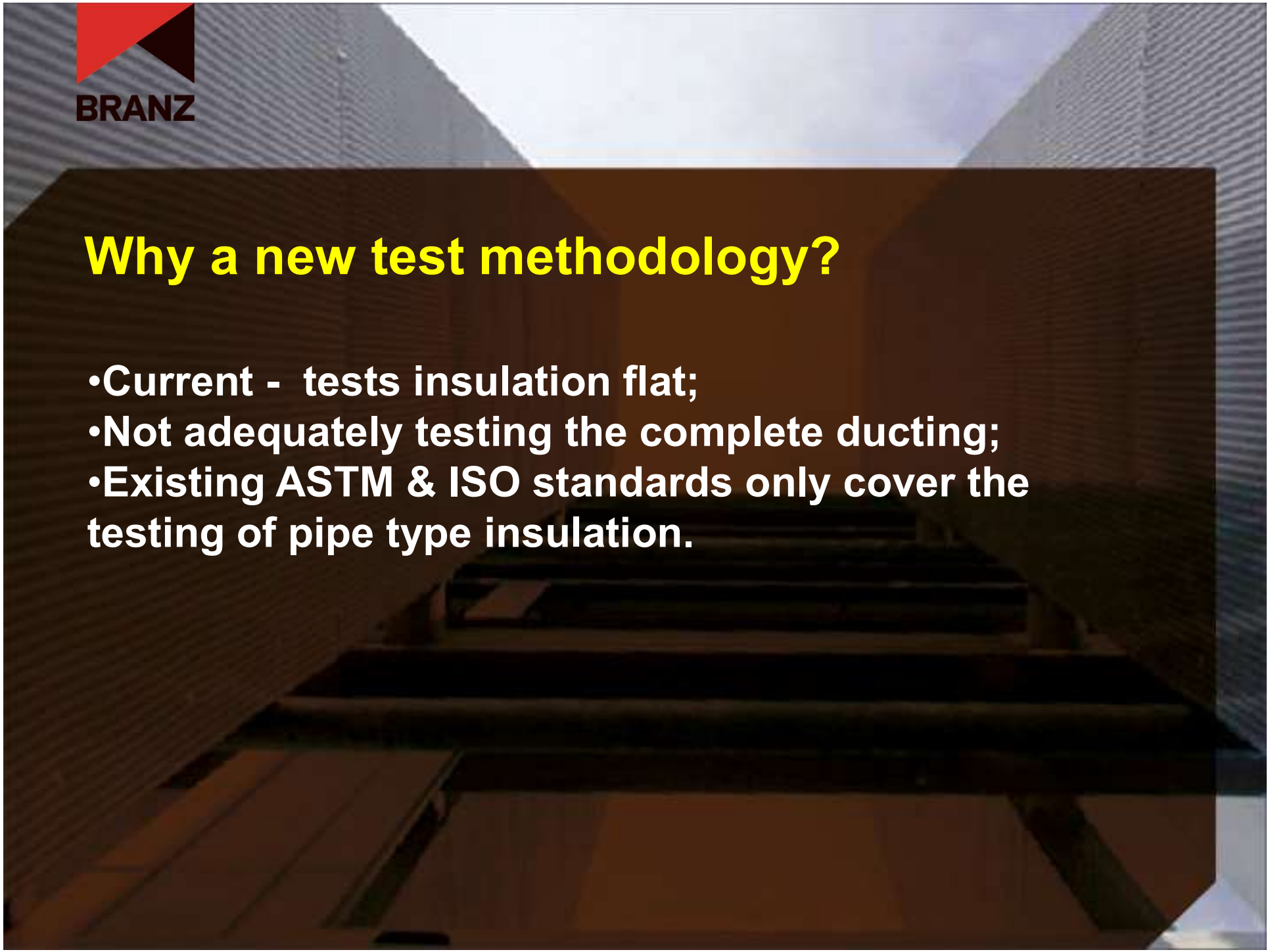
Who is BRANZ and what are our credentials to be carrying out this work!
•An accredited laboratory;
•Have developed techniques and equipment for testing insulation materials;
•Guarded hot box test apparatus;
•Adapt/develop new testing methods;
•Standards committees, (ASNZS 4859.1 for insulation materials)



# Why a new test methodology?

- Current - tests insulation flat;
- Not adequately testing the complete ducting;
- Existing ASTM & ISO standards only cover the testing of pipe type insulation.

