

Hall 9

Chillventa Specialist Forums 2022
Chillventa Fachforen 2022

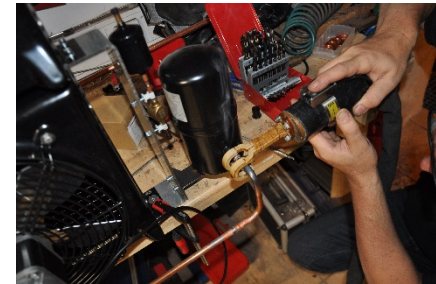
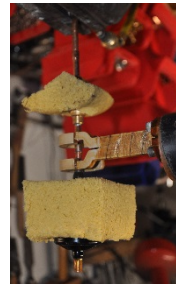
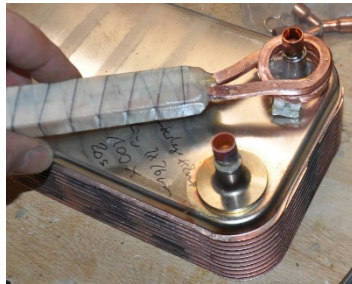
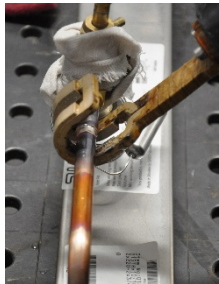
**CONNECTING
EXPERTS.**



NürnbergMesse, Arbeitstitel, Datum

Brazing of Mixed Joints with Penetration Depth Induction

Process reliability und energy efficiency – not only but also when brazing stainless steel – copper joints



Dipl.-Ing. Thomas Vauderwange IWE

VauQuadrat GmbH



- Thomas Vauderwange, born 1968
- Dipl.-Ing. (univ) Aerospace Engineering
- MBA
- International welding engineer
- Kältetechnik Kat. I
- Numerous publications, two textbooks
- Founder and Managing Director VauQuadrat
- Five Patents, four Innovation Awards
- Inventing „Penetration Depth Induction“ applications for all kinds of joining applications since 2009.



The Challenges

- Brazing with a torch – even with OxyPropane – is extremely demanding concerning handcraft skills, especially if stainless steel is involved
- In the worst case, flux will make for a seemingly leak free joint that can pass pressure test, but leaks over time when humidity dissolves flux
- The brazing materials (high silver contents) are expensive, reliable dosing would help
- Rework for flux removal is tedious and time consuming
- Brazer qualification test and process test are both just spotlights, many factors endanger repeatability!
- Could „Induction“ be a solution?

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Induction: Pest and Cholera...

Low Working Frequency

- Greater penetration depth
- Weak field concentration
- „Tame“ surface temperatures
- Big stray areas – low efficiency
- Large electromagnetic danger zones

(2013/35/EU)

High Working Frequency / Resonant induction

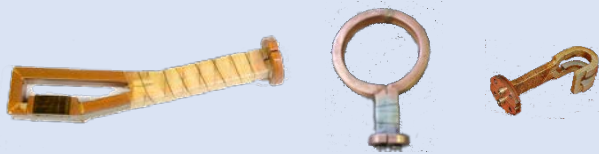
- Smaller penetration depth
- Strong field concentration
- Runaway surface temperatures
- Small stray areas
- Small electromagnetic danger zones



