सेल SAIL

SAIL TMT HCR

THE HIDDEN STRENGTH OF MODERN INDIA

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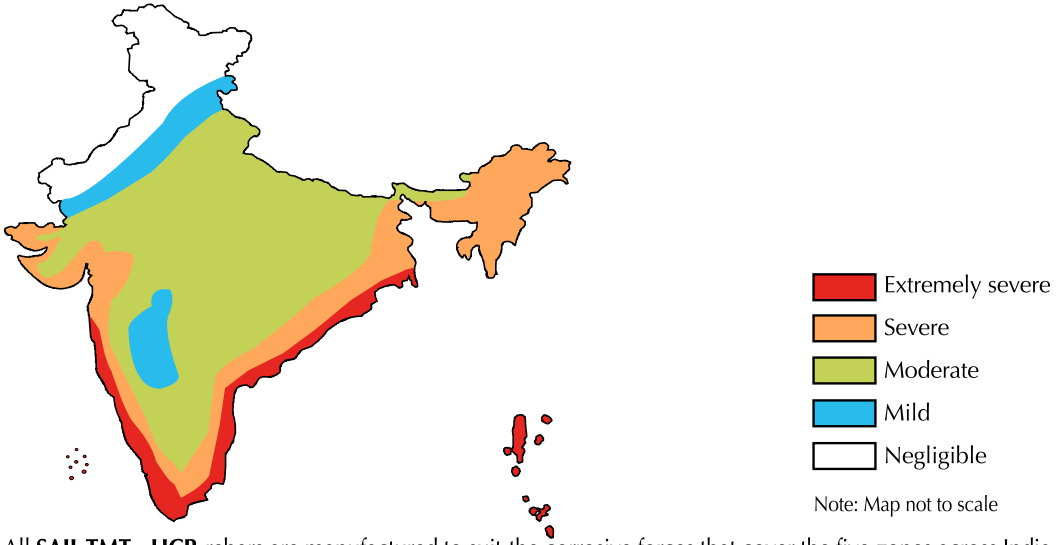
The Hidden Strength of Modern India

Thermo-mechanically treated (TMT) reinforcement bars are extensively used in the construction sector for several decades now. These rebars are characterised by a unique combination of high strength and high ductility which was not present in the CTD rebars produced earlier.

However, in coastal areas, industrial areas and in areas which record high rainfall, conventional rebars start to corrode, shortening the life-span of structures in which they have been used. Resistance to corrosion governs the life expectancy of a steel structural component under natural environmental degradation.

Steel Authority of India Limited, India's largest and most trusted steel maker, has therefore developed **SAIL TMT-HCR** (high corrosion resistant) rebars and coils. These rebars and wire rods are intentionally alloyed with Copper (Cu) and Chromium (Cr), etc. to impart improved corrosion-resistance properties to TMT bars without compromising their superior mechanical properties. SAIL TMT-HCR also has low spalling characteristics because of its unique chemical composition, thus protecting the concrete cover for longer life.

Corrosive Zones of India At a Glance



All **SAIL TMT – HCR** rebars are manufactured to suit the corrosive forces that cover the five zones across India.

Chemistry of SAIL TMT-HCR Rebars Coils (Ladle Analysis, %)

Element TMT	IS : 1786-2008 Fe-500	IS : 1786-2008 Fe-500 D	SAIL-HCR Fe-500 D
Carbon % maximum	0.30	0.25	0.25
Sulphur (S), % maximum	0.055	0.040	0.040
Phosphorous (P), % maximum	0.055	0.040	0.040
S + P, % maximum	0.105	0.075	0.075
*Corrosion Resistant Alloying Elements, % minimum	-	-	0.40

*As per amendment no. 3 March 2017 of IS 1786: "Low alloy steel by addition of Cr, Cu, Ni, Mo and P either individually or in combination to improve corrosion resistance properties shall not be less than 0.40 wt%."

