

OUTREACH FEATURE

Essar Steel Develops Ultra-Strength Ballistic Steel For Battle Tanks

India currently procures approximately 70% of its defence equipment needs from abroad, but the Government aims to reverse this imbalance and manufacture 70% or more of these equipment in India. This provides an immense opportunity for both domestic and foreign players in the defence sector.

Under "Make in India" campaign, the Government's manifesto explicitly envisages India as an exporter of defence equipment over the next decade. Measures already taken and proposed by the Government in the new Defence Procurement Policy will support this initiative.

As part of the strategy employed by Essar Steel, the company focuses on developing and engaging with sectors demanding value added grades for critical application and substitute imports in such areas. The requirements of steel for the defence sector fits well into this approach, and thus the company has embarked on a long term plan to address the same.

Essar Steel is well positioned with its state-of-the-art facility, strength of product development and performance track in order to leverage and secure a major share in supplies of steel for defence manufacturing. Steel intensive equipment for defence would primarily be for land and sea application – battle tank, combat vehicle, mine protected vehicles, recovery vehicles, air craft carriers, warships, submarines, missile casings and so on.

While the company will focus on demand from the defence sector in India, we will continue to explore the export markets. India currently imports over 100,000 MT annually to meet its defence requirement. Essar Steel's efforts are towards reducing imports and make the country self-reliant in this critical sector.

There is also growing demand for ballistic and blast protection for civilian protection and from paramilitary and state police force owing to threat within the country. Essar Steel has developed its brand of armoured plates ARMAPRO in several hardness viz. 370 HBN, 500 HBN and 600 HBN to meet the various threat levels required by the customers.

Manufacturing of armour plates require control over the raw ingredients that are used, combined with the tight control of the production process, including the rapid quench system. This



Aerial view of Essar Steel Hazira facility



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steel undergoes stringent testing procedures according to various standards set by the Ministry of Home Affairs, National Institute of Justice (NIJ), NATO (STANAG), etc. which are tested at PXE, TBRL, Gujarat Forensic and international labs like Beschussamt, IABG, H P White, and TNO, to be approved.

Essar Steel's Plate Mill is a state-of-the-art facility and amongst the most modern in the world with an installed capacity of 1.5 MTPY. Its heat treatment facilities is complete with normalizing and austenitizing furnaces followed by quenching and tempering units. The heat treatment units have an installed capacity of 0.3 MTPY, with quenching and tempering constrained to 0.1 MTPY (depending on grade and section rolled).

Essar Steel has developed Quenched and Tempered (Q&T) special alloy plate viz. SPADE and CDA099 grades for ballistic protection in armoured vehicle, mine protected vehicle and main battle tank (MBTs). After extensive evaluation for ballistic and other critical

properties, this product is now indigenously available. The company has jointly developed DMR 1700 grade with Defence Metallurgical Research Laboratory (DMRL), Hyderabad. This is a special Q&T grade steel plates with a strength level of 1700 MPa, for application in the future combat vehicles, MBTs and motor casings in missile. For the first time in India, this grade of high strength steel is cast in a continuous caster and rolled. This is a matter of pride not only for Essar Steel, but for the whole nation. The company has also developed special steel grades according to EN10025-6 S690QL and S890QL for manufacturing components in 155 mm artillery guns. The company is a registered supplier with the Ordnance Factory Board for supply of these grades.

The company has been a forerunner in developing naval ship plate according to DMR 249A for construction of hull of warships. For this product, the company has been approved by the Directorate of Naval Architecture (DNA). In 2012-13, the company successfully executed an order for supply of DMR 249A steel plates from Mazagon Dock for the P-15B project. Under this project, the dock will construct 4 nos. stealth warships for the navy. The company has also supplied this grades for construction of a floating dock to L&T Shipbuilding and regular supplies the same for repairs work to Hindustan Shipyard, Reliance Defence, Garden Reach Shipbuilders and various Material Organisations at Karwar, Vizag and Mumbai. The company regularly participates in the requirement of other ship plates for construction of Naval and Coast Guard Offshore Patrol Vessels (NOPVs/CGOPVs). For the purpose, the company has received accreditations from class societies like American Bureau of Shipping, Det Norske Veritas, Bureau Veritas, RINA, Germanischer Lloyd, Lloyd Register and others for all its shipping grades.

Going forward, the company has been approached by defence companies in India as well as overseas for development of new steel grades for critical land defence and naval defence systems including sub-sea systems. The company's forte lies in meeting the stringent metallurgical conditions required, achieving the required combination of high strength and toughness, good welding, excellent fatigue and weather resistance properties. Its exceptional high corrosion resistant and fungal resistant properties enable Essar Steel plates to withstand the severe marine conditions. These indigenous developments pave the way for exports of these special steels thereby aiding India in earning precious foreign exchange.

Essar is focusing on the defence segment to target high value added plates apart from normal structural steels used for engineering constructions. In the last few years, Essar product range of plates include high wear and abrasion resistance steels for earth moving vessels, advanced high strength and ultra-tough steels for building war ships, special class of Q&T ballistic applications. These are some of the major breakthrough products with in-house know how that Essar Steel has developed in the country.



