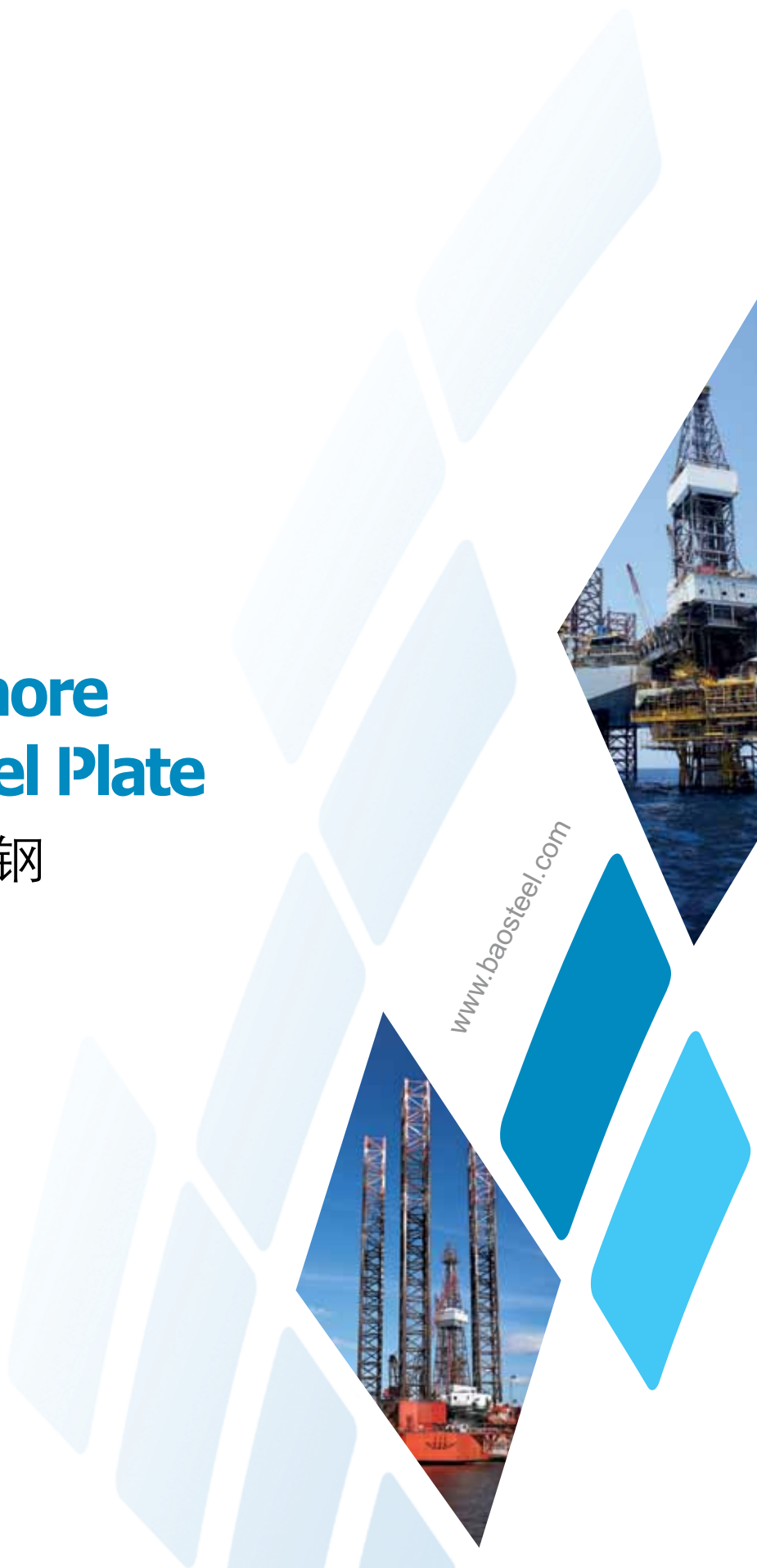


# Baosteel Offshore Structural Steel Plate

宝钢海洋结构用钢

[www.baosteel.com](http://www.baosteel.com)



A large red offshore oil rig is shown against a clear blue sky with scattered white clouds. The rig features three prominent, tall, lattice-structured derrick towers. The base of the rig is a large, red-painted platform with various structures, including a white control room and other smaller towers. The rig is situated in a body of water, with a distant shoreline visible in the background.

