



Designation: B 391 – 99

Standard Specification for Niobium and Niobium Alloy Ingots¹

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1. Scope

1.1 This specification covers unalloyed and alloyed niobium ingots prepared by vacuum- or plasma-arc melting or electron-beam melting to produce consolidated metal for processing to various mill shapes.

NOTE 1—Committee B-10 has adopted “niobium” as the designation for Element No. 41, formerly named “columbium.”

1.2 The materials covered by this specification are:

1.2.1 R04200-Type 1—Reactor grade unalloyed niobium,

1.2.2 R04210-Type 2—Commercial grade unalloyed niobium,

1.2.3 R04251-Type 3—Reactor grade niobium alloy containing 1 % zirconium, and

1.2.4 R04261-Type 4—Commercial grade niobium alloy containing 1 % zirconium.

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

1.4 The following precautionary caveat pertains only to the test method portions of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 10 Test Method for Brinell Hardness of Metallic Materials²

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications³

3. Ordering Information

3.1 Orders for material under this specification shall include the following information as applicable:

3.1.1 Type (see 1.2),

3.1.2 Quantity in weight or pieces,

3.1.3 Size, diameter and length,

3.1.4 Method of manufacture (Section 4),

3.1.5 Chemistry (Section 5),

3.1.6 Hardness (Section 6),

3.1.7 Quality and finish (Section 8),

3.1.8 Marking (Section 15)

3.1.9 Packaging (Section 16),

3.1.10 Required reports (Section 14), and

3.1.11 Disposition of rejected material (Section 13).

4. Materials and Manufacture

4.1 The ingot metal for all four types may be vacuum or plasma arc melted, vacuum electron-beam melted, or any combination of these three methods.

5. Chemical Requirements

5.1 The finished ingot shall conform to the requirements for chemical composition as prescribed in Table 1.

5.2 Analysis for elements not listed in Table 1 and not normally expected in niobium shall not be required unless specified at time of purchase.

6. Hardness

6.1 The maximum Brinell hardness shall conform to the requirements specified in Table 2.

6.2 If the hardness test impressions on the ingot side wall would be detrimental to subsequent fabrication, the hardness test requirements may be waived or changed as mutually agreed upon between the purchaser and the manufacturer.

7. Permissible Variations

7.1 *Quantity*—For orders requiring up to 100 lb (45.4 kg) of ingots, the manufacturer may overshoot up to a maximum of 20 %. For orders up to 1000 lb (454 kg), the manufacturer may overshoot up to a maximum of 10 %. The permissible overshoot shall be negotiated for orders larger than 1000 lb.

8. Quality and Finish

8.1 The manufacturer shall use care to have each lot of ingot material as uniform in quality as possible.

8.2 When specified, the ingots shall be conditioned on the surface to standards agreed upon between the manufacturer and the purchaser.

8.3 Subsequent fabrication will be permitted. The difference between the maximum and minimum radius of the conditioned ingot shall not exceed 20 % of the maximum radius. Lands,

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² Annual Book of ASTM Standards, Vol 03.01.

³ Annual Book of ASTM Standards, Vol 14.02.