



Designation: **F364 – 96 (Reapproved 2009) F364 – 96 (Reapproved 2014)**

Standard Specification for Molybdenum Flattened Wire for Electron Tubes ¹

This standard is issued under the fixed designation F364; 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 two types of molybdenum flattened wire up to 0.050 in. (1.27 mm) thick and up to 0.375 in. (9.52 mm) wide, specifically for use in electron tubes. The two grades have UNS numbers R03604 and R03603.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The following safety hazards caveat pertains only to the test method described in this specification (see 10.2). *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:*²

E18 Test Methods for Rockwell Hardness of Metallic Materials

E315 Test Methods for Chemical Analysis of Molybdenum (Withdrawn 2010)³

E384 Test Method for Knoop and Vickers Hardness of Materials

3. Classification

3.1 Two types of molybdenum flattened wire are covered by this specification:

3.1.1 *Type I, UNS R03604*—This type shall have the composition limits prescribed in Table 1.

3.1.2 *Type II, UNS R03603*—This type shall be a high-recrystallization-temperature material having the composition limits prescribed in Table 1 and shall be capable of retaining its ductility after firing at a temperature of 2375 ± 25°F (1300 ± 14°C) for at least 20 min.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Quantity of each size,

4.1.2 Dimensions or size (see 8.1),

4.1.3 Edgewise curvature (camber) if required (see 8.2),

4.1.4 Type (see 3.1),

4.1.5 Temper (see 7.1), and

4.1.6 How furnished (coils, spools, etc.).

5. Materials and Manufacture

5.1 The molybdenum wires covered by this specification shall be made by any appropriate process.

NOTE 1—It has been found that molybdenum wire made by the powder metallurgy process will meet the requirements of this specification.

6. Chemical Composition

6.1 Type I and Type II molybdenum wire shall conform to the chemical compositions prescribed in Table 1.

¹ This specification is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.03 on Metallic Materials. Current edition approved May 1, 2009; June 1, 2014. Published July 2009. Originally approved in 1973. Last previous edition approved in 2002 as F364 – 96 (2002); (2009). DOI: 10.1520/F0364-96R09-10.1520/F0364-96R14.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Chemical Composition

Element	Composition, max, ppm	
	Type I	Type II
	UNS R03604	UNS R03603
Carbon	50	15
Oxygen	80	175
Nitrogen	20	10
Hydrogen	10	10
Aluminum	150	150
Calcium	50	50
Silicon	100	350
Iron	100	100
Tungsten	200	200
Potassium	150	150
Tin	25	25
Other elements, each	50	50
	min % by difference	
Molybdenum	99.90	99.90

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Other elements, each	50	50
	min % by difference	
Molybdenum	99.90	99.90

6.2 The materials shall be analyzed in accordance with Test Methods E315 or other appropriate ASTM methods when available. Other methods, as mutually agreed upon between seller and purchaser, may be employed.

7. Physical Properties

7.1 *Temper*—Material under this specification shall be supplied in one of the following classifications of temper:

7.1.1 *Hard*—As-rolled, not stress-relieved, suitable for spring applications, or

7.1.2 *Stress-Relieved*—Suitable for bending or winding.

7.2 The hardness test (see 10.1) is to be used as the criterion for identifying hard and stress-relieved materials in accordance with Table 2.

7.2.1 When determining microhardness using light loads, the thickness and load relationships shown in Table 3 are recommended for best correlation and reproducibility.

TABLE 2 Hardness Ranges

Temper	Diamond Pyramid Hardness (HDP) or Vickers Hardness (HV)	Rockwell Superficial Hardness 30T-Scale ^A
Hard	300 and over	85 and over
Stress-relieved	up to 300, excl	up to 85, excl

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^ARockwell 30T for material 3/16 in. (4.8 mm) wide and over only.