Build Baosteel into the most  
competitive iron & steel enterprise in the world

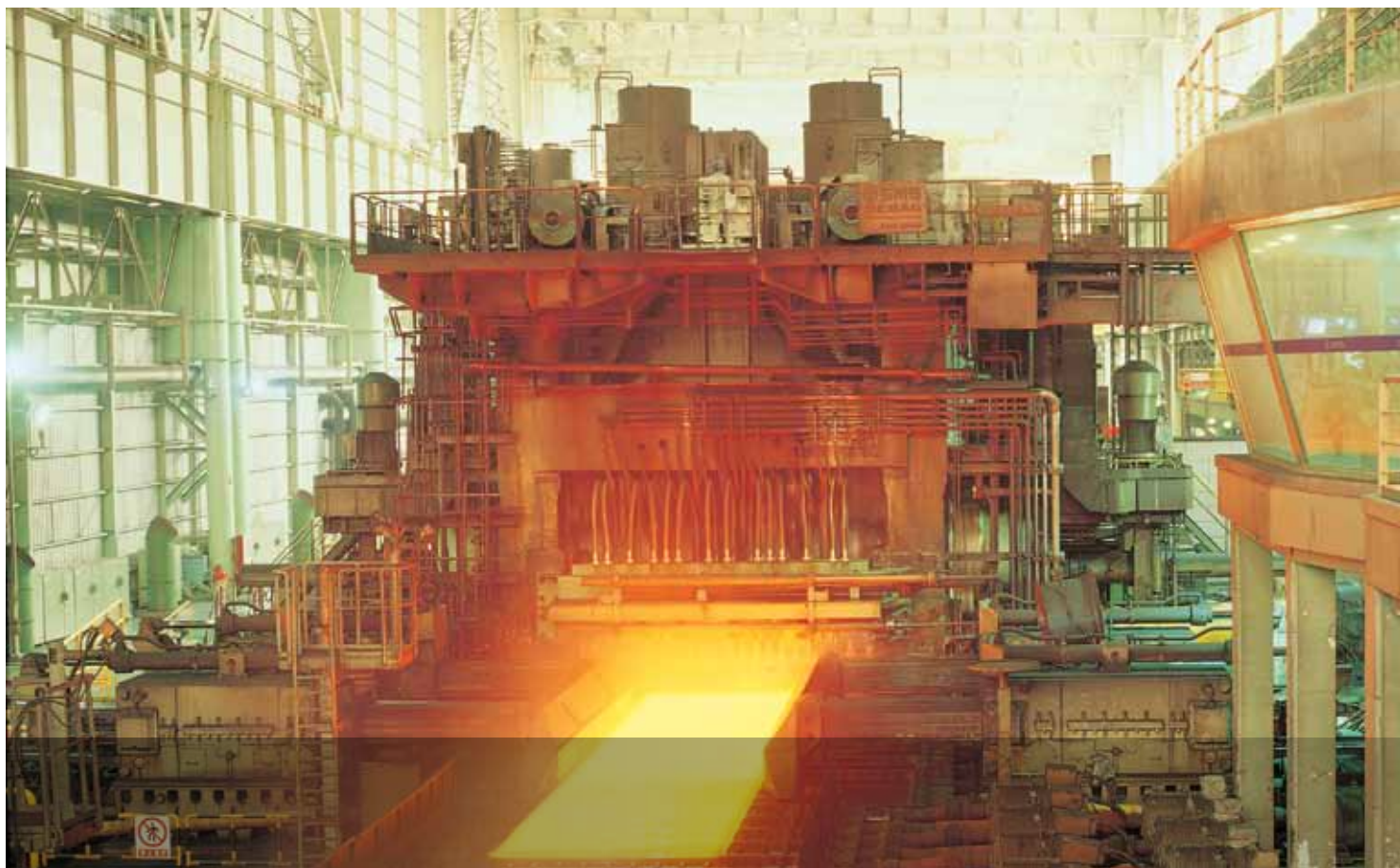
建成全球最具竞争力的钢铁企业

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## 5m厚板产线介绍

5m轧机工程于05年3月建成，年生产规模为180万吨。

宝钢厚板主作业线设备由德国SMS和SIE提供，广泛采用当今厚板领域最新技术及装备，包括高精度轧制技术、TMCP技术、强力矫直自动化控制技术、自动化剪切技术、在线自动化探伤技术、无氧化热处理技术、预矫直机、综合板型测量仪、自动标记等，以满足用户对高等级厚钢板的高尺寸精度、高性能的要求。

宝钢5m厚板轧机产品定位是高强度船舶及海洋工程用钢、大口径油气输送管线用钢板、高强度建筑结构板、焊接结构用高强度调质钢板、锅炉和压力容器用钢板等高难度厚板产品。

在过去的近十年中，宝钢不断扩大产品种类，提高产品质量，尽最大的努力开发和提供高品质的厚板以满足客户的需求。





## Introduction of 5-meter Heavy Plate Mill

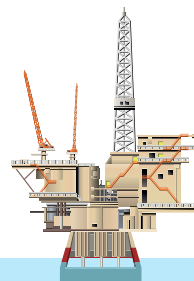
Baosteel 5-meter heavy plate mill was established in March 2005, with the annual production capacity of 1.8 million tons.

Its main production equipments are provided by German SMS and SIE. The 5-meter heavy plate mill extensively adopts the state-of-the-art heavy plate technologies and facilities in the world, including high precision of rolling technique, TMCP technology, automatic control technique for strong leveling process, automatic cutting technique, automatic online ultrasonic detective technique, non-oxidation heat treatment technique, pre-leveler, comprehensive plate surface measuring apparatus and automatic marking, etc. In this way, requirements of high dimensional accuracy and mechanical property for high grade heavy steel plates from customers can be satisfied.

