



Material and Performance Requirements for Induction Hardened Type TR (Thread Rolling) Tapping Screws

1 Scope

This standard covers material and performance requirements applicable to Type TR (thread rolling) tapping screws, heat treated to achieve properties comparable to GMW25, property class 10.9 screws with induction hardened points, in sizes 5 mm and larger.

1.1 Material Description.

1.1.1 Material Identification. When selecting the length of screw for any application, it should be an objective to locate the induction hardened zone beyond the exit side of the mating component as depicted in Figure 1, or to maintain a minimum length of thread engagement equal to four full form non-induction hardened threads as illustrated in Figure 2.

The performance values specified in this standard are not valid for design use unless all conditions of the application are identical to the combination of laboratory conditions described in the testing procedure.

1.2 Symbols. Not applicable.

1.3 Typical Applications. The screws covered by this specification are suitable for use in general engineering and structural attachments.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM E140	SAE J423
ISO 898-1	SAE J864

2.2 GM Standards/Specifications.

9986167	GMW3059
GMW25	GMW3179

2.3 Additional References.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

3.1 Material and Process. Screws shall be made from cold heading quality, killed steel, spheroidize annealed (60% minimum spheroidization) wire conforming to medium carbon alloy steel per ISO 898-1 property class 10.9 requirements. The material shall be capable of producing fasteners free of chemical segregation, porosity and micro cracks during cold working.

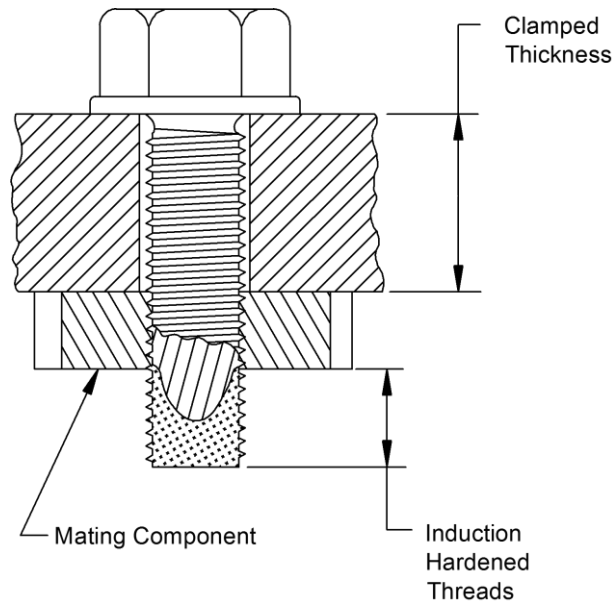


Figure 1: Thread Engagement Requirements

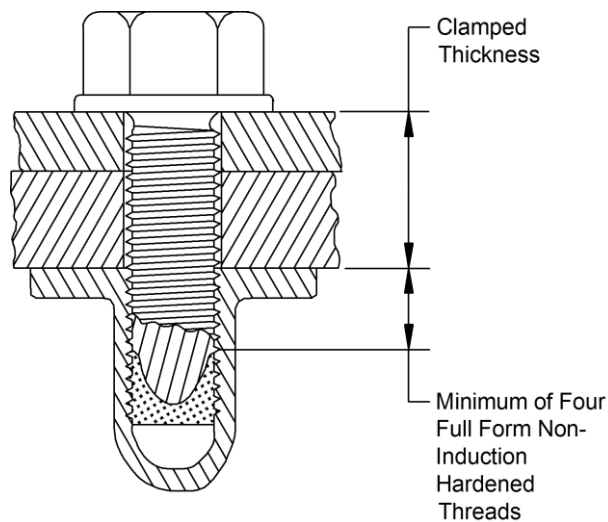


Figure 2: Thread Engagement Requirements

3.1.1 Heat Treatment. Screws shall be heat treated in a neutral atmosphere furnace. Carbon restoration of the surface to an extent not exceeding that of the core by more than 30 HV 0.3 points (3 HRC), not exceeding 393 HV 0.3.

3.1.1.1 Microstructure. Screws shall show no decarburization of the surface as determined by metallographic examination at 100x. Partial or complete decarburization of screw thread would seriously impair the thread rolling properties of the screw.

3.1.1.2 Tempering Temperature. The minimum tempering temperature shall be 425 °C.

3.1.1.3 Induction Hardening. The end portion of screws shall be induction hardened to achieve a minimum surface hardness equivalent to 445 HV 0.3 (HRC 45) after stress relief. The pattern of the induction hardening shall conform to the limits designated in Figure 3, unless otherwise specified on the detail drawing.

3.1.1.4 Stress Relief. Subsequent to induction hardening, screws shall be stress relieved at 230 °C minimum. Screws shall be held at the stress relieve temperature continuously for 1 h minimum.

3.1.2 Finish. Electroplated and coated screws shall be suitably treated subsequent to plating or coating to avoid hydrogen embrittlement in accordance with the respective finish specification.

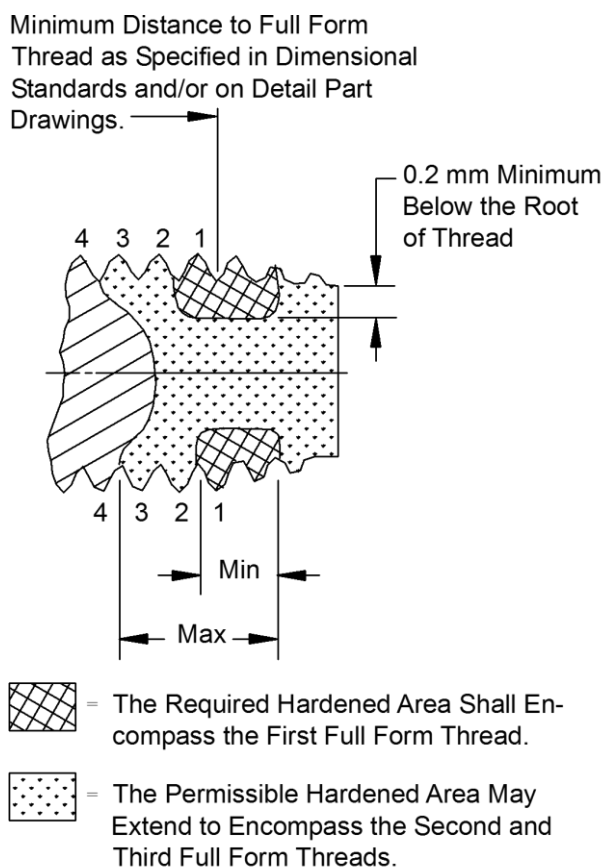


Figure 3: Induction Hardened Point Detail

Table 1: Mechanical and Performance Requirements for Thread Rolling Screws (Metric (SI) Units)

Nominal Screw Size and Pitch (mm)	Tensile Fracture Load (kN)	Torsional Torque to Fracture (N·m)	Drive Torques		
			Finish/Lubrication		
			GMW3179 Code A Phos and oil (N·m)	All Other Finishes (N·m)	All Finishes with 9986167 Lubrication (N·m)
	minimum	minimum	maximum	maximum	maximum
5 x 0.80	14.8	9.3	4.8	6.0	4.0
6 x 1.00	20.9	16.0	7.5	9.2	6.0
8 x 1.25	38.1	40.0	16.0	20.0	13.0
10 x 1.50	60.3	81.0	28.0	35.0	23.0
12 x 1.75	87.7	143.0	46.0	55.0	35.0
14 x 2.00	120.0	231.0	56.6	75.1	48.0
7/16-20	77.2	125.0	39.0	47.0	30.0