

## Brazing recommendation Wieland K65

In the refrigeration industry, copper materials are brazed with copper-phosphoric alloys (CuP), silver-copper-phosphoric alloys (AgCuP) or cadmium-free silver brazing alloys. The new copper material K65 was developed for applications with high-pressure refrigerants (R410A, CO<sub>2</sub>.) as opposed to the conventional Cu-DHP (99.9% Cu), this material is a CuFe2P alloy.

The alloy composition of K65 may be used for brazing with silver brazing alloys without any restrictions.

Owing to formation of brittle phosphorous containing phases, AgCuP and CuP-brazing filler metals are not suited for applications with steel (Fe) and nickel alloys. A laboratory test was made to determine if brazing of K65 with AgCuP or CuP brazing alloys causes formation of brittle iron-phosphoric phases which might impair joining stability.

### 1) Recommendation

The examination (compare to chapter 2) showed that the composition of the K65 material is not subject to any restrictions as concerns the selection of brazing alloy. The base material's range of application is comparable to that of Cu-DHP. In the presence of significant overlapping lengths, it might be advisable to use the BrazeTec h paste flux for better gap filling.

The recommended brazing alloys are listed in chart 1. In addition to the brazing alloys admissible under DVGW worksheet GW 2 for gas and domestic water installations, the list also encompasses BrazeTec S 5 and BrazeTec S 15, which may also be used in the refrigeration industry. The listed silver brazing alloys BrazeTec 5600, BrazeTec 4576, BrazeTec 3476 and BrazeTec 4404 must always be processed with the flux BrazeTec h paste.

In case of brazing of stainless steel, the use of black/brown flux BrazeTec spezial h is recommended.

The selection of brazing alloy depends also on other factors (vibration, operating temperatures) and must be clarified with the brazing alloy supplier for each specific application.

Chart 1: Recommended brazing alloys.

Brazing alloy	DIN EN ISO 17672	AWS 5.8	Brazing temperature Ca. [°C]	Composition [% by weight]				
				Ag	Cu	Zn	Sn	P
BrazeTec 5600	Ag 156	BAG-7	630	56	22	17	5	-
BrazeTec 4576	Ag 145	BAG-36	670	45	27	25,5	2,5	-
BrazeTec 3476	Ag 134	-	710	34	36	27,5	2,5	-
BrazeTec 4404	Ag 244	-	730	44	30	26	-	-
BrazeTec S 15	CuP 284	BCuP-5	700	15	80	-	-	5.0
BrazeTec S 5	CuP 281a	-	710	5	89	-	-	6.0
BrazeTec S 2	CuP 279	-	740	2	91,7	-	-	6.3

Chart 2: Recommended flux.

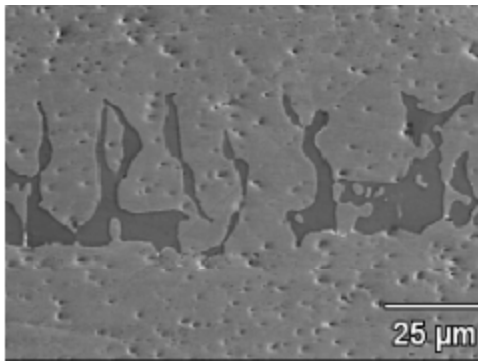
Flux	DIN EN 1045	AWS 5.31	Active temperature Ca. [°C]	Annotations
BrazeTec h	FH 10	FB3-A	550 -970	Flux residues are corrosive and must be removed.
BrazeTec spezial h	FH12	FB3-C	520 - 1030	

Chart 3: Recommended brazing filler metal and fluxes for base material combination

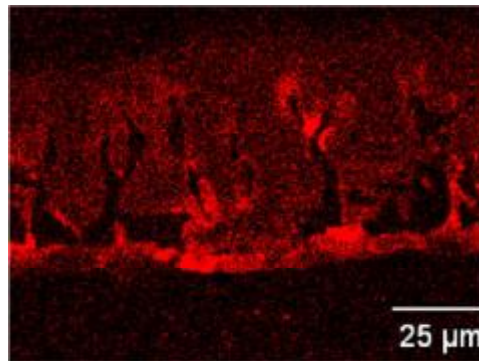
	Copper (K65)	Brass	Steel	Stainless steel
Copper (K65)	BrazeTec S 2 BrazeTec S 5 BrazeTec S 15 BrazeTec 5600 + BrazeTec h BrazeTec 4576 + BrazeTec h BrazeTec 3476 + BrazeTec h BrazeTec 4404 + BrazeTec h	BrazeTec S 2 + BrazeTec h BrazeTec S 5 + BrazeTec h BrazeTec S 15 + BrazeTec h BrazeTec 5600 + BrazeTec h BrazeTec 4576 + BrazeTec h BrazeTec 3476 + BrazeTec h BrazeTec 4404 + BrazeTec h	BrazeTec 5600 + BrazeTec h BrazeTec 4576 + BrazeTec h BrazeTec 3476 + BrazeTec h BrazeTec 4404 + BrazeTec h	BrazeTec 5600 + BrazeTec spezial h
Brass	-	BrazeTec S 2 + BrazeTec h BrazeTec S 5 + BrazeTec h BrazeTec S 15 + BrazeTec h BrazeTec 5600 + BrazeTec h BrazeTec 4576 + BrazeTec h BrazeTec 3476 + BrazeTec h BrazeTec 4404 + BrazeTec h	BrazeTec 5600 + BrazeTec h BrazeTec 4576 + BrazeTec h BrazeTec 3476 + BrazeTec h BrazeTec 4404 + BrazeTec h	BrazeTec 5600 + BrazeTec spezial h
Steel	-	-	BrazeTec 5600 + BrazeTec h BrazeTec 4576 + BrazeTec h BrazeTec 3476 + BrazeTec h BrazeTec 4404 + BrazeTec h	BrazeTec 5600 + BrazeTec spezial h

## 2) Laboratory test

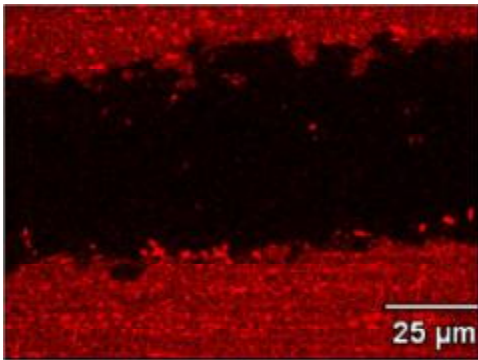
The material K65 was brazed with the brazing alloy BrazeTec S 2 (AgCuP) and the brazing specimen was then examined under an X-ray spectrograph (WDX). No iron-phosphoric phases were detected.



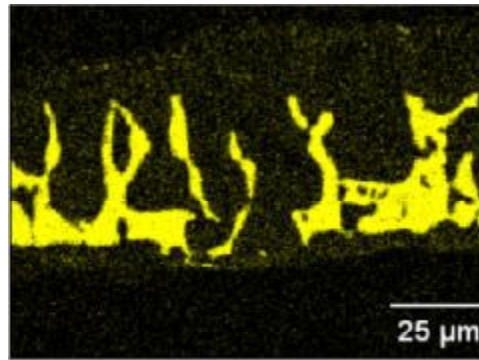
Examined cut



Dispersion of silver



Dispersion of iron



Dispersion of phosphor