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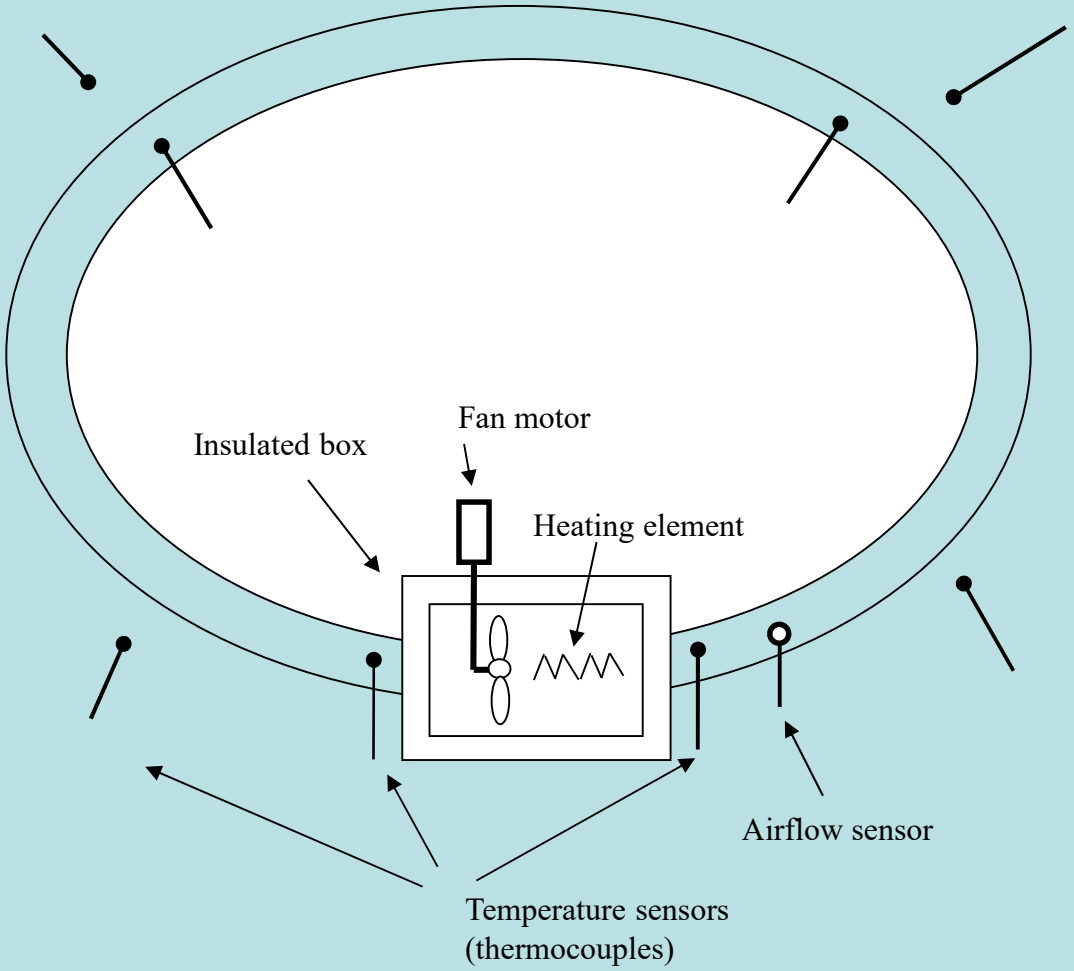
# Overview of proposed methodology

- Form a set length of ducting into a loop;
- Install the loop in a constant temperature environment;
- Circulate air inside the duct;
- Maintain a constant temperature difference between the inside and outside of the duct by applying heating to the inside of the duct;
- Measure the power required to maintain that measured temperature difference;
- Calculate the heat loss per metre of duct and also the thermal resistance.

