



Designation: F 239 – 81 (Reapproved 1987)

Standard Specification for NICKEL ALLOY CATHODE SLEEVES FOR ELECTRON DEVICES¹

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1. Scope

1.1 This specification covers nickel alloy cathode sleeves, seamless, welded-and-drawn, lockseam, or lapseam, for use as indirectly heated oxide-coated cathodes in electron devices.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards*:

E 39 Methods for Chemical Analysis of Nickel²

E 107 Methods for Chemical Analysis of Electronic Nickel²

E 129 Method for Spectrographic Analysis of Thermionic Nickel Alloys by the Powder Techniques³

E 383 Method for X-Ray Emission Spectrometric Determination of Tungsten in Nickel-Tungsten Alloys⁴

F 128 Methods of Testing Sleeves and Tubing for Electron Tube Cathodes³

3. Ordering Information

3.1 Orders for cathode sleeves furnished to this specification shall include the following information, all dimensions being expressed in inches and decimal parts with metric equivalents:

3.1.1 Method of fabrication,

3.1.2 Alloy grade (Table 1),

3.1.3 Diameter (either outside diameter or inside diameter),

3.1.4 Wall thickness,

3.1.5 Length (expressed in inches and millimetres),

3.1.6 Bead diameter,

3.1.7 Bead location, and

3.1.8 Number of cathode sleeves required.

4. Materials and Manufacture

4.1 The cathode sleeves shall be of such quality, purity, and surface cleanliness (Section 10) that the finished product shall have the properties and characteristics prescribed in this specification.

4.2 The cathode sleeves shall be manufactured by hot working and cold drawing or cold rolling, welding and drawing, or seaming as may be required.

5. Chemical Composition

5.1 *Chemical Composition*—The cathode sleeves shall conform to the requirements as to chemical composition for the particular grade ordered, as prescribed in Table 1.

5.2 *Certification*—The manufacturer of the cathode sleeves shall, upon request, furnish a certified analysis covering the elements, except carbon, listed in Table 1 for the particular grade specified. The carbon content will vary slightly from lot to lot of a heat and for different thicknesses of cathode sleeves. The certificate shall state whether the carbon content is within the limits prescribed for the particular grade specified.

¹ This specification is under the jurisdiction of ASTM Committee F-1 on Electronics, and is the direct responsibility of Subcommittee F01.03 on Metallic Materials.

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² *Annual Book of ASTM Standards*, Vol 03.05.

³ *Annual Book of ASTM Standards*, Vol 10.04.

⁴ *Annual Book of ASTM Standards*, Vol 03.06.



5.3 Chemical Analyses—A chemical analysis shall be made for each heat of cathode nickel. The chemical composition thus determined shall be reported to the purchaser or his representative and shall conform to the requirements prescribed in Table 1 for the designated grade. In the event of disagreement, chemical analysis shall be performed in accordance with one of the following methods:

5.3.1 Methods E 39,

5.3.2 Methods E 107,

5.3.3 Method E 129,

5.3.4 Method E 383, or

5.3.5 X-ray fluorescent or emission heat analyses using standards analyzed by Methods 1, 2, or 3.

6. Heat Approval (Seamless or Welded-and-Drawn Cathode Sleeves)

6.1 When requested by the purchaser, and agreed to by the manufacturer the latter shall advise the purchaser each time a new heat is available. The purchaser shall then advise the manufacturer as to the size of sample required for a heat approval test. Approval of the sample shall constitute approval for the entire heat, but each shipment may be tested by the purchaser for conformance with this specification.

7. Physical Properties

7.1 *Outside Diameter*—The outside diameter shall not vary from that specified by more than the amounts prescribed in Table 2.

7.2 *Inside Diameter*—The generally accepted practice is to specify the inside diameter simply as a minimum since the outside diameter and wall thickness (strip thickness) are adequately controlled. "Go" gage sizes for measuring the inside clearance of cathode sleeves shall be in accordance with the values listed in Table 3.

7.3 *Wall Thickness*—The wall thickness shall not vary from that specified by more than the amounts prescribed in Table 4.