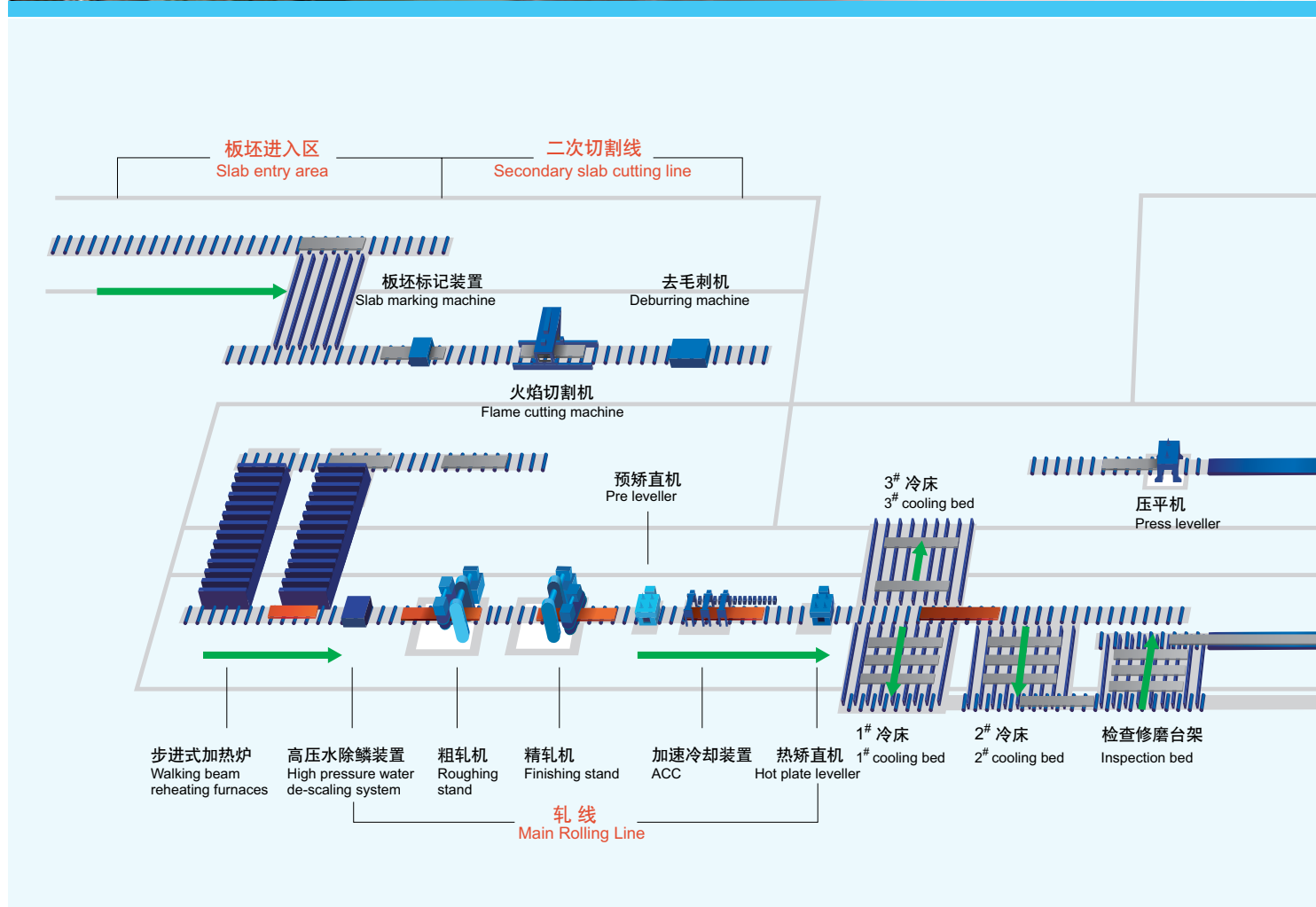
The heavy plate mill can produce high strength hull structural steel plates, offshore structural steel plates, oil and gas transportation

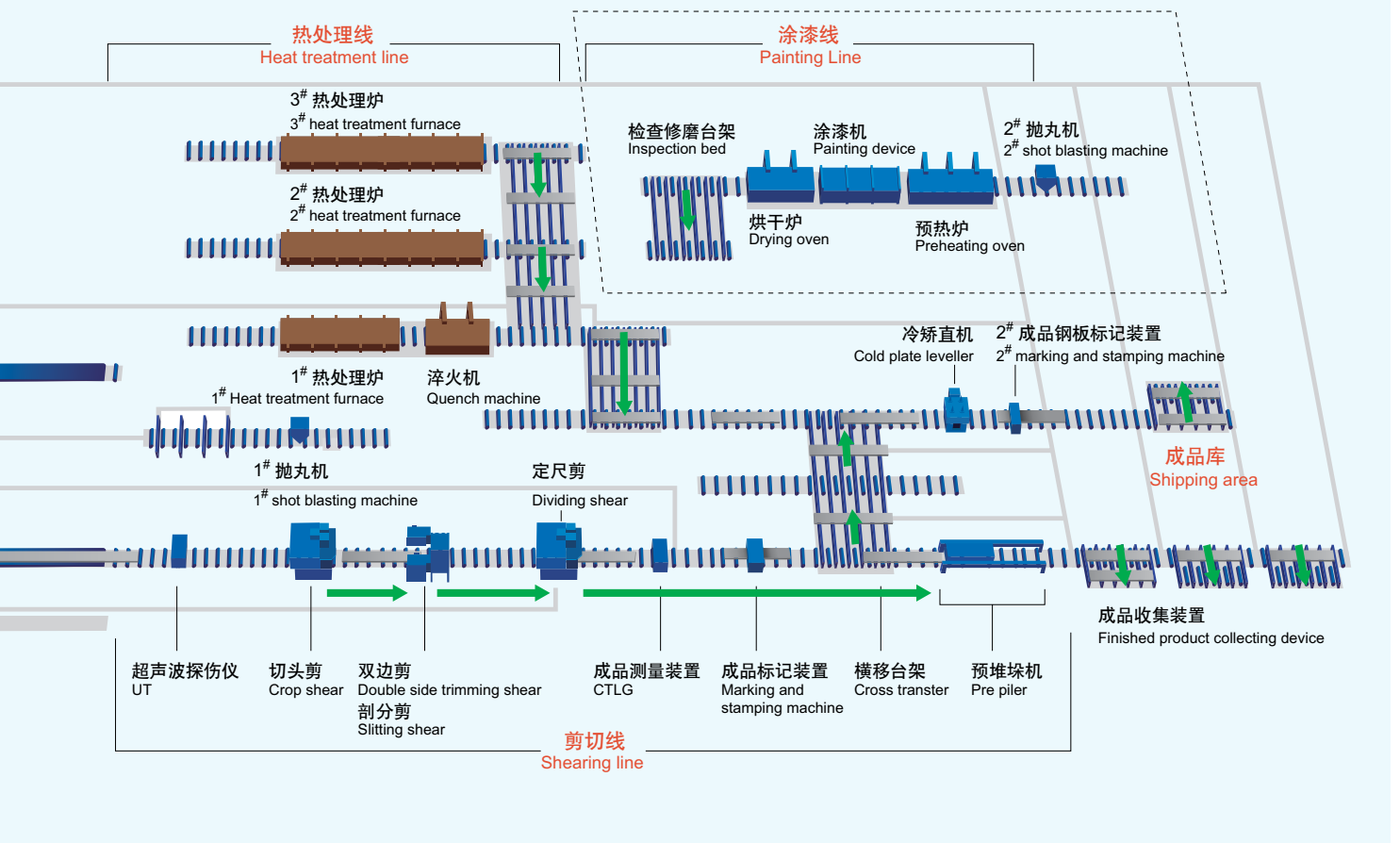
pipeline steel plates, high strength construction structural steel plates, high strength Q&T steel plates for welded structure and steel plates for boilers and pressure vessels.