# Test Apparatus



# Equipment required

- Constant temperature room (23 °C)
- 10 m length of ducting for test
- Stand or hangers to suspend duct 1.5 m off the floor
- Well insulated box to hold heat element and fan
- Spigots of various diameter to interface the heating box into the ducting
- Heating element with large surface area to reduce radiant heat
- Controllable power supply for heating element (approx 500 Watts)
- DC fan with external motor, power supply, and speed controller for circulating air through 10m duct.
- Anemometer for measuring and controlling air velocity in the duct using the DC fan
- Two current shunts plus 5 channel data acquisition unit for measuring air velocity, current from both power supplies, and voltage output from both power supplies
- At least 8 channel thermocouple based temperature logger for measuring temperatures inside and outside the duct
- Computer plus software (Labview application) to log data and control heat element and fan

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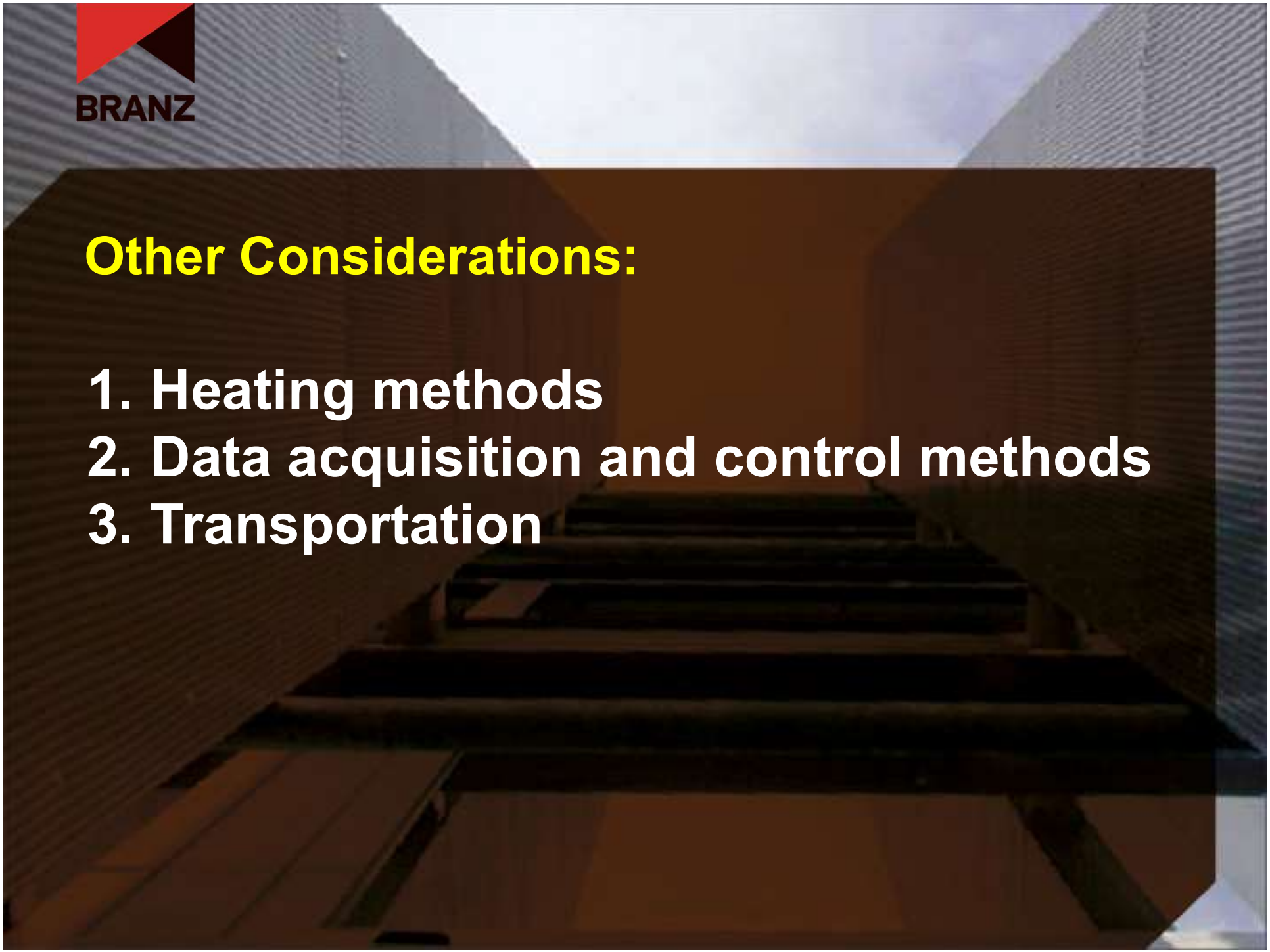
# Detail of design; Industry engagement required:

- Length of ducting needed – should it vary with the diameter
- Size of heat element and power supply
- Resolution of power supply
- Stability required for the power supplies
- Air velocity to use – should it vary with the diameter?
- Temperature difference to use (suggestion of 20K) – is it acceptable?
- Is heat flow outwards appropriate and acceptable
- Is the mean temperature of say 33°C appropriate and acceptable?
- Resolution required for current measurement
- Type of air mixing (surface coefficient for the outside of the duct) in the test room
- Quality of temperature control in the test room
- Time required to complete a test
- Accuracy required for air-flow measurement
- Accuracy required for temperature measurement
- Accuracy required for power measurement
- Overall accuracy and is it acceptable?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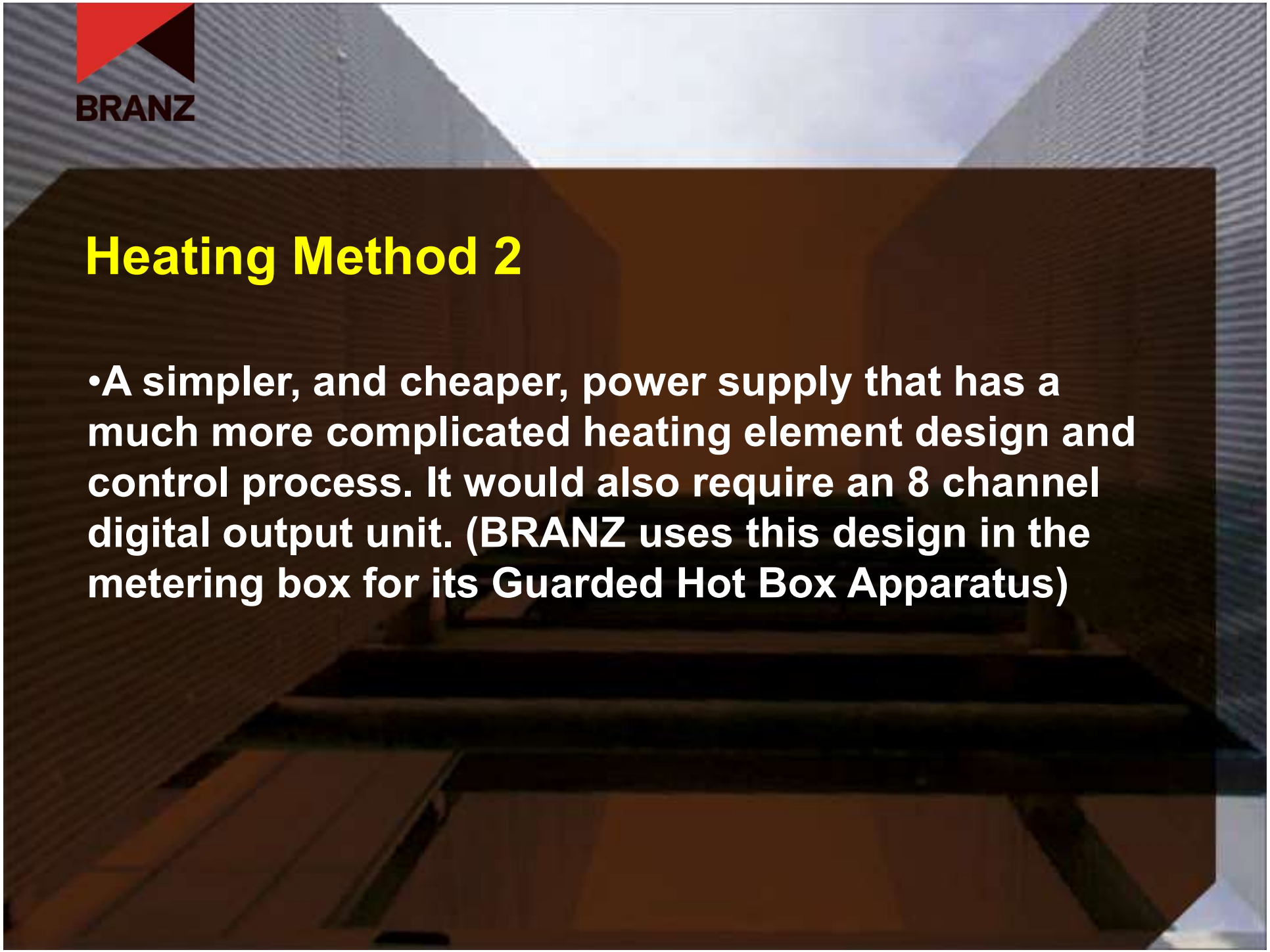
Other Considerations:
1. Heating methods
2. Data acquisition and control methods
3. Transportation

