Early Years and CTD Bar Production at Kamdhenu Limited

Kamdhenu Limited was originally incorporated as **Kamdhenu Ispat Limited** in **1994** and commenced commercial production in **1995** with the manufacturing of **CTD (Cold Twisted Deformed) bars**. In its initial phase, the company focused on establishing a solid foundation in quality manufacturing, which led to the early acquisition of certifications for **International Quality Standards – ISO 9001** and **BIS 1786:1985**.

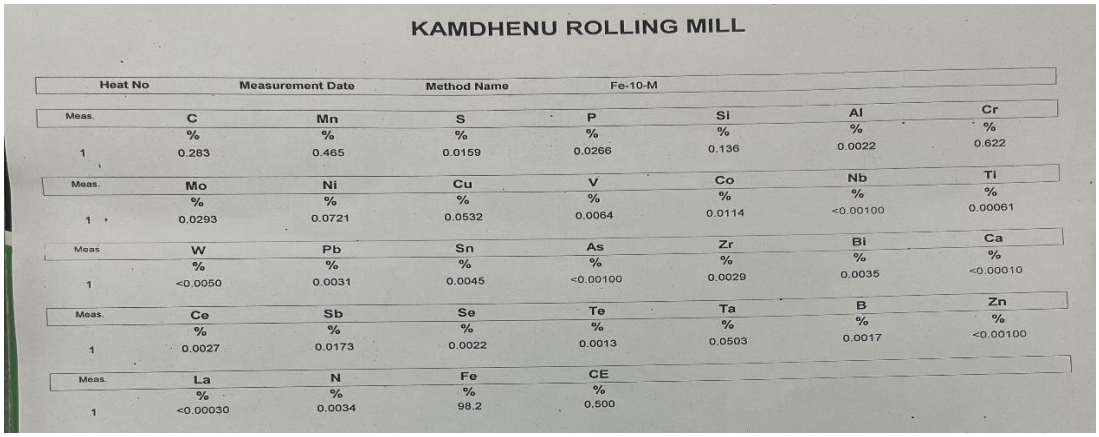
Kamdhenu Limited, the flagship entity of the Kamdhenu Group, has firmly established itself as a prominent manufacturer and supplier of branded building materials in India. Demonstrating its robust market position and operational excellence, **Kamdhenu Limited** has achieved an impressive turnover of **USD 2 billion**, reflecting its significant contribution to the industry and its continued growth trajectory.

CTD Bars: Properties and Limitations

During its early operations, the company produced **CTD bars**, which were widely used in construction at the time. These bars were manufactured as per **BIS 1786** standards and typically conformed to the **Fe 415 grade**.

Chemical Composition (Fe 415 Grade – CTD Bars):

- **Carbon (C):** Max. 0.30%
- **Sulphur (S):** Max. 0.065%
- **Phosphorus (P):** Max. 0.065%