7.4 *Length*—The length of cathode sleeves shall not vary from that specified by more than the amounts prescribed in Table 5.

7.5 *Diameter, Width, and Location of Circumferential Beads*—These sizes and locations vary with the sleeve design, wall thickness and size and shall be as agreed upon between the manufacturer and the purchaser.

7.6 *Integral Tabs*—The basic sizes and tolerances for integral tabs are as shown in Table 6. Special requirements shall be as agreed upon between the manufacturer and the purchaser.

7.7 *Stiffness*—The minimum cold collapse strength of round seamless and lockseam sleeves, measured in grams of collapsing load for a designated span, shall be in accordance with the values listed in Table 7.

NOTE—It is intended that limits for minimum collapse strength will be developed.

7.8 *Seam*—The seam dimensions shall be in accordance with the values listed in Table 8.

8. Number of Tests

8.1 When a stiffness test is required, the number of samples tested shall be as agreed upon between the manufacturer and the purchaser.

9. Test Methods

9.1 The dimensions and physical properties prescribed in this section shall be determined in accordance with Methods F 128. The number of samples tested shall be as agreed upon between the manufacturer and the purchaser. All dimensions and tolerances shown shall be considered as standard and representative of a commercially available product. Special requirements shall be as agreed upon between the manufacturer and the purchaser.

10. Workmanship and Finish

10.1 The surfaces, both inside and outside, of the cathode sleeves shall be smooth, free of oxide, and commercially free of cracks, dents, die and straightening marks, and flakes. The surfaces shall be free of lubricants to a cleanliness standard as agreed upon between the manufacturer and the purchaser.

11. Packaging

11.1 Cathode sleeves shall be packed in suitable type containers and with sufficient spacers or padding, or both, to prevent damage in transit. Spacers, padding, and boxes shall be made from lint-free material.

12. Product Marking

12.1 Each box of cathode sleeves shall be plainly marked with the following information:

12.1.1 Method of fabrication (seamless, lock-



seam, etc.),

12.1.2 Alloy type and grade or commercial designation,

12.1.3 Heat number,

12.1.4 Quantity,

12.1.5 Size (outside diameter, wall thickness, and length) and bead location,

12.1.6 Manufacturer's or purchaser's part number,

12.1.7 Name of manufacturer, and

12.1.8 Identifying date.

13. Inspection and Rejection

13.1 Any boxes of cathode sleeves not conforming to the requirements of this specification may be rejected. If 10 % or more of the boxes fail to conform to this specification the entire shipment may be rejected. The manufacturer shall be notified of any rejection within 4 months from receipt of the material by the purchaser. The acceptable quality level must be subject to prior agreement between the manufacturer and the purchaser.

TABLE 1 Chemical Requirement of Nickel Alloys as Cathode Sleeves of 0.005 in. Wall Thickness or Less

NOTE—All grades except Grade 23 are melted alloys. Grade 23 is produced by powder metallurgy methods.

Grade	Composition, weight %									
	Copper, max	Iron, max	Manganese, max	Carbon, max ^a	Sulfur, max	Titanium, max	Magnesium	Silicon	Tungsten	Nickel + Cobalt, min
Active Alloy Type ^b										
7	0.20	0.20	0.05	0.10	0.008	0.02	0.01-0.10	0.06 max	3.75-4.75	94.25
10	0.10	0.10	0.30	...	0.008	0.005	0.01-0.10	0.10 max	...	99.00
11	0.10	0.10	0.20	...	0.008	0.01-0.05	0.01-0.08	0.01-0.05	...	99.10
Passive Alloy Type ^b										
23 ^c	0.01	0.05	0.003	0.02	0.003	0.005	0.005 max	0.005 max		99.90

^a Electron emission activity of an oxide-coated cathode base material is its relative ability to provide reducing elements to the oxide coating and is measured by the rate at which and the degree to which cathode electron emission develops under controlled conditions.

^b Generally the carbon content of these alloys in the form of lockseam sleeves averages 0.01 % for each 0.001 in. of thickness while seamless sleeves average slightly higher.

^c Grade 23 additional elements (max, %): chromium 0.005, cobalt 0.10.