# Heating methods

- There are two alternatives for the heating method:

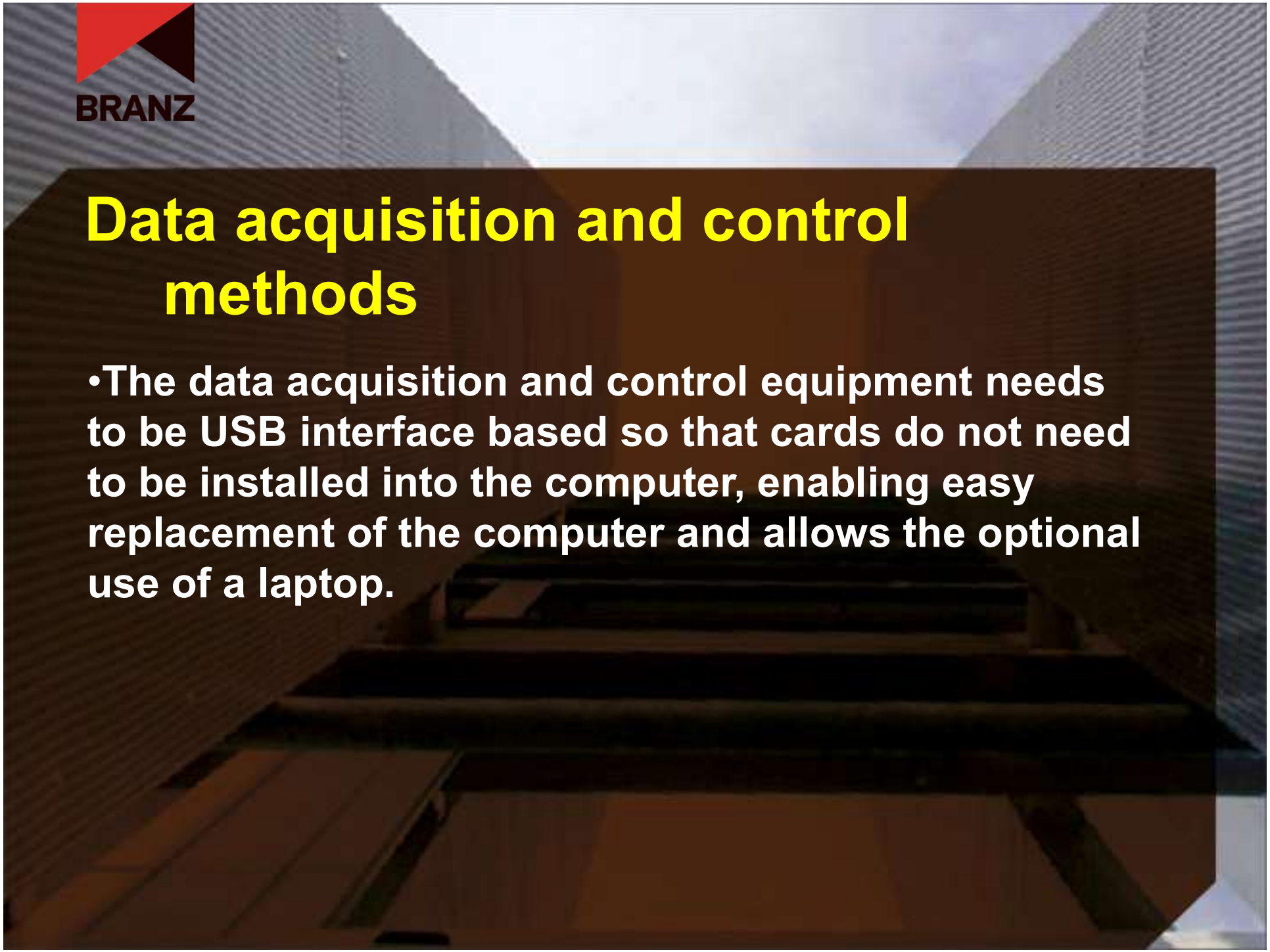
# Heating method 1

- Single heating element using a continuously variable power source or a pre-set sequence of digitally selectable heat elements and a constant voltage power source. This option has a simple heating element design but requires a more sophisticated, and expensive, power supply. It will also require a more intensive data acquisition cycle.