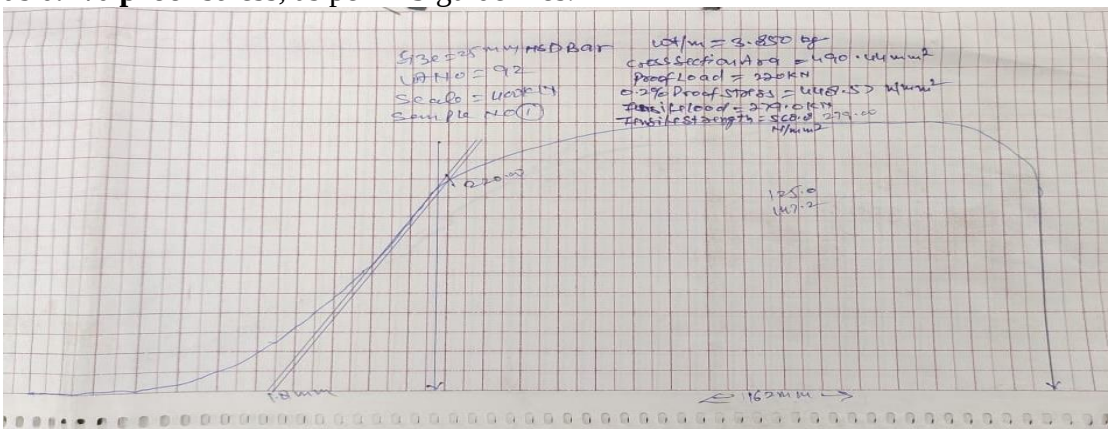


KAMDHENU ROLLING MILL

Heat No		Measurement Date		Method Name	Fe-10-M			
Meas.	C	Mn	S	P	Si	Al	Cr	
	%	%	%	%	%	%	%	
1	0.283	0.465	0.0159	0.0266	0.136	0.0022	0.622	
Meas.	Mo	Ni	Cu	V	Co	Nb	Ti	
	%	%	%	%	%	%	%	
1	0.0293	0.0721	0.0532	0.0064	0.0114	<0.00100	0.00061	
Meas.	W	Pb	Sn	As	Zr	Bi	Ca	
	%	%	%	%	%	%	%	
1	<0.0050	0.0031	0.0045	<0.00100	0.0029	0.0035	<0.00010	
Meas.	Ce	Sb	Se	Te	Ta	B	Zn	
	%	%	%	%	%	%	%	
1	0.0027	0.0173	0.0022	0.0013	0.0503	0.0017	<0.00100	
Meas.	La	N	Fe	CE				
	%	%	%	%				
1	<0.00030	0.0034	98.2	0.500				

Mechanical Properties:

- The **yield stress** of CTD bars could not be directly measured and was typically **assumed as 0.2% proof stress**, as per BIS guidelines.



Manufacturing of CTD Bars at Kamdhenu Limited

1. Rolling of Hot Billets

- **Mild steel billets** were first heated in a **reheating furnace** to attain the desired malleability.
- These heated billets were then passed through the **rolling mill**, where they were gradually reduced in size and shaped into **round steel bars** of specific diameters.

2. Cooling

- After rolling, the **hot-rolled bars** were allowed to **cool down to room temperature** under controlled conditions.

3. Cold Twisting (Deformation)

- Once cooled, the bars were fed into a **twisting machine**.
- During the twisting process:
    - The bars were **twisted longitudinally** along their length.
    - This twisting introduced **deformations or surface ribs**, which improved **bond strength with concrete**.
    - The process also **increased the tensile strength** of the bars due to strain hardening.
    - However, it resulted in **reduced ductility**, making the bars less flexible and more brittle under stress.

Although CTD bars provided improved strength over plain bars, they had **limitations in ductility and corrosion resistance**, which eventually led to their **replacement by TMT bars**, offering superior structural performance and durability.