In the past decade Baosteel has exerted utmost effort to develop and supply high-quality heavy plates to meet customers' demands. We are continuously expanding our products types ,improving our products quality.



# 制造工艺流程 Process Flow







## 产线特色

### 1) 产品交货能力:

多种交货状态包括普通轧制态AR、控轧（正火轧制）、控轧控冷态TMCP、正火态N、调质态QT；产品最大厚度为200mm，最大宽度达4800mm，最大长度为25m，最大单重22.5吨；宝钢可生产屈服强度1300Mpa级别的超高强度钢板或-196℃低温冲击韧性钢板。

### 2) 钢水纯净度高:

宝钢运用先进的炼钢设备和技术，并通过铁水脱硫、转炉脱磷和炉外精炼设备RH-MFB、LF、RH-OB、KIP/CAS，钢水的化学成分控制稳定，波动小，使钢水纯净度能够达到[S] ≤ 10ppm、[P] ≤ 50ppm、[O] ≤ 20ppm、[H] ≤ 1.5ppm的世界一流水平。

### 3) 铸坯内质优良:

通过电磁搅拌、轻压下技术，有效控制中心偏析、夹杂物、疏松和内裂，中心偏析可以稳定控制在M20级以下，低倍内裂、三角区裂纹、角裂、夹杂及黑点等缺陷可以控制在10级内，铸坯冶金质量好。（备注：根据宝钢厚板连铸坯低倍组织试验检查基准，按酸浸低倍检验的标准图谱进行判定）。

### 4) 板形控制技术:

采用高精度设定模型，实现多点设定、道次间自适应，多功能AGC控制技术及CVC<sup>PLUS</sup>板型控制技术，获得良好平面形状。钢板不平度 ≤ 2mm/m，5mm/全长。

### 5) 高尺寸精度控制:

精轧机采用绝对AGC及近置式测厚仪的监控AGC，实现高厚度精度控制。钢板厚度同板差 ≤ 0.5mm，船舶及海工产品厚度正公差增重量 ≤ 1.5%。计算机自动组板、控制切割，钢板厚度可按0.1mm进级，长度、宽度可按1mm进级，提高用户的材料利用率。







## Process Features

### 1) Product delivery capability:

Many delivery conditions can be available: as-rolled, control rolled (normalized rolled), TMCP, normalized, quenched & tempered, etc.

Max. thickness: 200mm    Max. width: 4800mm

Max. length: 25m    Max. unit weight: 22.5 tons

And high-strength steel plate with yield stress of 1300MPa or plate with -196°C low temperature impact toughness are available in Baosteel.

### 2) High purity of steel:

[S]≤10ppm, [P]≤50ppm, [O]≤20ppm, [H]≤1.5ppm. With advanced steel-making equipment and technology, high purity of the steel plates can be ensured by desulfurization of liquid iron, converter dephosphorization and ladle refining (RH-MFB、LF、RH-OB、KIP/CAS).

### 3) Excellent metallurgical properties of the slab:

Center segregation, inclusion, porosity and internal crack can be effectively controlled by electromagnetic stirring and soft reduction technique.

### 4) Plate shape control technology:

CVC plate profile control technique. Multi-point setting and adaptation between passes can be implemented by high accuracy setting model. Plate flatness is less than 2mm/m and 5mm/L.

### 5) Highly-accurate dimension control:

The finishing mill stand is equipped with absolute AGC and closed-loop gaugemeter type monitor AGC functions to improve thickness control accuracy. Thickness variation in length is less than 0.5mm. The average positive weight tolerance in mass production can be limited less than 1.5% for hull and offshore structural steel plates.

For ordering, the minimum thickness unit is 0.1mm, and the minimum length and width unit is 1mm.

## 质量保证体系 Quality Assurance System

宝钢5m厚板产线建立了完善的各项管理机制，获得了ISO9001、ISO14001、OHSAS18001等体系的认证。

Baosteel 5-meter heavy plate mill has established and improved comprehensive quality management mechanism. Certificates of system registration such as ISO9001, ISO14001 and OHSAS18001 have been successively obtained since 2005.



