



TYFO[®] Ti NEAR SURFACE MOUNTED (NSM) Titanium Bars

DESCRIPTION

The Tyfo Ti NSM bars are an aerospace grade alloy consisting of Titanium, 6% Aluminum and 4% Vanadium (commonly referred to as Ti-6Al-4V) used to strengthen reinforced concrete structures. The Tyfo Ti bars are high-strength and light weight tension members that do not corrode, do not fatigue and provide ductility. Most applications are near surface mounted (NSM) to improve the structural performance of members that have insufficient strength. The Tyfo Ti bars can be bent in the field and can provide a strengthening alternative where FRP is not suitable.

USE IN INFRASTRUCTURE

1. Increase ductility of strengthened structural members
2. Provide additional tensile reinforcement to existing concrete or masonry elements
3. Increase flexural capacity of existing concrete beams, slabs and walls
4. Develop insufficient steel reinforcing bar splices
5. Replace corroded steel reinforcement
6. Increase shear strength of existing concrete beams and slabs

ADVANTAGES

1. Corrosion resistant
2. High fatigue resistance given low notch sensitivity
3. High strength-to-weight ratio (approximately 43% lighter than steel)
4. Cost effectiveness in comparison to demolition and rebuilding
5. Recessed installation causes little to no obstruction
6. Abundant in nature and a poor conductor of electricity

PACKAGING

Packaging and weight will vary based on the design requirements.

SHELF LIFE

No specified shelf life limit.

STORAGE CONDITIONS

Store in a clean dry area where bars cannot get damaged.

Typical Mechanical Properties

Property	ASTM Method	Minimum Test Value*
Ultimate Tensile Strength	E8/E8M	140 ksi (965 MPa)
Tensile Modulus	E8/E8M	15.2 x 10 ⁵ KSI (105 GPa)
Elongation ¹	E8/E8M	10%
Density		0.160 lbs./in. ³ (4.43 g/cm ³)
Yield Strength	E8/E8M	130 ksi (895 MPa)

¹The minimum mechanical properties are reported based on Class 130 Titanium alloy as specified in ASTM B1009-20.

Tyfo Ti NSM Bar Detailing

Nominal Diameter ¹		Nominal Area ²		Groove Height/Width		Nominal Weight	
Size	in	mm	in ²	(mm ²)	in	(mm)	lb/ft (kg/m)
2	1/4	6	0.048	30.97	0.375	(9.53)	0.094 (0.140)
3	3/8	10	0.1028	66.32	0.5625	(14.3)	0.212 (0.315)
4	1/2	13	0.1899	122.5	0.750	(19.1)	0.377 (0.561)
5	5/8	16	0.288	185.8	0.9375	(23.8)	0.589 (0.877)
6	3/4	19	0.423	272.9	1.125	(28.6)	0.848 (1.262)

¹Nominal diameter of a deformed bar is equivalent to a plain round bar having the same weight (mass) per foot (meter) as the deformed bar.

²The minimum area of the deformed bars as per material testing is computed by taking the average cross-sectional area of five NSM bars and subtracting three standard deviations ($A_n = \bar{A}_n - 3\sigma$) for a production run. Divide each bar's total weight by Titanium's unit weight (276 lb/ft³ [4421 kg/m³]) and the total bar length (3 ft min.) to calculate each bar's nominal area.

INSTALLATION OF THE TYFO[®] Ti NSM BARS

DESIGN

The Tyfo Ti NSM Bar system is designed to meet specific project criteria dictated by the engineer of record and any relevant building codes and/or guidelines. The design shall be based on the quantified performance goals defined for each project. FyfeFRP LLC engineering staff may provide preliminary details based on the project requirements.

INSTALLATION

Cut grooves for NSM Bars once the layout specified by the Engineer of Record is marked. The dimensions of the groove are typically 1.5 times the bar diameter in both the depth and width.

Note: Proper equipment such as diamond crack chasing blades, guide rails, and sufficient power tools will make cutting grooves easier. It is recommended to cut parallel saw cuts, then remove concrete rather than cut the groove in a single pass.

CLEANING

No sharp points or rough edges of concrete should be left in the groove, use a chisel if needed. Clean the groove by using compressed air or a vacuum to remove any residual dust.

Note: No roughening to the concrete surface within the groove is necessary.

TYFO NSM ADHESIVE

Mask the perimeter of the groove to ensure the surface remains clean when applying adhesive. Fill the groove with Tyfo NSM adhesive until it is approximately half-to-three-quarters full.

INSTALLATION OF THE TYFO® Ti NSM BARS

TYFO Ti NSM BAR

Press the Tyfo Ti NSM bar into the Tyfo NSM adhesive that was applied in the previous step. The goal is to have the NSM bar fully coated by the NSM adhesive with no air pockets.

FINISHING

Finish the installation by applying a final coat of Tyfo NSM adhesive to completely cover the groove. Use a trowel or putty knife to level the surface and remove the masking.

Note: Be sure to remove masking prior to the NSM adhesive curing.

CAUTION!

CLEANUP

Collect with absorbent material. Dispose in accordance with local disposal regulations. Uncured material can be removed with approved solvent. Cured materials must be mechanically removed.

HAZARDS

Consult the Safety Data Sheets (SDS) for associated hazards. SDS will be supplied upon request.

Consult safety data sheet
(SDS) for more information.
For industrial use only.

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