TMT Bars as per BIS 1786 – Fe 500 Grade

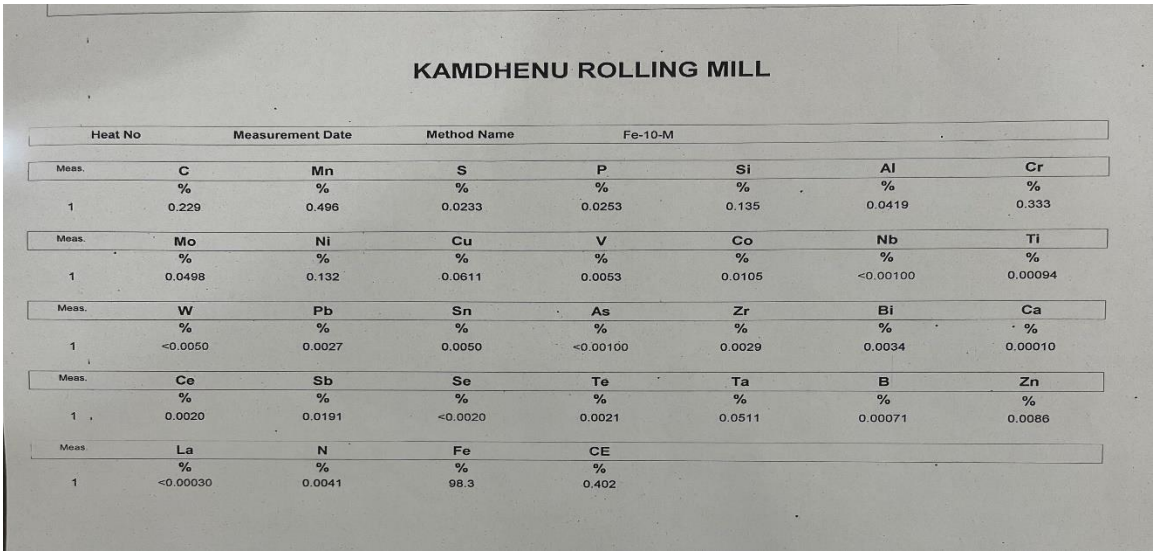
After extensive **research and development** in the field of steel manufacturing, Kamdhenu Limited made a significant technological advancement in **2005** by transitioning to the production of **high-quality TMT (Thermo-Mechanically Treated) steel bars**. This transition was made possible through the adoption of **Tempcore Technology**, licensed from **CRM, Belgium**—a globally renowned organization in steel technology.

The introduction of Tempcore Technology enabled Kamdhenu to produce TMT bars with superior strength, ductility, and corrosion resistance, thereby aligning its products with modern construction requirements. This technological upgrade played a vital role in establishing Kamdhenu as a trusted name in the Indian steel industry.

As per the **Bureau of Indian Standards (BIS 1786)**, **Fe 500 grade TMT bars** must meet the following chemical composition requirements:

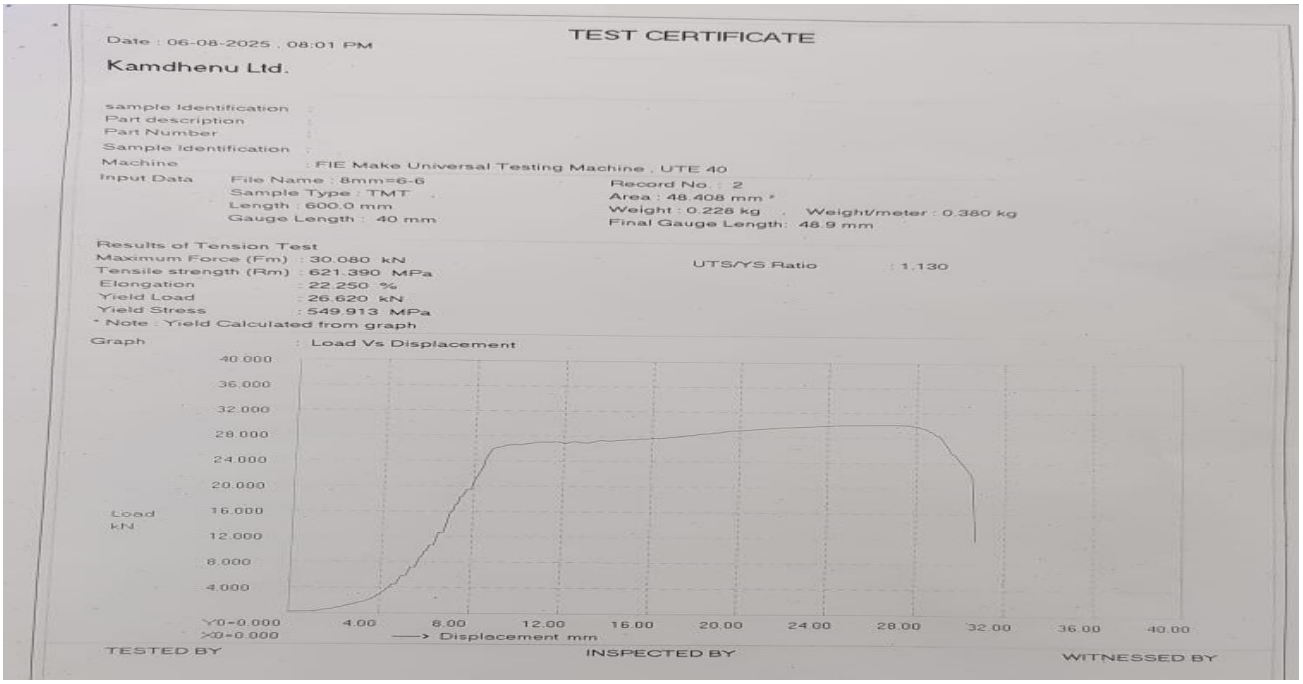
This optimized chemical composition ensures a balance between **high tensile strength** and **enhanced ductility**, making Fe 500 TMT bars ideal for heavy-duty and earthquake-resistant construction.