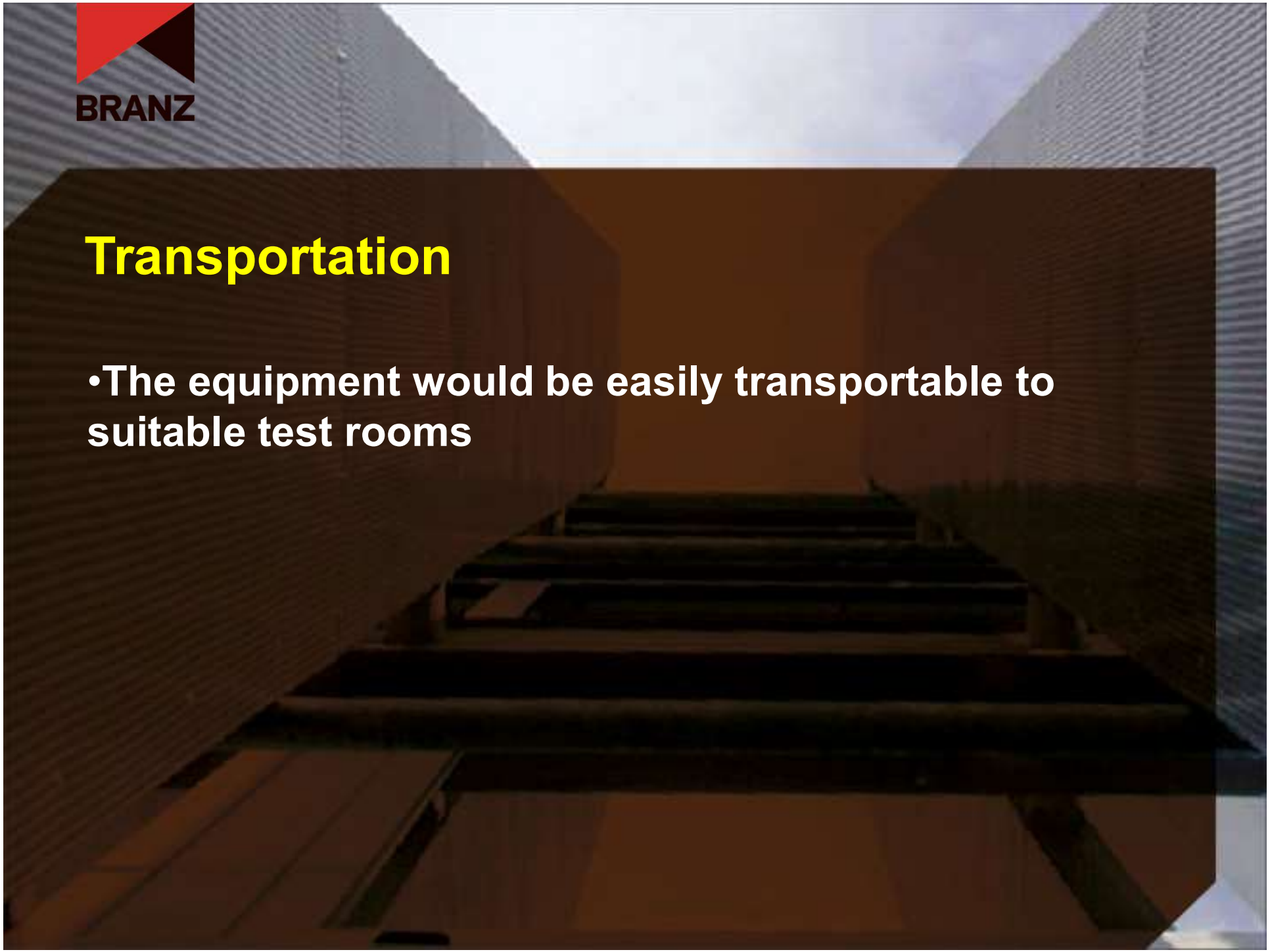
# Heating Method 2

- A simpler, and cheaper, power supply that has a much more complicated heating element design and control process. It would also require an 8 channel digital output unit. (BRANZ uses this design in the metering box for its Guarded Hot Box Apparatus)