**bsi.**  
**Certificate of Registration**  
**OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM**

This is to certify that: Baosteel Iron & Steel Co., Ltd. 宝山钢铁股份有限公司  
 Fujin Road 中一路  
 Baoshan District 宝山区  
 Shanghai 201900 上海市  
 China 中国 邮编: 201900

Issue Certificate No: OHS 83723

and operates an Occupational Health and Safety Management System which complies with the requirements of BS OHSAS 18001:2007 for the following scope:  
 The production of iron and steel and related supporting system.  
 钢铁生产及相关的辅助系统。

For and on behalf of BSI: Gary Parker, Global Assurance Director

Originally registered: 27/06/2008 Latest Issue: 23/10/2012 Expiry Date: 23/10/2015

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Certificate No: OHS 83723

Location	Registered Activities
Baosteel Iron & Steel Co., Ltd. Fujin Road Baoshan District Shanghai 201900 China 201900 201900 201900 201900 201900 201900	The production of iron and steel and related supporting system. 钢铁生产及相关的辅助系统。
Baosteel Iron & Steel Co., Ltd. No. 2388 Kangyang Road Baoshan District Shanghai 200421 China 200421 200421 200421 200421 200421 200421	The production of cold rolling steel products and related supporting system. 冷轧产品的生产及相关的辅助系统。

Originally registered: 27/06/2008 Latest Issue: 23/10/2012 Expiry Date: 23/10/2015

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**bsi.**  
**Certificate of Registration**  
**ENVIRONMENTAL MANAGEMENT SYSTEM - ISO 14001:2004**

This is to certify that: Baosteel Iron & Steel Co., Ltd. 宝山钢铁股份有限公司  
 Fujin Road 中一路  
 Baoshan District 宝山区  
 Shanghai 201900 上海市  
 China 中国 邮编: 201900

Issue Certificate No: EMS 83746

and operates an Environmental Management System which complies with the requirements of ISO 14001:2004 for the following scope:  
 The production of iron and steel and related supporting system.  
 钢铁生产及相关的辅助系统。

For and on behalf of BSI: Gary Parker, Global Assurance Director

Originally registered: 16/06/2008 Latest Issue: 23/10/2012 Expiry Date: 23/10/2015

Page 1 of 2

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Certificate No: EMS 83746

Location	Registered Activities
Baosteel Iron & Steel Co., Ltd. Fujin Road Baoshan District Shanghai 201900 China 201900 201900 201900 201900 201900 201900	The production of iron and steel and related supporting system. 钢铁生产及相关的辅助系统。
Baosteel Iron & Steel Co., Ltd. No. 2388 Kangyang Road Baoshan District Shanghai 200421 China 200421 200421 200421 200421 200421 200421	The production of cold rolling steel products and related supporting system. 冷轧产品的生产及相关的辅助系统。

Originally registered: 16/06/2008 Latest Issue: 23/10/2012 Expiry Date: 23/10/2015

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## 检测设备

### Testing Devices and Equipments

宝钢拥有化学、力学、物理性能检测实验室，有热轧试验机、拉伸试验机、冲击试验机、光学显微镜、透射电镜、热模拟试验机等大型检测设备近百台，为宝钢厚板新产品的开发提供了有力的支持。

Baosteel possesses chemical, mechanical and physics testing laboratories which are equipped with nearly one hundred sets of large scale testing devices such as hot rolling testing machine, tensile testing machine, impact testing machine, optical microscopes, TEM, and hot stimulating testing machine, etc. They supply the strong support for the available product testing and new heavy plate product developed by Baosteel.





## 主要产品介绍

### Introduction of Main Products

#### 1) 船板

##### Hull Structural Steel Plate

规范 Specification	分类 Classification	牌号 Steel Grade	厚度 Thickness (mm)	交货状态 Delivery Condition	厚度方向性能 Through Thickness Property
ABS BV CCS DNV GL KR LR NK RINA	普通船板 Normal strength hull structural steel plate	A/B	≤50	AR	Z25/Z35
			≤130	N	
		D	≤35	AR	
			≤130	N	
	E	≤130	N		
	高强船板 High strength hull structural steel plate	AH32/ DH32	≤20	AR	
			≤40	CR/NR	
			≤100	N	
		AH36/DH36	≤20	AR	
			≤40	CR/NR	
			≤100	N	
			EH32/EH36	≤100	
	AH/DH/EH32/36	≤80	TM		
AH40/DH40/EH40	≤68	TM			
高韧性船板 High toughness hull structural steel plate	FH32/FH36/FH40	≤68	TM		
GL DNV	大型集装箱船板 Large container hull structural steel plate	D47/E47	≤80	TM	



## 2) 海洋结构用钢

## Offshore Structural Steel Plate

标准或规范 Standard or Specification	分类 Classification	牌号 Steel Grade	厚度 Thickness (mm)	交货状态 Delivery Condition	厚度方向性能 Through Thickness Property
ABS CCS DNV GL	超高强船板 Extra high strength hull structural steel plate	AQ/DQ/EQ 43/47/51/56 A/D/E 420/460/500/550	≤88	QT	Z25/Z35
		AQ/DQ/EQ 63/70 A/D/E 620/690	≤178	QT	
		A514Q/517Q	≤178	QT	
API	海洋结构用钢 Offshore structural steel plate	API 2H GR 42/GR50	≤100	N	
		API 2Y GR50/GR60	≤80	QT	
		API 2W GR50/GR60	≤80	TM	
EN10225		S355G7/8/9/10+N	≤100	N	
		S355G7/8/9/10+M	≤80	TM	
ASTM A514/517					

## 3) 海底管线

## Subsea Pipelines

规范 Specification	分类 Classification	牌号 Steel Grade	厚度 Thickness (mm)	交货状态 Delivery Condition
API	管线钢 Pipeline	API 5L X65MO	≤31.8	TM
		API 5L X70MO	≤31.8	TM

备注: 1.AR-轧态, CR (NR) -控轧 (正火轧制), N-正火, TM(TMCP)-热机械轧制, QT-淬火

2.宝钢股份分别通过了ABS、CCS、NK、KR船级社的QA (Quality Assurance) 认证, BV船级社的Model I认证, LR船级社的MQS (Material quality Scheme) 认证和DNV船级社的MSA认证。

Remarks: 1. AR-as rolled, CR (NR)-control rolled (normalized rolled), N-normalized, TM-Thermomechanical controlled processing, QT-quenched & tempered.

