Designation: A 601 – 96 (Reapproved 2000)

Standard Specification for Electrolytic Manganese Metal[1]

This standard is issued under the fixed designation A 601; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers six grades of electrolytic manganese designated as follows:

	Grade
Regular	A
Intermediate Hydrogen	B
Low Hydrogen	C
4.5 % Nitrogen Bearing	D
6 % Nitrogen Bearing	E
Weld Grade Powder	F

2. Referenced Documents

2.1 *ASTM Standards:*

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications[2]

E 32 Practices for Sampling Ferroalloys and Steel Additives for Determination of Chemical Composition[3]

3. Ordering Information

3.1 Orders for material to this specification shall include the following information:

3.1.1 Quality,

3.1.2 Name of material,

3.1.3 ASTM designation and year of issue,

3.1.4 Grade (see 1.1),

3.1.5 Sizing, if appropriate (Section 6), and

3.1.6 Special requirements for packaging, inspection, analysis reports, etc., as appropriate.

4. Chemical Requirements

4.1 The various grades shall conform to the requirements as to chemical composition specified in Table 1 and Table 2.

4.2 The manufacturer shall furnish an analysis of each shipment showing the elements specified in the applicable table.

5. Size

5.1 The various grades are available in the sizes listed in Table 3.

5.2 The sizes listed in Table 3 are typical as shipped from the manufacturer's plant. These alloys exhibit varying degrees of friability; therefore, some attrition may be expected in transit, storage, and handling (see 5.3).

5.3 *Friability Ratings* (see Appendix):

Grades A, B, C	No. 6
Grades D, E	No. 5

6. Sampling

6.1 The material shall be sampled in accordance with Practices E 32.

6.2 Other methods of sampling that have been agreed upon between the manufacturer and the purchaser may be used. In case of discrepancy, Practices E 32 shall be used for referee.

7. Chemical Analysis

7.1 Chemical procedures for analysis of ferroalloy components are not standardized. The chemical content procedures must be mutually agreed upon between the purchaser and the manufacturer if there are differences in results.

7.2 *Special Analysis Requirements*—Analysis for additional elements other than those listed in Table 1 and Table 2 shall be agreed upon between the purchaser and the manufacturer. Such elements in trace quantities shall be reported as less than "<" the limit of analytical equipment. This shall be mutually agreed upon between the purchaser and the manufacturer.

7.3 For purposes of determining conformance with this specification, the reported analysis shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Practice E 29.

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[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.18 on Castings.

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[2] *Annual Book of ASTM Standards*, Vol 14.02.

[3] *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 1 Chemical Requirements

Element	Composition, %					
	Regular A	Intermediate Hydrogen B	Low Hydrogen C	4.5 % Nitrogen Bearing D	6 % Nitrogen Bearing E	Weld Grade Powder F
Manganese, total	99.5 min	99.5 min	99.5 min	94–95[A]	93–94[A]	99.5 min
Manganese,[B] metallic	99.9 min[A]	99.9 min[A]	99.9 min[A]	[C]	[C]	99.9 min
Sulfur	0.030 max[A]	0.030 max	0.030 max	0.035 max	0.035 max	0.035 max
Hydrogen	0.015 max	0.005 max[A]	0.0010 max[A]	[C]	[C]	0.0030 max[A]
Nitrogen	[C]	[C]	[C]	4.0–5.4[A]	5.5–6.5[A]	[C]

[A] Analysis required with each lot.
[B] Percentage of total as metallic manganese.
[C] No requirement.

TABLE 2 Supplemental Chemical Requirements

Element, max	Composition, max, %					
	Regular A	Intermediate Hydrogen B	Low Hydrogen C	4.5 % Nitrogen Bearing D	6 % Nitrogen Bearing E	Weld Grade Powder F
Iron	0.005	0.005	0.005	0.005	0.005	0.08
Carbon	0.005	0.005	0.005	0.040	0.040	0.010
Phosphorus	0.001	0.001	0.001	0.001	0.001	0.001
Silicon	0.001	0.001	0.001	0.001	0.001	0.001
Aluminum	0.001	0.001	0.001	0.001	0.001	0.001

8. Inspection

8.1 The manufacturer shall afford the inspector representing the purchaser all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification.

9. Rejection

9.1 Any claims of rejections based upon check analysis shall be made to the manufacturer within 45 days from the receipt of the material by the purchasers.

10. Packaging

10.1 When a shipment is made in bulk, it shall be accompanied by appropriate identification showing the name of the material, the grade designation, the ASTM designation, the lot number, and the name, brand, or trademark of the manufacturer.

10.2 When shipment is made in containers, each container shall be marked or a label or tag attached. The marking shall show the material, lot number, net weight, name, and brand or trademark of the manufacturer.

10.3 Color coding shall be used when shipment is made in containers. The color coding may be used in lieu of grade designation, if agreed upon between the purchaser and the manufacturer. The following colors shall be used to designate the grades:

Color	Designation	Grade
Blue	Regular	A
Purple	Intermediate Hydrogen	B
White	Low Hydrogen	C
Red	4.5 % Nitrogen Bearing	D
Yellow	6 % Nitrogen Bearing	E
No color	Weld Grade Powder	F

11. Packaging and Package Marking

11.1 The material shall be packed so that it will be protected from loss or damage during shipment.

11.2 When shipment is required to be in containers under the provision of Section 3, the containers shall be sound and capable of protecting the material from loss or damage during shipment and handling.

12. Keywords

12.1 electrolytic manganese; electrolytic manganese powder; intermediate hydrogen electrolytic manganese; low hydrogen electrolytic manganese; manganese metal; nitrogen bearing manganese; weld grade electrolytic manganese powder; weld grade powdered electrolytic manganese

TABLE 3 Standard Sizes and Tolerances

Grade	Standard Sizes	Tolerances[A]
Regular		15 % max retained on 2-in. (50.8-mm) sieve
Intermediate Hydrogen	Plate 2 in. (51 mm) by down	10 % max passing No. 8 (2.36-mm) sieve
Low Hydrogen		
4.5 % Nitrogen Bearing	Plate 2 in. (51 mm) by down	10 % max retained on 2-in. (50.8-mm) sieve
6 % Nitrogen Bearing		10 % max passing No. 10 (2.00-mm) sieve

[A] Specification of sieve sizes used to define tolerances herein are as listed in Specification E 11.

APPENDIX

(Nonmandatory Information)

X1. FRIABILITY RATINGS OF FERROALLOYS

X1.1 Descriptions of material of each friability rating are as follows:

Friability Code No.	Description
1	Very tough materials which are susceptible to little, if any, breakage during shipment or handling.
2	Some breakage of large pieces probable in shipping and handling. No appreciable fines produced from either lump or crushed sizes.
3	Appreciable reduction in size of large pieces possible in shipping and handling. No appreciable production of fines in handling of crushed sizes.
4	Appreciable reduction in size of large pieces upon repeated handling. Some fines produced upon repeated handling of crushed sizes.
5	Appreciable reduction in size in repeated handling of large pieces. Appreciable fines may be produced in the handling of crushed sizes.
6	This category represents the most friable alloys.