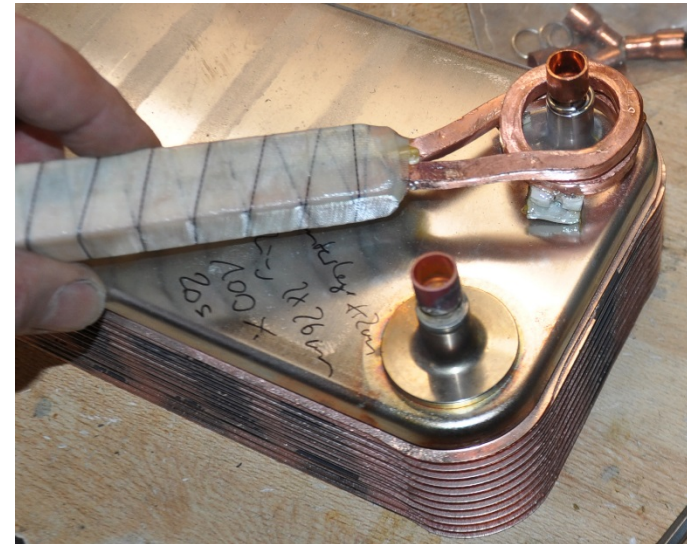
Penetration Depth Induction?



- Basically mid-frequency (e.g. 15,8kHz)
- Extremely high field concentration
- Both penetration depth AND small danger zone
- Surface temperatures under control
- Works both with core losses on ferritic materials AND eddy currents -> useable on non-magnetisable metals like copper, brass, stainless steels
- Inductors with ring, hook, and/or field enhancer



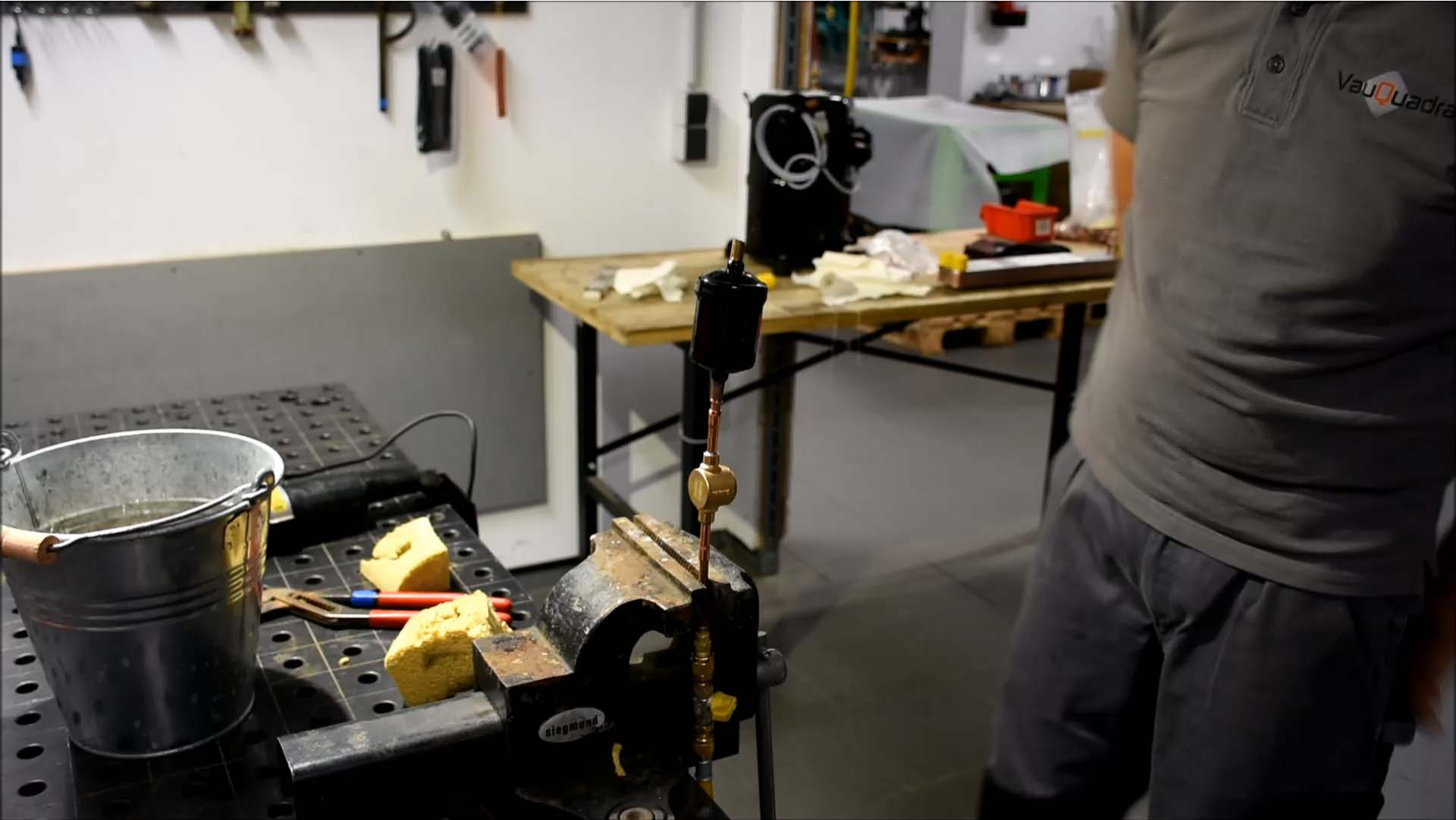
- Ring inductor or „Hookyductor“ for uniformity of heating
- Normally two-phase purely timer-controlled
- No preparation needed except clean, blank surface
- Special high silver cored wire rings, or Phosphorous solder rings
- Inside protected by Forming gas 90/10
- Critical zones get additional protection by wet cloth or sponge
- Quench with dripping wet cloth afterwards
- Visual inspection criteria: 100% perfect
Lower gap completely filled
- The chillers that form the lower part of VauQuadrat's V series units are completely brazed with penetration depth induction, no flame!