2. Baosteel has obtained the approval certificate of QA (Quality Assurance) of ABS, CCS, NK and KR, Model I of BV, MQS (Material quality Scheme) of LR and MSA of DNV respectively.

## 典型产品特性及供货业绩 Typical Products and Applications

### 1) API系列 / API Series

API 2W-50(厚度: 80mm) / API 2W-50 ( Thickness: 80mm )

化学成分 ( wt.% )

Chemical Composition (wt.%)

C	Si	Mn	P	S	Al	Ti、Cu、Ni、Nb	Ceq	Pcm
0.07	0.20	1.48	0.004	0.001	0.053	添加 added	0.36-0.38	0.17-0.19

机械性能

Mechanical Property

牌号 Grade	厚度 Thickness mm	屈服 强度 YS MPa	抗拉 强度 TS MPa	延伸率 EL %	屈强比 YR %	冲击功 Impact, J (-40°C)		时效冲击 Strain Age Tsetting Impact, J (-40°C)		厚内位置 Thickness Position	布氏硬度 Brinell Hardness	
						单值 Single	均值 Av.	单值 Single	均值 Av.		单值 Single	均值 Av.
API 2W-50	80	433	548	37	83	391/383/396	390	338/260/303	300	Surface	189/190/186	188
										1/4	162/164/163	163
										1/2	158/158/158	158
API 规范 API Specification		345-483	≥448	≥23	—	≥34	≥41	≥34	≥41			

NDT及厚度方向性能

NDT Property and Through Thickness Property

NDT性能 (横向) NDT Property (Transverse)			厚度方向性能, % (Z35) Through Thickness Property, %(Z35)	
试验温度 Test temperature, °C	试验结果 Test result		单值 Single	均值 Av.
-35	O No-break	O No-break	70/77/75	74
-45	O No-break	O No-break		
-50	O No-break	× Break		





## 可焊性

## Weldability Property



拉伸试验 Tensile Test			冲击试验 Impact Test Test						
热输入量 Heat Input KJ/cm	抗拉强度 Rm MPa	断裂点 Break Point	热输入量 Heat Input, KJ/cm	状态 Condition	方向 Direction	厚内位置 Location in Thickness	缺口位置 Notch Location	冲击功 Absorbed Energy, J (-40°C)	
								单值 Single	均值 Av.
45	539	Base Metal	45	As welded	T	1/4	CGHAZ	409/395/402	402
							SCHAZ	391/394/382	389
						ROOT	CGHAZ	400/401/401	401
							SCHAZ	403/391/396	397

## 焊接接头的CTOD试验结果

## CTOD test results of welded joint

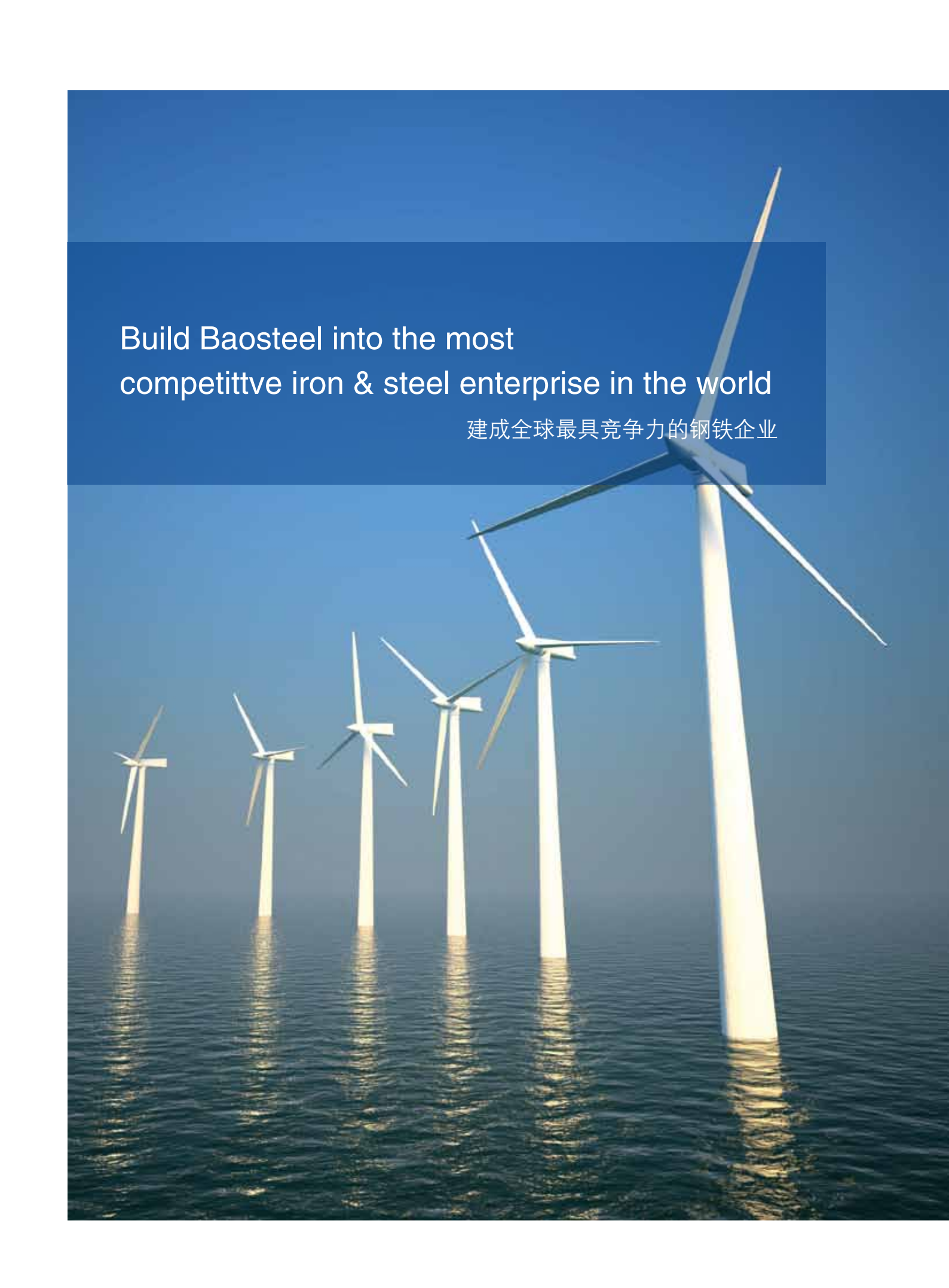
试验温度 Test temp. (°C)	热输入量 Heat input, KJ/cm	状态 Condition	缺口位置 Notch Location	B, mm	W, mm	a0, mm	δ, mm
-10	45	As welded	CGHAZ	69.91	69.93	35.31	0.80
				69.90	69.90	35.43	0.81
				69.93	70.00	35.01	0.41
			SCHAZ	69.79	69.92	36.2	0.77
				69.95	69.98	36.45	0.78
			规范 Specification	δ≥0.38mm			

