



Standard Specification for UNS N08020, UNS N08026, and UNS N08024 Nickel Alloy Spring Wire¹

This standard is issued under the fixed designation B 471; 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 UNS N08020, UNS N08026, and UNS N08024* round spring wire.

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

2. Referenced Documents

2.1 ASTM Standards:

E 8 Test Methods for Tension Testing of Metallic Materials²

E 38 Methods for Chemical Analysis of Nickel-Chromium and Nickel-Chromium-Iron Alloys³

E 353 Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *spring wire*—the term spring wire, as used in this specification, shall be understood to cover round wire intended especially for the manufacture of springs.

4. Ordering Information

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

4.1.1 Quantity (weight),

4.1.2 Name of material or UNS number,

4.1.3 Dimensions,

4.1.4 Coating for forming (5.3),

4.1.5 ASTM designation and year of issue,

4.1.6 *Certification*—State if certification or a report of test results is required (Section 16),

4.1.7 Inspection (14.1), and

4.1.8 If possible, the intended use.

NOTE 1—A typical ordering description is as follows: 200 lb (90.7 kg), UNS N08020, 0.020 in. (0.508 mm), ASTM Specification B 471.

5. Materials and Manufacture

5.1 *Heat Treatment*—The last heat treatment shall be a solution-annealing heat treatment.

5.2 Wire shall be cold drawn to produce the specified mechanical properties.

5.3 When the purchaser specifies that the wire shall be suitable for automatic cooling, it shall have a thin and uniform surface film of a metallic or nonmetallic substance that will prevent the coiling tool from seizing or galling the wire.

NOTE 2—The recommended solution-annealing heat treatment shall consist of heating the material to a temperature of 1900 to 2100°F (1038 to 1149°C) for UNS N08020 and 2050 to 2200°F (1121 to 1204°C) for UNS N08026 and UNS N08024, all followed by quenching in water or rapidly cooling by other means.

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition prescribed in Table 1.

6.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations prescribed in Table 2.

7. Mechanical Requirements

7.1 The material shall conform to the requirements as to mechanical properties prescribed in Table 3 at room temperature.

8. Dimensions and Permissible Variations

8.1 The diameter of the wire shall not vary from that specified by more than the permissible variations prescribed in Table 4.

9. Workmanship, Finish, and Appearance

9.1 The wire shall not be kinked or improperly cast. To test for cast, a few rings of wire shall be cut from the coil or spool and allowed to fall on the floor. The wire rings shall lie flat and not spring up and show a wavy condition.

9.2 The surface of the wire shall be free of injurious seams, laps, pits, or die marks tending to impair the use of the wire for springs.

¹ This specification is under the jurisdiction of ASTM Committee B-2 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt, and Alloys Containing Nickel or Cobalt or Both as Principal Constituents.

Current edition approved Feb. 15, 1993. Published April 1993. Originally published as B 471 – 68. Last previous edition B 471 – 91.

* New designation established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

² *Annual Book of ASTM Standards*, Vol 03.01.

³ Discontinued—see 1989 *Annual Book of ASTM Standards*, Vol 03.05.

⁴ *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 1 Chemical Requirements

Element	Composition, %		
	UNS N08026	UNS N08020	UNS N08024
Carbon, max	0.03	0.07	0.03
Manganese, max	1.00	2.00	1.00
Phosphorus, max	0.03	0.045	0.035
Sulfur, max	0.03	0.035	0.035
Silicon, max	0.50	1.00	0.50
Nickel	33.00 to 37.20	32.00 to 38.00	35.00 to 40.00
Chromium	22.00 to 26.00	19.00 to 21.00	22.50 to 25.00
Molybdenum	5.00 to 6.70	2.00 to 3.00	3.50 to 5.00
Copper	2.00 to 4.00	3.00 to 4.00	0.50 to 1.50
Columbium (Nb) + tantalum	...	8 × carbon–1.00	0.15 to 0.35
Nitrogen	0.10–0.16	...	...
Iron	remainder ^A	remainder ^A	remainder ^A

^A By difference.

