



Internal information

Instruction

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KTS002-Copper Components for Canisters

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1. Purpose

Copper blanks for lids or bases are manufactured by forging, and seamless copper tubes are produced by the pierce and draw process, extrusion or forging. This technical specification, KTS002, defines technical requirements and documentation routines for those components.

Note: An alternative tube manufacturing process includes roll forming and longitudinal welding of copper plate. When applicable, details of the process will be specified separately.

2. Requirements

2.1 Quality plan

A quality plan¹ shall be established by the manufacturer and accepted by SKB prior to production of copper blanks for lids or bases and seamless copper tubes.

2.2 Material specification

The starting copper billet and ingot material for hot working to components for canisters shall fulfil requirements in a separate specification².

2.3 Grain size and mechanical properties

Forged copper blanks and seamless copper tubes shall have a grain size less than the limit specified in Table 1. The grain size is to be determined according to EN ISO 2624³, using the comparison, intercept or planimetric procedure.

Note: The standard grain size chart for the comparison method showing the structure for 0,120 mm (120 µm) average grain diameter at 75x magnification can be used for 360 µm grain size at 25x magnification.

2.4 Macroscopic discontinuities

Experience is being collected to determine acceptance criteria for internal and surface defects of copper blanks and tubes. See also 5.1.

Table 1. Requirements and comments concerning grain size and mechanical properties in hot formed material.

Property	Specification	Comments
Microstructure in forged copper blanks	Grain size < 360 µm	This grain size gives a resolution at ultrasonic testing comparable to X-ray testing of 50 mm thick copper.
Microstructure in seamless copper tubes	Grain size < 360 µm	Same comment as above.
Ductility	Elongation > 40% RT–100°C	The canister will be deformed 4% in final repository.
Creep ductility	Elongation at creeprupture > 10% RT–100°C	Same comment as above.

2.5 Size, shape and tolerances

Forged copper blank for base or lid

Size, shape, surface condition and tolerances according to the SKB order and applicable drawing.

Seamless copper tube

Length, diameter, wall thickness, surface condition and tolerances according to the SKB order and applicable drawing.

2.6 Identification marking

Each forged copper blank or copper tube shall be marked in accordance with requirements in the SKB order and applicable procedure⁴.

3. Hot forming process

The hot forming process shall be performed in such a manner that the specified properties of the delivered product are met. The process shall be controlled and documented by the manufacturer of copper blanks or tubes to the extent necessary for ensuring reproducibility. It shall be ensured that appropriate, identified tools or equipment are selected and used. This shall be suitably documented.

Note: If an accepted ingot shows minor line cracks, pores or other inhomogeneities in one end surface, that end shall be the base end when upset forging and piercing is applied.

4. Machining

4.1 Copper lid

Machining of each blank for copper lids shall be performed in accordance with applicable SKB drawings, normally in two steps, pre-machining to a rough shape and final machining to the end shape.

4.2 Copper base

Machining of each blank for copper bases shall be performed in accordance with applicable SKB drawings normally in two steps, pre-machining to a rough shape and machining to the shape necessary for welding.

Final machining shall be carried out after welding of the base to the copper tube in accordance with applicable SKB drawings.

4.3 Copper tube

Machining of all surfaces of each copper tube shall be performed after hot forming to size and shape as stated in applicable SKB drawings. When welding of base to the tube is applied (such as for extruded or forged tube), the final machining of the top end shall be performed after the base-to-tube welding, since the tube length may be affected by the welding.

5. Inspection and testing

5.1 Visual inspection and non-destructive testing

The copper blank or tube shall be inspected visually and by 100% non-destructive testing. Experience is being collected to determine methods to be applied, sizes and shapes of reference defects, which will be stated in separate procedures. Result of the examination shall be recorded.

5.2 Sampling for determination of mechanical properties and structure

All sampling is to be described or referenced in the quality plan in agreement with SKB⁵.

5.3 Mechanical properties

Test pieces for tensile testing ($R_{p0.2}$; R_m ; A_5) preferably according to EN 10002-1⁶, shall be taken from tubes and from blanks for lids and bases as specified by SKB.

Tensile testing shall be performed in accordance with EN 10002-1 by an accredited laboratory or by a laboratory meeting at least ISO 9001⁷ requirements with exclusion of clause 7.3, if this clause is not applicable. Test records shall be retained.

5.4 Structure

Specimens shall be taken from both ends of each tube for grain size/structure inspection. For similar purpose, samples of specimens from blanks shall be taken as specified in the SKB order. The structure shall be documented by photos at approximately 25x magnification.