Element	Maximum Percentage (%)
Carbon (C)	0.25%
Sulphur (S)	0.040%
Phosphorus (P)	0.040%



KAMDHENU ROLLING MILL

Heat No		Measurement Date		Method Name		Fe-10-M		
Meas.	C	Mn	S	P	Si	Al	Cr	
	%	%	%	%	%	%	%	
1	0.229	0.496	0.0233	0.0253	0.135	0.0419	0.333	
Meas.	Mo	Ni	Cu	V	Co	Nb	Ti	
	%	%	%	%	%	%	%	
1	0.0498	0.132	0.0611	0.0053	0.0105	<0.00100	0.00094	
Meas.	W	Pb	Sn	As	Zr	Bi	Ca	
	%	%	%	%	%	%	%	
1	<0.0050	0.0027	0.0050	<0.00100	0.0029	0.0034	0.00010	
Meas.	Ce	Sb	Se	Te	Ta	B	Zn	
	%	%	%	%	%	%	%	
1	0.0020	0.0191	<0.0020	0.0021	0.0511	0.00071	0.0086	
Meas.	La	N	Fe	CE				
	%	%	%	%				
1	<0.00030	0.0041	98.3	0.402				



TEST CERTIFICATE

Date : 06-08-2025 , 08:01 PM

Kamdhenu Ltd.

sample Identification :
Part description :
Part Number :
Sample Identification :
Machine : FIE Make Universal Testing Machine , UTE 40
Input Data File Name : 8mm=6-6
Sample Type : TMT
Length : 600.0 mm
Gauge Length : 40 mm
Record No. : 2
Area : 48.408 mm ²
Weight : 0.228 kg . Weight/meter : 0.380 kg
Final Gauge Length: 48.9 mm

Results of Tension Test
Maximum Force (Fm) : 30.080 kN
Tensile strength (Rm) : 621.390 MPa
Elongation : 22.250 %
Yield Load : 26.620 kN
Yield Stress : 549.913 MPa
UTS/YS Ratio : 1.130
* Note : Yield Calculated from graph

Graph : Load Vs Displacement

Load kN: 40.000, 36.000, 32.000, 28.000, 24.000, 20.000, 16.000, 12.000, 8.000, 4.000
Y0=0.000
X0=0.000
4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00
Displacement mm

TESTED BY INSPECTED BY WITNESSED BY

Significance of the Transition

The shift from CTD to TMT bar production allowed Kamdhenu to:

- Manufacture bars with **higher strength-to-weight ratio**
- Improve **bendability** and **seismic resistance**
- Offer better **corrosion resistance**
- Comply with **modern construction standards**

By integrating **Tempcore technology**, Kamdhenu Limited firmly positioned itself as a leader in the Indian steel industry, delivering products that meet both **national and international standards**.