Case study 1: Copper fitting 22mm on plate heat exchanger



Case study 2: Dryer-Sightglass-combination with Hookyductor and Phosphorous solder ring



Case study 3: Copper Tee 12mm on condenser assembly





VauQuadrat V4

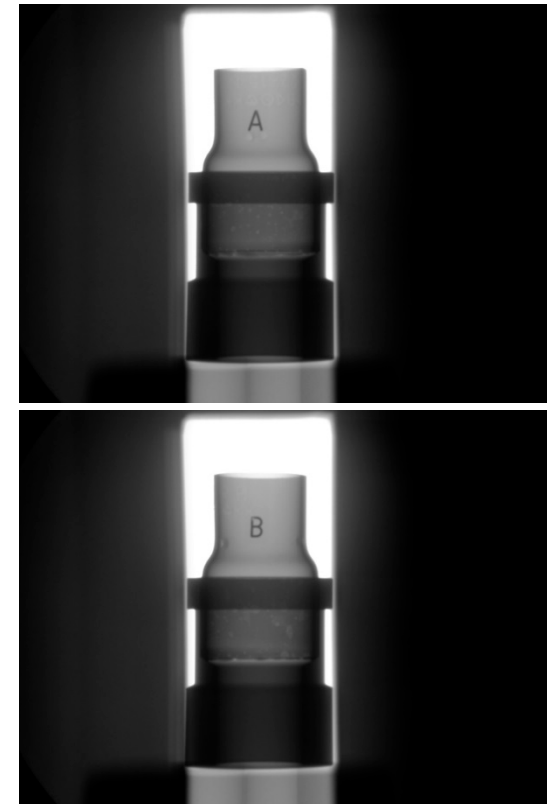


VauQuadrat V7S



VauQuadrat V7 / V7B

- Penetration depth provides a more stable process
 - Probably a decisive advantage is to be able to heat copper actively through a layer of stainless steel
 - Cored wire brazing ring VQBRAZE 56 contains the perfect amount of flux – minimum rework
 - Process development and process qualification with minimum effort
 - Much easier to train and qualify personnel
 - There's potential for automation
-
- At VauQuadrat's chiller manufacturing: In the fourth year after start of in-house production, there is still zero leaks in the R455A chillers of the Penetration Depth Induction units



Thanks for listening.



VauQuadrat GmbH --- The waterfall of innovations

Your questions?

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