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KTS001-Copper ingots and billets for canister components

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1. Purpose

Copper ingots and billets are used for production of copper components to canisters¹. This technical specification, KTS001, defines technical requirements and documentation procedures for copper ingots, including continuously cast billets, for this purpose.

Note: The term ingot may be replaced by billet, depending on the producer's method and terminology.

2. Requirements

2.1 Quality plan

A quality plan² shall be established by the producer and accepted by SKB prior to production of copper ingots and billets.

2.2 Material specification

The material for copper canisters shall fulfil the specification in EN 1976:1998³ for the grades Cu-OFE (Table 2) or Cu-OF1 (Table 3) with the following additional requirements: O < 5 ppm, P 30–70 ppm, H < 0,6 ppm, S < 8 ppm.

2.3 Chemical composition

Table 1. Requirements and comments concerning various properties

Property	Specification	Comments
Weldability	O < 5 ppm	Higher levels give a reduced weldability.
Ductility	H < 0,6 ppm	Higher levels give reduced mechanical properties. (Hydrogen embrittlement).
Tensile strength, ductility	S < 8 ppm	Higher levels give reduced mechanical properties caused by non-dissolved sulphur which will be concentrated to grain boundaries.
Creep ductility	P 30–70 ppm	A phosphorus content of this order reduces the influence of sulphur impurities, increases creep ductility, increases recrystallisation temperature and has a minor influence on the weldability.

Note: The P content in Table 1 is required for the canister application. It is substantially higher than in the standard referred to in Table 2 on the next page.

Table 2. EN 1976 Cu-OFE composition (UNS C10100⁴)

Element	Cu %	Ag ppm ^{b)}	As ^	Fe	S	Sb	Se	Te	Pb
	99,99 ^{a)}	25	5	10	15	4	3	2	5
	P ppm ^{b)} ^	Bi	Cd	Mn	Hg	Ni	O	Sn	Zn
	3	1	1	0,5	1	10	5	2	1

Table 3. EN 1976 Cu-OF1 composition

Element	Cu (rem.)	Ag ppm	As ^	Fe	S	Sb	Se	Te	Pb
		25 ^{b)}	5 ^{c)}	10 ^{d)}	15 ^{b)}	4 ^{b)}	2 ^{e)}	2 ^{f)}	5 ^{b)}

- a) Including Ag
b) Maximum content
c) $\Sigma \text{As} + \text{Cd} + \text{Cr} + \text{Mn} + \text{Sb} \leq 15 \text{ ppm}$

- d) $\Sigma \text{Co} + \text{Fe} + \text{Ni} + \text{Si} + \text{Sn} + \text{Zn} \leq 20 \text{ ppm}$
- e) $\Sigma \text{Bi} + \text{Se} + \text{Te} \leq 3 \text{ ppm}$
- f) $\Sigma \text{Se} + \text{Te} \leq 3,0 \text{ ppm}$

2.4 Weight, size and surface condition

Delivery net weight per piece, size and surface condition of ingots and continuously cast billets shall be as stated in the SKB order.

2.5 Macroscopic discontinuities

Experience is being collected to determine permissible types and extent of discontinuities. Possible acceptance is yet to be agreed with SKB case by case when discontinuities appear.

2.6 Identification marking

Each copper ingot or continuously cast billet shall be marked with the producer's cast number and any additional requirements in the SKB order. The top end of each ingot intended for tubes shall be marked TOP. No marking is needed on the bottom end.

2.7 Sampling

Sampling for chemical analysis and any other testing shall be described by the manufacturer and be made available to SKB.

2.8 Ingots

Samples shall be taken from representative material of cut-off ends.

2.9 Continuously cast billets

The manufacturer's normal sampling method shall be applied. Additional samples for P test shall be taken at least from the start and final ends of a casting intended for forged blanks, unless other sampling is agreed with SKB.