ARMAPRO 500

High Hardness Protection Steel Plate



Standard (*)	Type of bullet	Velocity (minimum)	Nominal Plate Thickness
NIJ			
Level -III	7.62 X 51 M80 NATO Ball	838±15m/sec	6.00 mm
Level -IV	0.30 Caliber AP M2	868±15m/sec	14.50 mm
STANAG4569			
Level - I	5.56 x 45mm M193	937±20m/sec	9.20 mm
5.56 x 45mm SS109	900±20m/sec		
7.62 X 51 M80 NATO Ball	833±20m/sec		
Level - II	7.62 X 39 API BZ	695±20m/sec	12.20 mm
En1522			
FB6	7.62 X 51 M80 NATO Ball	830±10m/sec	6.0 mm
Fb7	7.62 X 51 P80 NATO AP	820±10m/sec	14.5 mm

(*) Other ballistic requirements to be agreed on case to case basis

Essar Steel has developed ARMAPRO 500 which is a high-hardness steel (500 HB) with excellent ballistic resistance properties, strength and workability for a range of applications – Vehicle Protection (Military and Civilian), Shields, Bank Counters, Safes, Burglar Proof Storage Premises.

ARMAPRO 500, armour plate is being marketed for the first time in India, to provide ballistic and blast protection for military and civilian use. The grade has been developed through the continuous casting route and subjected to stringent process control to achieve uniform properties.

ARMAPRO brand is also available in variety of hardness viz. 370 HBN and 600 HBN depending on threat level and application.

ARMAPRO 500 is available in thicknesses between 6.0 and 25.0 mm. Width is available between 1500 mm and 3000 mm, Length between 3.0 m and 12.0 m.

ARMAPRO 500 possesses excellent combination of high strength, toughness, bending and welding properties.

ARMAPRO can be supplied in accordance with the required threat perception and ballistic evaluation:

Plate Mill Facility



The demand for thicker, wider and ultra-high strength steel plates has been increasing due to rapid industrialization across the world. Key industry players across different segments in India, have concurred that availability of thicker and wider width plates will result in enormous savings on fabrication and welding, and also lead to an improvement in yield, quality and durability.

Recognizing the growing needs and potential of the plate market in India, Essar Steel has commissioned a state-of-the-art Plate Mill at Hazira. The 4 Hi Rolling mill has a roll separating force of 10,000 metric tonnes and can produce plates with a width of up to 5 meters. Other facilities include Normalizing, Accelerated Cooling / Direct Quenching, Hot and Cold

Plate Mill Size Capability

Thickness	Upto 150 mm
Width	1,100 to 4,950 mm (in mill edge condition) 900 to 4,850 mm (in trimmed condition)
Length	3,000 to 25,000 mm

Levelling and Quenching and Tempering.

It produces over 300 grades of steel conforming to quality standards of international certification agencies like API, ABS, NACE, Lloyd's Register, TUV Nord, Bureau Veritas and DNV-GL etc.

Plate Applications

Boiler and Pressure Vessels – Grades supplied according to ASTM A 537, A 387, A285 and A515, JIS G3115, JIS G 4109 etc

Line Pipe – Grades as per API 5L-A, B, X-42 to X-70

Shipbuilding Steel – Grades as per ABS A, B, D, AH32, DH32, EH 32, AH40 and also as per DNV-GL, NKK, LR etc

Structural Steel – As per ASTM A572, A573, EN 10025 S235, S275JR, S355 etc

High Strength Steel – EN10025 S690QL, S890QL, S700MC etc

Wear Resistant Steel – Rockstar 400, 450, 500 with hardness from 400 to 500 BHN

Ballistic Resistant Steel – As per MIL 46100E, DMRL specs, withstanding protection against NIJ, STANAG, EN and VPAM threat levels.

Rolling Mill

The reversible rolling mill along with cross rolling facilities has a roll separating force of 10,000 tonnes. This force helps in high shape factor rolling and thus reduces the internal discontinuities. The rolling mill is supported by high-speed automatic gauge control for accurate dimensions, plan view rolling for proper cross-section and shape, profile and flatness gauge for ensuring premium quality in plates.



Essar Steel's 1.5 MTPA extra-wide Plate Mill at Hazira, India

“Innovation is an integral part of the work culture at Essar Steel. It has amalgamated into our business strategy for long term sustainability, address the changing need of the customers and staying ahead in the marketplace.”

- Thermo-Mechanical Controlled Rolling (TMCR) and Accelerated Direct Cooling • (ADCO)
- Hot Leveller
- Shearing Units
- Ultrasonic Testing
- Heat Treatment
- Marking and Traceability
- Logistics

Innovation is an integral part of the work culture at Essar Steel. It has amalgamated into our business strategy for long term sustainability, address the changing need of the customers and staying ahead in the marketplace. Therefore it is not surprising to note that the company has been

at the forefront of indigenous development of special steel products for critical and high end applications, resulting in import substitution and cost savings for our customers.

The Research & Development Centre at Essar Steel in Hazira is approved by the Department of Science & Technology.

At Essar Steel, the Research & Development team is engaged in three broad activities viz. i) new product development, ii) raw material and iii) Process Improvement. Over the years, the procedures have been streamlined and as the activities are championed by senior business leaders, there is seamless integration of development activities with the business goals. The product development cycles are short leading to speedy trial and commercialization. Over the past 4 years, Essar Steel has developed 40 new products catering to a broad spectrum of applications including defence, automobiles, energy, transportation and construction. 25% of current sales revenues have been contributed by these new products.

Leveraging our knowledge and experience in developing special steel for critical and high end applications, Essar Steel has developed high strength and high quality grades suitable for providing ballistic and blast protection for combat vehicles and battle tanks, depending on varying threat perceptions.