Blank for lid or base

Grain size/structure shall be determined close to the surface or rim and also, when specified in the SKB order, in the centre of the material. The centre part refers to the surface of the blank centre.

Tube

Grain size/structure shall be determined at both tube ends close to the envelope surface and also in the centre (in thickness direction) of the material, unless otherwise specified in the SKB order.

Experience is being collected regarding the possibility to determine the copper grain size from ultrasonic parameters (damping).

5.5 Photographic documentation

The production sequence shall be photographically documented when required by SKB. The extent is to be agreed with SKB from case to case.

6. Nonconformities

Any deviation, e.g. from specified shape or size or any other significant deviation from requirements shall immediately be reported in accordance with the manufacturer's quality management system. This party shall consult with SKB for decision about suitable action.

7. Request for concession

Any request for concession⁸ shall be documented on SKB form⁹ or similar and sent to SKB.

8. Manufacturer's documentation

8.1 Quality plan

The quality plan¹ according to 2.1 shall be completed and submitted to SKB.

8.2 Material certificate

The copper blank or copper tube manufacturer shall issue a certificate according to

EN 10204, 3.1¹⁰, or declaration of conformity according to EN 1655 Type C or D¹¹, stating or including as a minimum:

- the manufacturer's name and address,
- date of issue,
- SKB order number,
- applicable SKB drawing and specification numbers, including revisions,
- original heat or cast number,
- lot number and/or number of the blank or tube,
- dimensions of the blank or tube,
- results of non-destructive testing,
- results of tensile testing when applicable, and determination of grain size and structure,
- illustrated description of sampling⁵,
- a declaration that the component has been produced in accordance with the company's own current quality system and quality plan, both to be accepted by SKB,
- any other requirement specified in the SKB order.

8.3 Submission of documents and information

Any request for concession, the certification according to 8.2 and request for delivery permit¹² shall be sent to SKB for authorization prior to delivery of the blank or tube.

SKB shall be informed when ingots or billets arrive and when shipping of blanks or tubes takes place.

The supplier shall, without delay, give complete information to SKB on all observations and other circumstances in connection with the production, which may influence the design and properties of the components and/or the copper canister. SKB shall have the right to use this information without any restriction.

8.4 Retention of documentation

PE, Projekt Engineer, is responsible for the retention of documentation according to sections 2, 3, 4, 5, 6, 7 and 8 described in a separate procedure¹³.

QA Co-ordinator Canister Manufacturing Technique, QASK, is to be informed by PE if nonconformities according to section 6 occurs.

The manufacturer shall retain the documentation according to sections 5.1, 5.2, 8.1 and 8.2 for (presently) at least 10 years under suitable security. If any records are stored on electronic/magnetic media the readability shall be ensured for this time period.

9. Retention of test samples

SKB is to retain samples for determination of microstructure and, when applicable, tensile properties for (presently) minimum 10 years under suitable conditions. The identification of samples shall be maintained

10. Document control

QA Co-ordinator Canister Manufacturing Technique is responsible for document control, including distribution, of this technical specification¹⁴.

Revision record

Revision	Date	Revision includes	Author	Reviewed	Approved
2.0	2005-06-01		MWn	LW/PEr	NLe
3.0	2007-08-13	Responsibility for retention of documents shifted to PE. SKB retains the test samples	GH	See SKB doc	
4.0	2007-11-22	A50 changed to A ₅	GH	See SKB doc	
5.0	2008-04-08	EN10204-1995 ersatt med EN10204-2005, 3.1B ersatt med 3.1-intyg	GH	Se SKBdoc	

Footnotes

1. SKB Procedure KT0704, Requirements on 1) Quality plan, 2) Manufacturing and inspection plan
2. SKB Technical Specification KTS001, Copper ingots and billets for canister components
3. EN ISO 2624:1995, Copper and copper alloys – Estimation of average grain size
4. SKB Procedure KT0705, Identification of canister components and assembled canisters
5. Requirements on sampling, including sample positions, may be added in a later revision of this document.
6. EN 10002-1:2001 – Metallic materials – Tensile testing
7. ISO 9001:2000, Quality management systems – Requirements
8. SKB Procedure KT1102, Supplier's request for concession
9. SKB Form KTF11-1 or KTF11-2
10. EN 10204:2005, Metallic products – Types of inspection documents
11. EN 1655:1997, Copper and copper alloys – Declaration of conformity
12. SKB Form KTF07-7 or KTF07-8 or similar
13. SKB Procedure KT1002, Retention of quality documents and records
14. SKB Procedure KT1001, Establishing and control of SKB technical specifications, procedures and forms