3. Inspection and testing

3.1 Chemical analysis

The analysis shall be performed in accordance with industry practice by an accredited laboratory or by a laboratory meeting ISO 9001:2000⁵ requirements.

Laboratory reference material shall be traceable to accredited sources and its identity and use for the analysis shall be recorded.

3.2 Visual inspection

The manufacturer shall inspect the ingots and billets visually for surface defects, for example cracks or flaws, particularly at the centre of the ingot end surfaces. The result shall be recorded and sent to SKB for possible acceptance prior to delivery.

Any further inspection as specified in the SKB order.

4. Nonconformities

Any deviation, e.g. from specified weight, size, surface condition 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.

5. Request for concession

Any request for concession ⁶ shall be documented on SKB form ⁷ or similar and sent to SKB.

6. Supplier's documentation

6.1 Quality plan

The quality plan ² according to 2.1 shall be completed and submitted to SKB.

6.2 Certification of copper ingots and cast billets

The copper ingot/billet manufacturer shall issue a certificate according to EN 10204 3.1.B ⁸ or declaration of conformity according to EN 1655 Type C or Type D ⁹, stating as a minimum:

- the manufacturer's name and address,
- date of issue,
- SKB order and specification numbers,
- heat or cast number,
- copper ingot or billet dimensions and net weight per piece,
- applicable standard,
- chemical composition,
- result of visual inspection,
- illustrated description or sketch of sampling of solid material,
- a declaration that the material has been produced in accordance with the manufacturer's own current quality system and quality plan, both to be accepted by SKB,
- any other requirement specified in the SKB order.

6.3 Submission of documents and information

Any request for concession, the certificate according to 6.2 and request for delivery permit ¹⁰ shall be sent to SKB by mail or telefax for authorization prior to dispatching the copper ingot or billet for hot working.

SKB shall be informed when the shipping takes place.

The manufacturer 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 copper canister. SKB shall have the right to use this information without any restriction.

6.4 Retention of documentation

PE, Projekt Engineer, is responsible for the retention of documentation according to sections 2, 3, 4, 5, 6.1 and 6.2, described in a separate procedure ¹¹.

QA Co-ordinator Canister Manufacturing Technique, QASK, is to be informed by PE if nonconformities according to section 4 occurs.

The manufacturer shall retain the documentation according to sections 2.7 and 3.1 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.

7. Retention of test samples

SKB shall retain samples for determination of the chemical composition for (presently) minimum 10 years under suitable conditions. Identifiable samples from ingots and billets is to be sent by the supplier to SKB.

8. Document control

QASK is responsible for document control, including distribution, of this technical specification¹².

Revision record

Revision	Date	Revision includes	Author	Reviewed	Approved
5.0	2005-06-01		MWn	LW/PEr	NLe
6.0	2007-08-13	Responsibility for retention of documents changed to PE, test samples to be retained by SKB	GH	See SKBdoc	
7.0	2008-04-08	EN 1976:1998 insatt. Felskrivning EN1975:1988 borttagen.	GH	Se SKBdoc	

Footnotes

1. SKB Technical Specification KTS002, Copper components for canisters
2. SKB Procedure KT0704, Requirements on 1) Quality plan, 2) Manufacturing and inspection plan
3. EN 1976:1998, Copper and copper alloys – Cast unwrought copper products
4. UNS C10100 according to Application Datasheet, Standard Designation for Wrought Alloys, www.copper.org
5. ISO 9001:2000, Quality management systems – Requirements
6. SKB Procedure KT1102, Supplier's request for concession
7. SKB Form KTF11-1 (Eng) or KTF11-2 (Sv)
8. EN 10204:1995, Metallic products – Types of inspection documents
9. EN 1655:1997, Copper and copper alloys – Declaration of conformity
10. SKB Form KTF07-07 (Eng) or KFT07-08 (Sv) or similar
11. SKB Procedure KT1002, Retention of quality documents and records
12. SKB Procedure KT1001, Establishing and control of SKB technical specifications, procedures and forms