Mechanical Properties of SAIL TMT-HCR Rebars & Wire Rods

Parameter	IS : 1786-2008 Fe-500	IS : 1786-2008 Fe-500 D	SAIL-HCR TMT Fe-500 D
YS, MPa (minimum)	500	500	500
Tensile Strength, MPa (minimum)	545	565	565
Total Elongation % (minimum) (GL = 5.65÷Ao)	12.0	16.0	18 (up to 28 mm) 16 (abv 28 mm)

Various types of tests such as potentiodynamic and salt spray tests were conducted on HCR rebars/wire rods alloyed with a combination of Cu, Cr and P to assess their corrosion properties. **SAIL TMT-HCR** has been field tested by the **Structural Engineering Research Institute, Chennai (CIS Lab)** at a site off the Chennai Harbour with an exposure time of more than two years and it was found that its Corrosion Resistance Index (CRI)* is 1.7-1.8. The life expectancy of SAIL TMT-HCR is expected to be 1.5-1.7 times more than that of plain TMT rebars in coastal regions/marine environments and corrosion-prone zones.

* CRI: Corrosion rate of plain TMT bars/Corrosion rate of SAIL TMT-HCR.

Features of SAIL TMT-HCR rebars

WELDABILITY

SAIL TMT-HCR rebars are perfectly weldable by normal processes of welding with suitable electrodes. They are also weldable without preheating, preferably with low hydrogen electrode. The weldability of SAIL TMT-HCR rebars has been tested and certified by the **Welding Research Institute, Trichy**.

BOND STRENGTH

The bond strength of all SAIL TMT-HCR rebars has been tested at the **National Test House, Alipore, Kolkata** and has been found to meet IS 1786-2008 norms.

BENDABILITY

All SAIL TMT-HCR rebars have lower bend diameter compared to specified bend diameters as per IS 1786-2008, Grade D specifications. This allows easier bending with less effort and thus facilitates easier onsite workability.

FIRE RESISTANCE

All SAIL TMT-HCR rebars are able to withstand fire hazards when enclosed in concrete to up to 600^0C bar temperature

Applications of SAIL TMT HCR

SAIL TMT-HCR rebars are suitable for construction of RCC structures in coastal areas, industrial areas, in areas with high rainfall and in corrosion prone zones.

SAIL has also developed earthquake-resistant and corrosion-resistant TMT nomenclatured as SAIL TMT-EQR HCR. This TMT is suitable for construction in earthquake and tsunami-prone areas. This grade (SAIL TMT EQR HCR) apart from having the same corrosion-resistance properties as explained above also guarantees a UTS/YS ratio of minimum 1.18 and the percentage elongation is further enhanced to a minimum 18%. With this, the bars, apart from combating the corrosive elements in the atmosphere, are also able to absorb more sudden loadings which are encountered during earthquakes, tsunamis, etc.

Rationalised Sizes of SAIL TMT-HCR

Size (in mm)	Weight (in kg/m)	Length (in m)	Mill
6	0.22	Coil form	IWRM
8	0.39	Coil form/Straight*	BWRM/IWRM/IBRM
10	0.62		
12	0.89		
16	1.58	5.5 to 13.5	DMM/IBRM
20	2.47		
25	3.85		DMM/IBRM/BMM
28	4.83		BMM/IBRM
32	6.31		
36	7.99		
40	9.85		
45	12.5		

Abbreviations used: IWRM: IISCO Wire Rod Mill; BWRM: Bhilai Wire Rod Mill; IBM: IISCO Bar Mill; DMM: Durgapur Merchant Mill; BMM: Bhilai Merchant Mill, BBRM: Bhilai Bar & Rod Mill

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STEEL AUTHORITY OF INDIA LIMITED
केन्द्रीय विपणन संगठन
CENTRAL MARKETING ORGANISATION
A Government of India Enterprise

There's a little bit of SAIL in everybody's life