TABLE 2 Product Analysis Tolerances

Elements	Tolerances Over the Maximum Limit or Under the Minimum Limit		
	UNS N08026	UNS N08020	UNS N08024
Carbon	0.005	0.01	0.005
Manganese	0.03	0.04	0.03
Phosphorus	0.005	0.005	0.005
Sulfur	0.005	0.005	0.005
Silicon	0.05	0.05	0.05
Chromium	0.25	0.25	0.25
Nickel	0.30	0.30	0.30
Molybdenum	0.10	0.10	0.10
Columbium (Nb) + tantalum	...	0.05	0.05
Copper	0.10	0.10	0.10
Nitrogen	0.01	...	...

10. Sampling

10.1 Lot:

10.1.1 A lot for chemical analysis shall consist of one heat.

10.1.2 A lot for mechanical properties shall consist of the same gage of each heat in each heat-treatment charge.

10.2 Test Material Selection:

10.2.1 *Chemical Analysis*—Representative samples shall be taken during pouring or subsequent processing.

10.2.1.1 *Check analysis* shall be wholly the responsibility of the purchaser.

10.2.2 *Mechanical Properties*—Samples of the material to provide test specimens shall be taken from such locations in each lot as to be representative of that lot.

11. Number of Tests

11.1 *Chemical Analysis*—One test per lot.

11.2 *Mechanical Properties*—One test per lot.

12. Specimen Preparation

12.1 Tension test specimens shall be taken from the material after final heat treatment and cold drawing. The tension test specimens shall be in accordance with the appropriate sections of Test Methods E 8.

13. Test Methods

13.1 The chemical composition and mechanical properties of the material as enumerated in this specification shall, in case of disagreement, be determined in accordance with the following ASTM standards:

Test	ASTM Designations
Chemical analysis	E 38, E353 ^{AB}
Tension	E8

^A Iron shall be determined arithmetically by difference.

^B Methods E 38 are to be used only for elements not covered by Test Methods E 353.

14. Inspection

14.1 If specified, source inspection of the material by the purchaser at the manufacturer's plant shall be made as agreed upon between the purchaser and the manufacturer as part of the purchase contract.

15. Rejection and Rehearing

15.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

16. Certification

16.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser stating that material has been manufactured, tested, and inspected in accordance with this specification, and that the test results on representative samples meet specification requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

17. Product Marking

17.1 The size of the wire, ASTM specification number, grade or UNS number, heat number, and name or trademark of the manufacturer shall be marked on a tag securely attached to each bundle of wire.

18. Packaging and Package Marking

18.1 Each bundle shall be one continuous length of wire, properly coiled or spooled, and firmly tied. Unless otherwise specified, each bundle shall be wrapped with paper or burlap.

TABLE 3 Tensile Requirements

Diameter		Tensile Strength			
in.	mm	ksi		MPa	
		min	max	min	max
Over 0.010 to 0.030, incl	Over 0.254 to 0.762, incl	200	230	1379	1586
Over 0.030 to 0.060, incl	Over 0.762 to 1.52, incl	195	225	1345	1551
Over 0.060 to 0.075, incl	Over 1.52 to 1.90, incl	190	220	1310	1517
Over 0.075 to 0.100, incl	Over 1.90 to 2.54, incl	185	215	1276	1482
Over 0.100 to 0.125, incl	Over 2.54 to 3.18, incl	180	210	1241	1448
Over 0.125 to 0.140, incl	Over 3.18 to 3.56, incl	170	200	1172	1379
Over 0.140 to 0.187, incl	Over 3.56 to 4.75, incl	160	190	1103	1310
Over 0.187 to 0.250, incl	Over 4.75 to 6.35, incl	150	180	1034	1241
Over 0.250 to 0.312, incl	Over 6.35 to 7.92, incl	135	165	931	1138
Over 0.312 to 0.375, incl	Over 7.92 to 9.52, incl	125	155	862	1069
Over 0.375 to 0.406, incl	Over 9.52 to 10.31, incl	115	145	793	1000

TABLE 4 Permissible Variations in Diameter^A

Diameter		Permissible Variations, ±	
in.	mm	in.	mm
0.015 and under	0.381 and under	0.0003	0.007
0.016 to 0.041, incl	0.406 to 1.041, incl	0.0005	0.013
0.042 to 0.312, incl	1.067 to 7.925, incl	0.001	0.025
Over 0.312	Over 7.925	0.002	0.050

^A The wire shall not be out of round more than one half of the total permissible variation.

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