



Standard Specification for Nuclear-Grade Silver-Indium-Cadmium Alloy¹

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1. Scope

1.1 This specification covers silver-indium-cadmium alloy for use as a control material in light-water nuclear reactors.

1.2 The scope of this specification excludes the use of this material in applications where material strength of this alloy is a prime requisite. Also, this material must be protected from the primary water by a corrosion and wear resistant cladding.

2. Referenced Documents

2.1 ASTM Standards:

C 760 Test Methods for Chemical and Spectrochemical Analysis of Nuclear-Grade Silver-Indium-Cadmium Alloys²

C 859 Terminology Relating to Nuclear Materials²

E 105 Practice for Probability Sampling of Materials³

2.2 ANSI Standard:

B46.1 Surface Roughness⁴

ANSI/ASME NQA-1 Quality Assurance Program Requirements for Nuclear Facility Applications⁴

2.3 U.S. Government Standard:

Title 10 Code of Federal Regulations, Energy Part 50 (10CFR50) Domestic Licensing of Production and Utilization Facilities⁵

3. Terminology

3.1 Terms shall be defined in accordance with the terminology in Terminology C 859, except for the following:

3.1.1 The term “buyer” shall refer to the organization issuing the purchase order.

3.1.2 The term “seller” shall refer to the silver-indium-cadmium supplier.

3.1.3 A lot shall be defined as all parts produced from the same melt by the same process.

4. Ordering Information

4.1 The buyer shall specify the following information on the order:

4.1.1 Quantity,

4.1.2 Lot size, and

4.1.3 Dimensions and tolerances.

5. Materials and Manufacture

5.1 The identity of each lot by melt number shall be maintained at all stages of manufacture.

5.2 Parts produced to this specification shall be made from billets by hot working and cold finishing to size.

5.3 The cold-finished parts shall be produced to the finish condition and dimensions as specified in the purchase order.

6. Chemical Composition

6.1 The parts shall conform to the following chemical composition:

Element	Weight %
Indium	15.00 \pm 0.25
Cadmium	5.00 \pm 0.25
Total impurities, max	0.50 max
Silver	remainder
Lead	0.03 max
Bismuth	0.03 max

7. Workmanship, Finish, and Appearance

7.1 The surface of the cold-finished part shall be free of oxides, grease, oil, residual lubricants, inclusions, and other extraneous materials.

7.2 Surface defects such as folds, cracks, seams, slivers, and blisters shall be cause for rejection.

7.3 Surface roughness shall be per B46.1 not to exceed 0.81 μm rms (32 μin . rms).

8. Sampling

8.1 A sampling plan to meet the acceptance criteria shall be agreed to between the buyer and the seller. Samples for chemical analysis shall be taken after completion of all hot-working operations. Recommended Practice E 105 is referenced as a guide.

8.2 The sample shall be sufficient to perform quality control tests, acceptance tests and referee tests, as necessary.

8.2.1 Quality control tests,

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² Annual Book of ASTM Standards, Vol 12.01.

³ Annual Book of ASTM Standards, Vol 14.02.

⁴ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁵ Available from U.S. Government Printing Office, North Capital and H Streets NW, Washington, DC 20401.

- 8.2.2 Acceptance tests, and
- 8.2.3 Referee tests.

9. Methods of Chemical Analysis

9.1 Use analytical chemistry methods in accordance with Test Method C 760 or demonstrated equivalent methods agreed upon between the buyer and the seller.

10. Inspection and Certification

10.1 Each part shall be visually inspected for cleanliness and the absence of defects.

10.2 Each part shall be inspected for dimensions as specified in the purchase order.

10.3 The seller shall furnish the buyer with certificates of tests showing the results of testing and inspection performed on each lot prior to shipment.

11. Rejection and Rehearing

11.1 Rejection of a lot or a part for failure to meet this specification shall be reported by the buyer to the seller within 60 calendar days. Rejected material may be returned to the

seller at the seller's expense, unless the buyer receives, within 3 weeks of notice of rejection, other instructions for disposition.

12. Packaging and Package Marking

12.1 Each part shall be individually wrapped or bagged and packed in suitable containers to prevent damage and contamination during shipment and storage.

12.2 The seller will be responsible for designing the shipping container to assure cleanliness, to provide adequate protection against damage during transportation, and to assure reasonable ease of unpackaging.

12.3 Each container shall contain material from only one lot and shall be clearly marked with the following: purchase order number, purchase order specifications, gross, net, and tare weights, lot number, and manufacturer's alloy designation.

13. Quality Assurance

13.1 Quality assurance requirements shall be agreed upon between the buyer and the seller when specified in the purchase order. Code of Federal Regulations, Title 10 Part 50 Appendix B and NQA-1 are referenced as guides.

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