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SURFACE VEHICLE RECOMMENDED PRACTICE

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Submitted for recognition as an American National Standard

Oil-Tempered Chromium—Silicon Alloy Steel Wire and Springs

1. ***Scope***—This SAE Recommended Practice covers the mechanical and chemical requirements of oil-tempered chromium silicon alloy steel wire used for the manufacture of springs requiring resistance to set when used at moderately elevated temperatures. It also covers the processing requirements of springs fabricated from this wire.

2. ***References***

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein.

2.1.1 ANSI PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI B32.4M—Preferred Metric Sizes for Round, Square, Rectangle, and Hexagon Metal Products

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 401—Specification for Chromium-Silicon Alloy Steel Spring Wire
ASTM A 401M—Specification for Chromium-Silicon Alloy Steel Spring Wire (Metric)

3. ***Wire***

3.1 The wire shall conform to the oil-tempered requirements of ASTM A 401/A 401M.

3.2 Microstructure—A longitudinal section shall show a fine homogeneous tempered martensitic structure. Decarburization shall be determined by etching a polished transverse section of wire in nital and examining the entire periphery at 100X magnification, measuring the worst area present but not measuring decarburization which is directly associated with a seam or other surface defect. Depth of carbon free decarburization shall not exceed 0.5% of the wire diameter.

Combined depth of carbon free and partial decarburization shall not exceed 2% of the wire diameter on all sizes of wire.

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4. *Springs*

4.1 Heat Treatment—Springs coiled from this wire shall be stress relieved immediately after coiling for a minimum of 30 min at heat unless otherwise agreed upon between purchaser and supplier. The temperature used will be the maximum which will leave the original hardness of the wire essentially unchanged. Typical temperatures are 340 to 430 °C (650 to 800 °F).

4.2 Hardness—It should be recognized that in certain applications, such as some torsional or extension springs, lower than typical stress-relieving temperatures may be used. Hardness of springs shall be measured on a suitable ground flat on wire sizes of 1.60 mm (0.062 in) and larger or on ground-mounted sections for wire sizes less than 1.60 mm (0.062 in). The hardness scale and values shall conform to the requirements of Table 1A or 1B for the respective wire diameters.

4.3 Surface Condition—The surface conditions on the finished parts shall be as described for the wire, except certain instances where shot peening might be used. In addition, there shall be no excessive coiling marks, nicks, or gouges which would impair the serviceability of the parts.

4.4 Shot Peening—When springs are shot peened, the surface appearance will be altered. Because of a resulting decrease in the spring resistance to relaxation, shot peening is permitted only when agreed upon by the purchaser. After shot peening, the springs shall be stress relieved at 200 to 245 °C (400 to 475 °F) for a minimum of 30 min at heat.

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TABLE 1A—HARDNESS[1], SI UNITS

	Wire Diameter [2] mm	Min	Max
R 15N	0.80	88.5	90.0
	1.00	88.5	90.0
	1.40	88.0	89.5
R 45N	1.60	59.5	63.0
	2.00	59.0	62.0
	2.20	58.5	61.5
	3.00	57.5	61.0
RC	3.50	51.5	54.0
	4.00	51.0	53.5
	4.50	50.5	53.0
	8.00	49.0	52.0
	11.00	48.0	51.0

Values for intermediate sizes may be interpolated.

1. Hardness ranges indicated apply to finished springs and are subject to normal variations found in standard hardness testing procedures.
2. Preferred sizes. For a complete list refer to ANSI B32.4M.

TABLE 1B—HARDNESS[1], INCH-POUND UNITS

	Wire Diameter in	Min	Max
R 15N	0.032	88.5	90.0
	0.041	88.5	90.0
	0.054	88.0	89.5
R 45N	0.062	59.5	63.0
	0.080	59.0	62.0
	0.092	58.5	61.5
	0.120	57.5	61.0
RC	0.135	51.5	54.0
	0.162	51.0	53.5
	0.177	50.5	53.0
	0.192	50.5	53.0
	0.218	50.0	52.5
	0.250	50.0	52.5
	0.312	49.0	52.0
	0.375	48.5	51.5
	0.438	48.0	51.0

Values for intermediate sizes may be interpolated.

1. Hardness ranges indicated apply to finished springs and are subject to normal variations found in standard hardness testing procedures.

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