

**Mechanical and Performance Requirements of Through Hardened and Carbon Restored Thread Rolling Screws with Induction Hardened Points****1. SCOPE**

This standard specifies the requirements for high performance through hardened and carbon restored thread rolling screws with induction hardened points which have performance capabilities beyond those normally expected of other types of tapping screws. The standard relates to screws with the standard 60 degree thread form, ranging from sizes M6 to M12 and for use in applications where fastener toughness is a prime consideration.

As partial or complete decarburization of the thread of thread forming screws seriously impairs the thread rolling properties of the screw, this condition is not permitted. Decarburization as permitted by ISO 898/1 is replaced in this standard by a requirement for carbon restoration as detailed in Clause 3.2.

Fasteners produced to this standard possess mechanical properties in line with ISO 898/1 property class 10.9 (010) except surface hardness.

Clause 3.4 defines thread forming capability in steel up to a hardness of 150 HV and thickness equal to the screw diameter. The parameters of material hardness and thread engagement may be varied by analysis of joint requirements and it is therefore recommended that the specific application be investigated to determine joint criteria.

NOTE: Lubrication approved by Ford is permitted on parts to which this specification is applied unless otherwise specified.

1.1 REFERENCES

ISO 262	General purpose metric screw threads - Selected sizes for screws, bolts and nuts
ISO 898/1	Mechanical properties of fasteners - Part 1: Bolts, screws and studs.
ISO 898/2	Mechanical properties of fasteners - Part 2: Nuts with specified proof load values.
ISO 6157-3	Fasteners – Surface Discontinuities
ISO 6507-1	Metallic Materials – Vickers Hardness, Part 1: Test Method
SAE/USCAR-8	Grain Flow Pattern for Bolts and Screws
WSS-M99A3-A	Embrittlement Avoidance

2. MATERIALS

Screws shall be made from cold heading quality fully killed, fine grain, spheroidized annealed steel wire. Material shall meet the chemical composition limits for PC10.9 per ISO 898 Part 1.

3. MECHANICAL PROPERTIES

Mechanical properties defined in ISO 898/1 apply except as detailed in Table 1.

Table 1 Mechanical Properties

Criteria	Clause	Test Reference
Wedge Tensile Strength	3.1	ISO 898/1
Decarburization	3.2	4.1
Surface Hardness	3.3 and Table 3	4.2
Thread Forming Capability	3.4	4.3
Point Hardness	3.5	4.4



3.1 WEDGE TENSILE STRENGTH

Finished screws shall be hardened and tempered to achieve the minimum tensile strength for the applicable equivalent property class detailed in ISO 898/1 (See Table 4).

3.2 DECARBURIZATION

During the hardening process the carbon potential of the atmosphere shall be maintained at a level slightly in excess of the carbon content of the screws being processed. This process of carbon restoration is designed to eliminate partial and total decarburization of the screw thread form. Partial or complete decarburization of the screw thread form would seriously impair the thread rolling properties of the screw.

Carbon enrichment up to 0.1mm maximum from the surface of the screw is permitted as a result of the carbon restoration process when tested in accordance with Clause 4.1.

3.3 SURFACE HARDNESS

The minimum tempering temperatures are specified in ISO 898/1. When tested in accordance with Clause 4.2, the hardness levels as given in Table 2 shall be achieved.

Table 2 Surface Hardness

PROPERTY CLASS	SURFACE HARDNESS (HV)
010	340 – 430 ¹⁾

¹⁾ Surface hardness shall not be more than 30 Vickers points above the measured core hardness on the product when the readings of both surface and core are carried out at HV 0.3.

3.4 THREAD FORMING CAPABILITY

The screw shall, without permanent deformation of its own thread when viewed at 10x magnification, form a mating thread in a test plate in accordance with Clause 4.3.

The thread formed by the screw in the test plate shall be capable of accepting a fastener threaded in accordance with ISO 262 tolerance class 6g and shall resist a proof load test in accordance with ISO 898/2 property class 8.

3.5 POINT HARDNESS

The lead threads shall be induction hardened to achieve a minimum hardness of 450 HV on one to three full threads to a depth of 0.2mm below the root as shown in Figure 1.

Following induction hardening the part shall be stress relieved to 200°C - 230°C for one hour at temperature.

3.6 EMBRITTLEMENT

All through hardened and carbon restored thread rolling screws shall meet the requirements of WSS-M99A3-A.