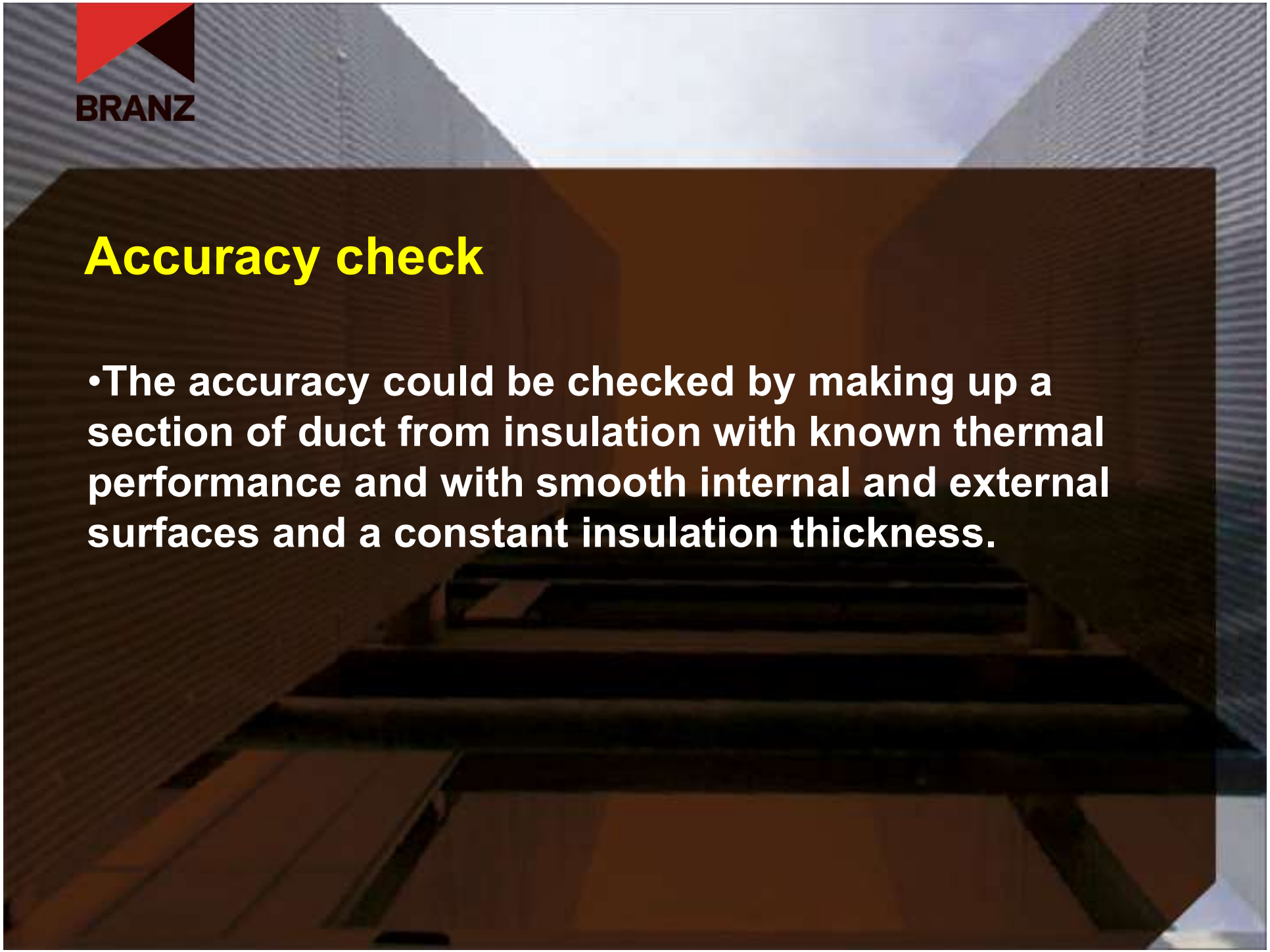

# Data acquisition and control methods

- The data acquisition and control equipment needs to be USB interface based so that cards do not need to be installed into the computer, enabling easy replacement of the computer and allows the optional use of a laptop.



