

ENGINEERING MATERIAL SPECIFICATION

Material Name	Specification Number
STEEL WIRE, VALVE SPRING, CHROMIUM VANADIUM ALLOY	WSD-M1A260-B1
STEEL WIRE, VALVE SPRING, CHROMIUM VANADIUM ALLOY, DRESSED SURFACE	WSD-M1A260-B2

1. SCOPE

The material defined by this specification is an oil hardened and tempered chromium-vanadium alloy high quality steel spring wire.

In general, steels shall be specially melted and processed to give a clean steel of uniform core and surface qualities to meet the quality requirements of this specification.

2. APPLICATION

This specification was released originally for valve springs subjected to high stresses at moderately increased working temperatures.

3. REQUIREMENTS

3.1 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements For Production Materials (WSS-M99P1111-A).

3.2 CHEMICAL COMPOSITION, weight %

Carbon	0.60 - 0.75
Manganese	0.50 - 0.90
Phosphorus	0.030 max
Sulphur	0.025 max
Silicon	0.15 - 0.30
Chromium	0.40 - 0.60
Vanadium	0.10 - 0.25
Oxygen	*
Aluminum	*

* The oxygen and aluminum contents shall be recorded as part of the control plan.

Optional material see para 4.1.

Specific composition limits, melting and casting practice, rod, wire and heat treatment processing route to meet performance and manufacturing requirements will form part of an agreed control plan for each spring component.

Date	Action	Revisions
2002 07 24	Revised	Updated and Renumbered
1991 12 12	C10181734	Released W. Jones/N. Riley EAO/C Webster NAAO

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3.3 MECHANICAL PROPERTIES

(ASTM E 8M, as delivered for spring manufacture)

Wire Diameter, mm	Ultimate Tensile Strength (MPa)
2.00 up to 2.49	1720 - 1860
greater than 2.50 up to 2.99	1670 - 1810
greater than 3.00 up to 3.49	1670 - 1770
greater than 3.50 up to 3.99	1620 - 1720
greater than 4.00 up to 4.49	1570 - 1670
greater than 4.50 up to 4.99	1570 - 1670
Yield Strength, (0.2 % Offset), min	0.90 x UTS**
Elongation (gauge length, 10 x d), min	7.0 %
Reduction in Area, min	40 %

** Ultimate Tensile Strength as determined on wire sample.

NOTE: d denotes test wire diameter.

3.4 TORSION TEST

A wire test piece of length 50X wire original diameter shall be unidirectionally twisted 6 revolutions then twisted in the reverse direction until fracture occurs. The rate of rotation shall not exceed 20 revolutions per minute. The primary fracture face shall exhibit a smooth shear surface formed at 90 ° to the axis of torsion. The presence of steps, shoulders or longitudinal cracks on the fracture face is not acceptable. Furthermore, no surface cracks on the twisted length of wire are permitted.

3.5 MICROSTRUCTURE

The microstructure shall consist of a uniform fine tempered martensite. When a wire transverse microsection is viewed at 200 x magnification no complete decarburisation shall be permitted and partial decarburisation is only acceptable with the following constraints:

Nominal Wire Diameter	Depth of partial decarburisation
2.0 - 3.99 mm	0.024 mm, max
4.0 - 5.0 mm	0.032 mm, max

No surface soft/hard spots due to local overheating from processing irregularities shall be permitted. No wire joins (weld) shall form part finished product, see also General Information 4.1.