TMT Bar Manufacturing Process

TMT (Thermo-Mechanically Treated) bars are high-strength reinforcement bars with a tough outer surface and a soft, ductile core. The process involves controlled heating, rolling, and rapid cooling to achieve the desired mechanical properties.

1. Raw Material Preparation

- **Input:** Mild Steel (MS) Billets
- **Heating:** Billets are heated in a **Reheating Furnace**
- **Temperature: ~1100°C to 1200°C**
    - This temperature ensures the billets are plastic enough for rolling without cracks or defects.

2. Rolling Mill Operation

- The hot billets pass through multiple **rolling stands** in the **Rolling Mill Division**, reducing them into desired bar diameters (8mm to 25mm).
- Rolling is performed while the billet is still at **~1050°C to 1100°C** to maintain formability and grain structure.

3. Quenching (Rapid Cooling)

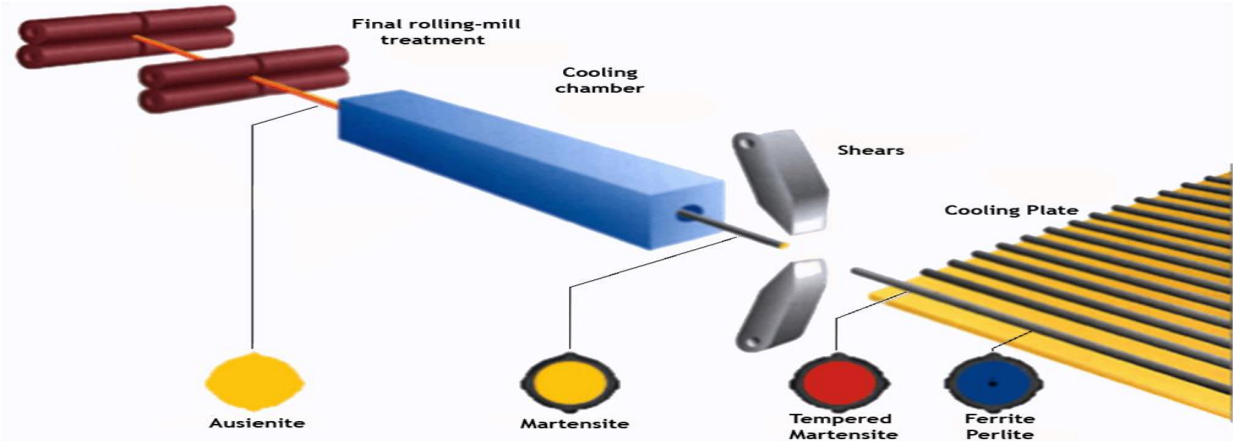
- After final rolling, the hot bars (still at **~950°C to 1000°C**) immediately enter a **quenching box**.
- **Tempcore Process (CRM Belgium Technology):**
  - High-pressure **water jets** rapidly cool the outer surface.
  - **Quenching Water Pressure: 10–12 bar (approx.)**
  - **Time Duration:** Few seconds (2–5 sec typically)
  - This rapid cooling hardens the outer layer (martensitic structure), while the core remains hot and soft.

4. Self-Tempering (Heat Flow Outward)

- As the bar exits the quenching box, the **hot core (~600–700°C)** transfers heat back to the hardened surface.
- This **self-tempering** process creates a tough outer layer with improved ductility.
- Microstructure transitions from brittle martensite to **tempered martensite**.

5. Atmospheric Cooling (Final Stage)

- The bars are allowed to **cool naturally** on a **cooling bed**.
- During this stage, the inner core transforms into **ferrite-pearlite**, ensuring a soft and ductile center.



Advantages of TMT Bars Produced with Controlled Parameters

- High tensile and yield strength **(Fe 500 grade)**
- Excellent ductility and bendability
- Superior earthquake and corrosion resistance
- Weldable without preheating