

EUROPEAN UNION
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ESF II project of the University of West Bohemia in Pilsen

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Induction heating of billets

Induction heating can be used in many applications for various forms of heat treatment of metals. For example, surface hardening. The frequency can be varied between surface hardening and induction heating.

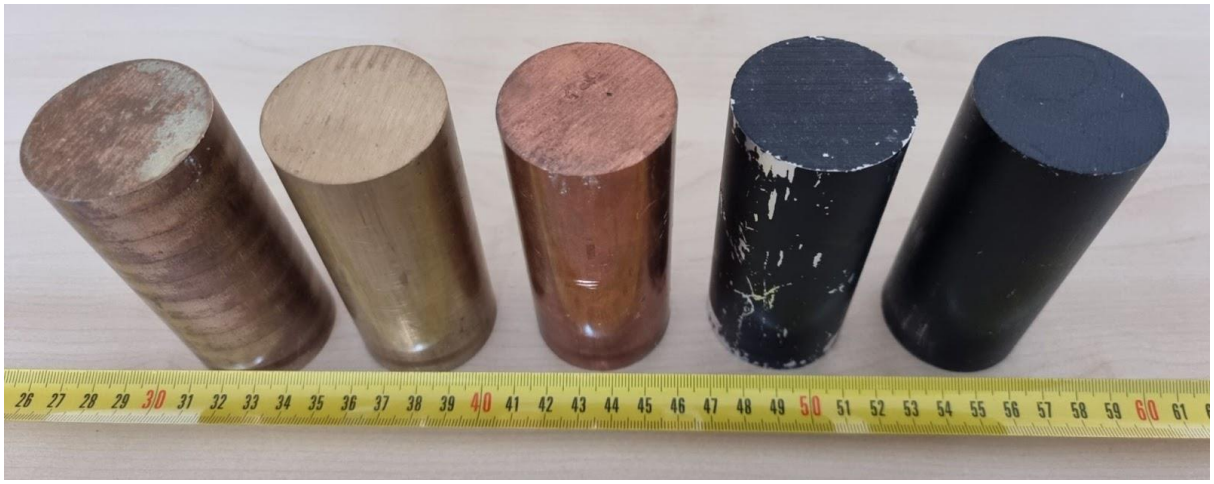


Fig. 1: Rods of different materials, all with a hole drilled in the axis of symmetry for the insertion of a temperature sensor

Measurement objectives:

- Based on the knowledge of the power input and losses of the Linn HTG 3000 high frequency inverter, determine the power transferred to the load.
- Based on the measurements taken, determine the specific material of each cylindrical charge.
- Keep the obtained data as a reference for your future numerical models.

Assignment - Experiment:

1. Using an IET Labs 7000 plus RLC meter, measure the R and L magnitudes for an empty inductor and 5 charges (steel-EN C45, aluminum-AlCu4PbMg, copper-Cu-ETP, brass-CuZn40Pb2, bronze-CuSn8) inside a Linn Di55 inductor. Measure R and L in the range 150 - 250 kHz and then calculate their corresponding impedance.
2. Heat 4 dimensionally identical blackened cylindrical charges of different materials (aluminium-AlCu4PbMg, copper-Cu-ETP, brass-CuZn40Pb2, bronze-CuSn8) to the specified temperature XX in their axis of symmetry using a Linn HTG 3000 high-frequency inverter.
3. During heating, monitor the input electrical parameters using a Fluke 437 II network analyzer. Determine the input power of the frequency converter.
4. Use an oscilloscope to monitor the electrical quantities (current and voltage) on the inductor and also on the DC circuit of the Linn HTG 3000 high frequency inverter.
5. Monitor the flow and temperature waveforms of the input and output coolant of the Linn HTG 3000 HF converter using the NI component-based measurement setup and LabView software. Measure the temperature at the center of the axis of symmetry of the cylindrical charges as well as the surface temperature at a point of your choice using a pyrometer. Determine the losses of the Linn HTG 3000 high frequency converter.

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6. Measure and record the surface temperature of all inserts with the IRCAM InfraTec VarioCAM HD research 980 IR camera.
7. Monitor the magnitude of magnetic induction at any suitable location using the NARDA ELT-400 EMF scatter probe.

Instruments and equipment used:

- Linn HTG 3000 high frequency transducer
- RLC meter IET Labs 7000 plus
- Tektronix DPO5204B oscilloscope (2 current, 2 voltage probes)
- IRCAM InfraTec VarioCAM HD research 980
- CRio + measurement cards for measuring temperature inside the plant, water temperature, water flow rate, surface temperature using a pyrometer
- Probe for measuring scattered EMF NARDA ELT-400
- Fluke 437 II network analyzer

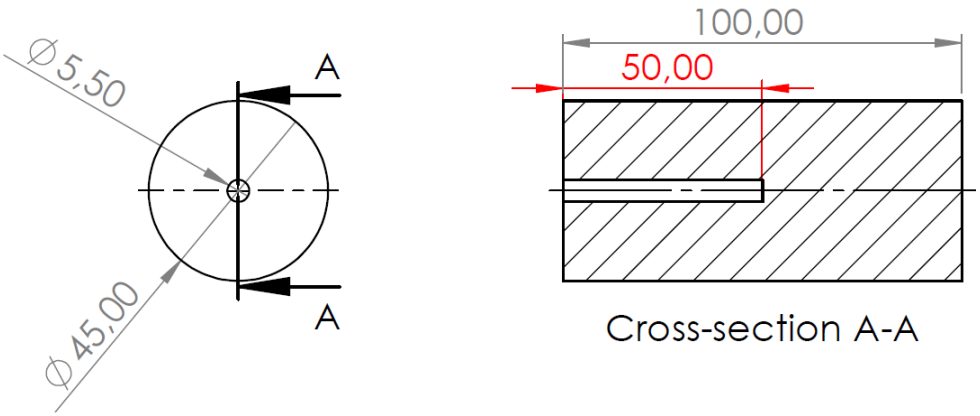


Fig. 2: Dimensions of all charges - they are identical

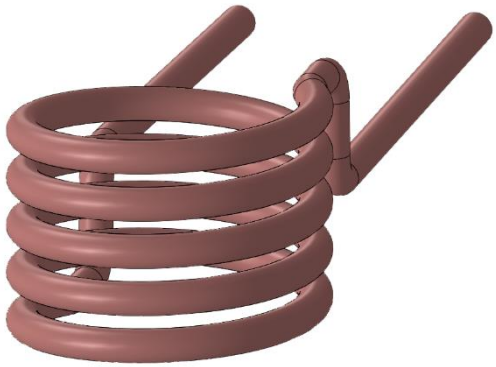


Fig. 3:Inductor: internal diameter of the inductor is 55 mm, the height of the threads is 40 mm and the diameter of the inductor tube is 6/4 mm, the length of the pins is 90 mm.