## 工程应用案例

## Project Applications

用户 Customers	牌号 Grade	厚度 Thickness (mm)	供货量 Weight (ton)	供货时间 Year	项目类型 Type
巴西国家石油公司 (GUARA AND LULA-NE 项目) PETROBRAS (GUARA AND LULA-NE Project)	API 2W-50 API 2W-50Z	16-51	4233	2012	浮箱和基座 Buoy and Foundation



A row of five white wind turbines stands in the ocean under a clear blue sky. The turbines are arranged in a line, receding into the distance. The water is dark blue with some ripples, and the sky is a uniform light blue. The turbines have three blades each, and their towers are tall and slender. The overall scene is clean and modern, representing renewable energy.

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competitive iron & steel enterprise in the world

建成全球最具竞争力的钢铁企业

## 2) EN10225 系列 / EN10225 Series

S355G10+M (厚度: 63.5mm) / S355G10+M (Thickness: 63.5mm)

## 化学成分 (wt.%)

Chemical Composition (wt.%)



C	Si	Mn	P	S	Al	Cu、Ni、Nb、Ti	Ceq	Pcm
0.07	0.23	1.50	0.01	0.001	0.041	添加 added	0.36-0.38	0.17-0.19

## 机械性能

Mechanical Property

牌号 Grade	厚度 Thickness mm	屈服强度 YS MPa	抗拉强度 TS MPa	延伸率 EL %	屈强比 YR %	冲击功 Impact, J (-40°C)	
						单值 Single	均值 Av.
S355G10+M	63.5	426	551	28	77	274/208/259	247
EN10225 标准 EN10225 Standard		≥325	460-620	≥22	—	≥35	≥50

## 工程应用案例

Project Applications

用户 Customers	牌号 Grade	厚度 Thickness (mm)	供货量 Weight (ton)	供货时间 Year	项目类型 Type
道达尔 (OFON 2 项目) TOTAL (OFON 2 Project)	S355KT-40/P S355KT-20 S355KL+20	20-63.5	1400	2012	固定式平台 Fixed



### 3) EQ系列 / EQ Series

调质超高强船板：EQ56、EQ70 / Q&T Hull Structural Steel Plate: EQ56、EQ70

化学成分 (wt.%)

Chemical Composition (wt.%)



牌号 Grade	厚度 Thickness (mm)	C	Si	Mn	P	S	Al	Cu、Ni、V、Ti、 Cr、Mo、B	Ceq	Pcm
EQ56	50	0.080	0.14	1.10	0.007	0.001	0.050	添加 added	0.43-0.51	0.20-0.23
EQ70	88	0.080	0.19	1.09	0.004	0.001	0.056	添加 added	0.53-0.58	0.23-0.26

机械性能

Mechanical Property

牌号 Grade	厚度 Thickness mm	屈服强度 YS MPa	抗拉强度 TS MPa	延伸率 EL %	屈强比 YR %	冲击功 Impact, J (-40°C)		时效冲击试验 Aging Test (-40°C)	
						单值 Single	均值 Av.	单值 Single	均值 Av.
EQ56	50	736	772	20	79	265/274/266	269	252/253/263	256
ABS 规范 ABS specification		≥550	670-835	≥16	—	≥39	≥55	≥39	≥55
EQ70	88	733	798	19	73	218/240/241	233	82/222/228	177
ABS 规范 ABS specification		≥690	770-940	≥14	—	≥49	≥69	≥49	≥69



## NDT及厚度方向性能

## NDT Property and Through Thickness Property

牌号 Grade	厚度 Thickness (mm)	NDT性能 (横向) NDT Property (Transverse)			厚度方向性能 (%) Through Thickness Property, %	
					单值 Single	均值 Av.
EQ56	50	-35	O No-break	O No-break	74/74/74	74
		-40	O No-break	O No-break		
		-45	x Break	O No-break		
EQ70	88	-35	O No-break	O No-break	70/70/71	70
		-40	O No-break	O No-break		
		-45	x Break	O No-break		