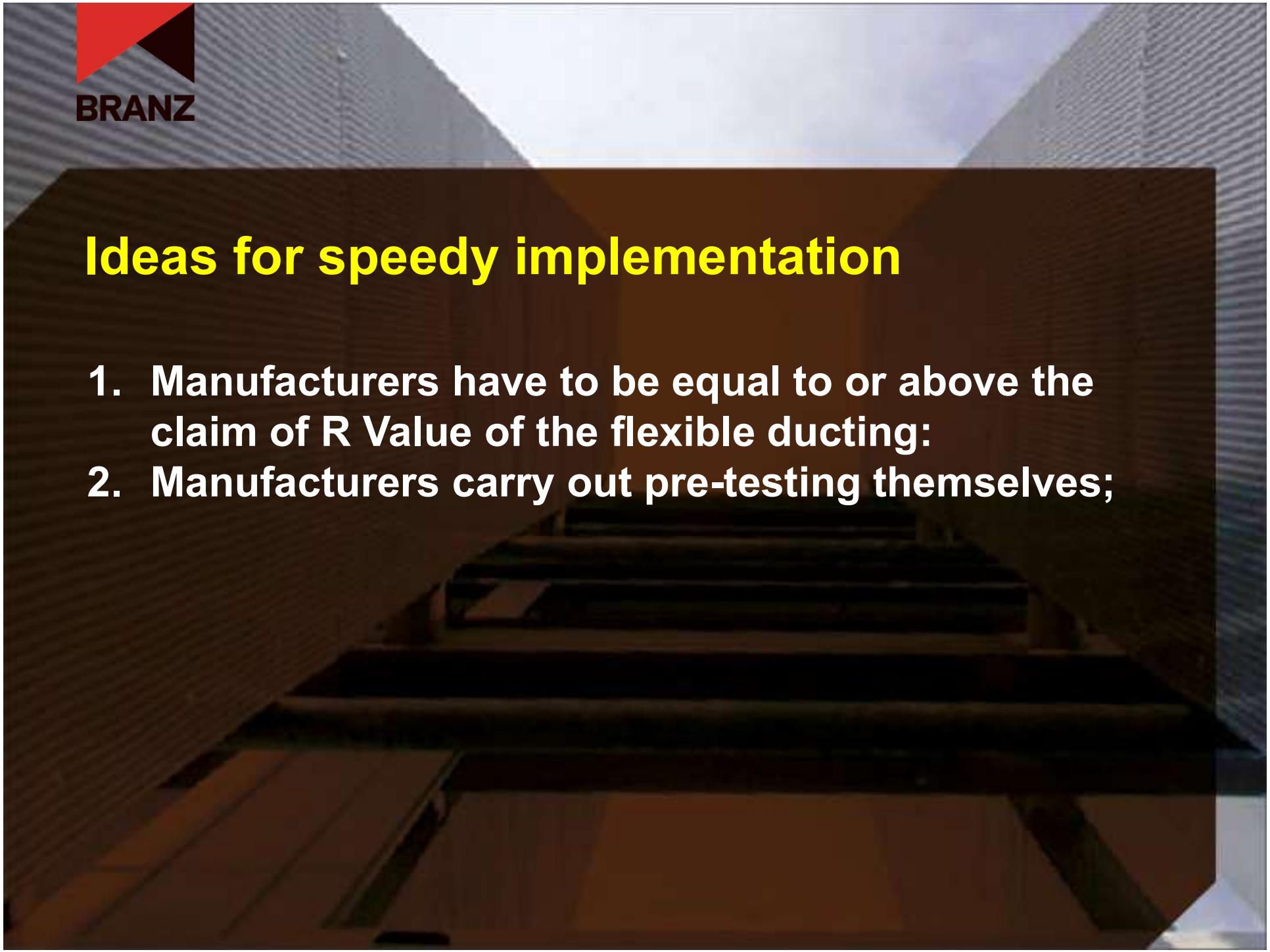
# Transportation

- The equipment would be easily transportable to suitable test rooms



# Accuracy check

- The accuracy could be checked by making up a section of duct from insulation with known thermal performance and with smooth internal and external surfaces and a constant insulation thickness.




# Ideas for speedy implementation

1. Manufacturers have to be equal to or above the claim of R Value of the flexible ducting:
2. Manufacturers carry out pre-testing themselves;