

Examples of good and poor terminal lug and compression quality

Aim

To demonstrate acceptable copper tube terminal lug crimping quality in terms of:

- Tube size and cross sectional area
- Material hardness
- Crimped joint characteristics

Method

A competitor's terminal lug designed to accept 95sqmm conductor was reviewed and compared with Cembre terminal lug ref. A19-M12.

Results

Terminal lug characteristics are summarised in Table 1.

Terminal lug ref.	I.D (mm)	Barrel cross sectional area (sqmm)	% of nom. conductor CSA	Hardness (Hv10)		Fully annealed
				Barrel	Palm	
'95-14'	13.4	80.6	85	52.7	74.2	No
A19-M12	13.5	97.4	103	51.1	52.4	Yes

Table 1. Terminal lug comparison

- Barrel cross section of the competitor terminal lug is less than the cross sectional area of the conductor. This results in a lower current carrying capacity and potentially higher temperatures, generated during current flow.
- Palm hardness of competitor terminal lug is approximately 'half hard' indicating that products are not fully annealed after palm pressing. Residual stresses are still present within the palm area, which may lead to material fracture.
- A fully annealed terminal lug ensures better mechanical performance and improved electrical contact at the interface.

Examples of poor quality crimped joints



Figure 1. Over-crimped condition

- Die set profile too small – mismatched dies
- Excess flash generated as copper is extruded from the die area
- Electrical and mechanical performance compromised
- Crimp does not conform to BS 7609:1992



Figure 2. Under-crimped condition

- Die profile too large – mismatched dies
- Insufficient deformation of terminal lug barrel to achieve effective filling ratio and compression
- Electrical and mechanical performance compromised

Example of good quality crimped joint



Figure 3. Correctly crimped joint

- Correctly matched die set to terminal lug
- Correct filling ratio
- Best condition for conforming electrical and mechanical performance

Crimp and terminal characteristics:

Poor quality terminal lug



No die set code to match against terminal lug and ensure quality crimp achieved (BS7609 requirement)

No manufacturer logo for traceability purposes

Figure 4. Poor quality terminal lug and crimp

Good quality terminal lug



Die set code marked on die to leave impression on terminal lug barrel. Can be matched against terminal lug type for quality inspection

Manufacturers logo and associated markings to provide information concerning conductor size and stud fixing

Figure 5. Cembre terminal lug and crimp

Additional comparisons:

1. 400sqmm terminal lugs



**Figure 6. Tube cross section difference. Competitor's terminal lug on left, Cembre lug on right.
Competitor's terminal lug cross section contains 38% less copper than Cembre lug.**



Figure 7. Physical differences between terminal lugs for identical conductor CSA



Figure 8. Palm thickness of Cembre terminal lug offers increased mechanical performance

2. 500sqmm terminal lugs



Figure 9. Competitor's terminal lug cross section contains 37% less copper than Cembre lug.



Figure 10. Physical differences between terminal lugs for identical conductor CSA



Figure 11. Palm thickness of Cembre terminal lug offers increased mechanical performance