## 可焊性

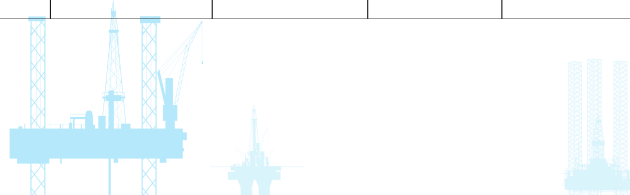
## Weldability Property

牌号 Grade	热输入量 Heat Input KJ/cm	状态 Condition	方向 Direction	厚内位置 Location in Thickness	缺口位置 Notch Location	冲击功 Absorbed Energy, J(-40°C)	
						单值 Single	均值 Av.
EQ56	45	As welded	L	surface	weld centre	75/90/90	85
					FL	61/60/65	62
					FL+2	210/68/225	168
					FL+5	89/239/223	184
					FL+20	255/266/258	260
EQ70	45	As welded	L	surface	weld centre	75/78/72	75
					FL	85/86/89	87
					FL+2	198/197/210	202
					FL+5	222/219/240	227
					FL+20	162/135/156	151

## 工程应用案例

## Project Applications

用户 Customers	牌号 Grade	厚度 Thickness (mm)	供货量 Weight (ton)	供货时间 Year	平台类型 Type of Jack-up Platforms
新加坡胜科海事 Sembcorp Marine	AQ51、DQ51、EQ51、 EQ56、EQ63	8-80	4600	2011-2013	400ft
烟台中集来福士 Yantai CIMC Raffles	EQ47、EQ56、EQ63、 EQ70	12-80	4600	2011-2013	300/400ft
振华重工 Zhenhua Heavy Industries	EQ47、EQ56、EQ63、 EQ70	10-80	2600	2011-2013	300/400ft
招商局重工 China Merchants Heavy Industry	EQ51、EQ70	12-160	9000	2011-2013	350/400 ft



#### 4) ASTM 系列 / ASTM Series

自升式平台用齿条和半圆板用钢：A514/A517 GrQ ( EQ70 ) / Offshore platform rack and chord steels: A514/A517 GrQ ( EQ70 )

化学成分 ( wt.% )

Chemical Composition (wt.%)

牌号 Grade	厚度 Thickness (mm)	板坯类型 Slab Type	C	Si	Mn	P	S	Cr、Ni、Mo、V、 Al、Nb、Ti、B	Ceq	Pcm
A517GrQ (A517GrQ-M) A514GrQ (A517GrQ-M) EQ70	88	连铸 Continuous Casting	0.13	0.20	1.00	0.0044	0.0005	添加 added	0.61~0.82	0.27~0.35
	178	模铸 Ingot Casting	0.17	0.26	1.13	0.0049	0.0008		0.73~0.85	0.35~0.39
ASTM A517/A517M 标准 Standard	≤150	—	0.14-0.21	0.15-0.35	0.95-1.30	≤0.035	≤0.035	添加 added	—	—
ABS 规范 Specification (EQ70)	≤88	—	≤0.20	≤0.55	≤1.70	≤0.030	≤0.030		—	—

机械性能

Mechanical Property

牌号 Grade	厚度 Thickness (mm)	厚内位置 Location in Thickness	屈服强度 ReH MPa	抗拉强度 Rm MPa	延伸率 A50,%	面缩率 Reduction of Area, %
A517GrQ A514GrQ EQ70	88	1/4	772	832	22	73
		1/2	769	831	22	74
	178	1/4	765	853	21	67
		1/2	763	866	20	58
ASTM A517/A517M 标准 Standard	≤150	—	≥690	795-930	≥14	≥45 (Round specimens)
ABS 规范 Specification (EQ70)	≤88	—	≥690	770-940	≥14	—

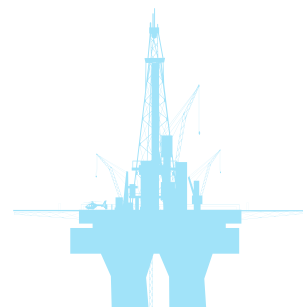


牌号 Grade	厚度 Thickness (mm)	厚内位置 Location in thickness	冲击功 Impact Test, J(-40°C, L)		侧膨胀值 Lateral Expansion, (mm)		时效冲击 Strain Age Testing, J(-40°C, L)		布氏硬度 Brinell Hardness	
			单值 Single	均值 Av.	单值 Single	均值 Av.	单值 Single	均值 Av.	单值 Single	均值 Av.
A517GrQ A514GrQ EQ70	88	1/4	222 /207 /201	210	1.92 /1.94 /1.90	1.92	222 /207 /201	204	265 /267 /266	267
		1/2	129 /198 /153	160	2.01 /2.03 /1.82	1.95	129 /198 /153	176	256 /260 /251	256
A517GrQ A514GrQ EQ70	178	1/4	96 /131 /134	120	0.99 /1.27 /1.13	1.13	103 /99 /78	93	275 /271 /270	272
		1/2	101 /142 /138	127	0.94 /1.05 /1.14	1.04	90 /95 /99	95	276 /277 /276	276

### NDT、CTOD及厚度方向性能

#### NDT Property, CTOD and Through Thickness Property

牌号 Grade	厚度 Thickness (mm)	NDT 试验 NDT Test (T)			CTOD试验 CTOD Test (-40°C, T)				厚度方向性能 Through Thickness Tensile Test, Room Temperature: %			
		温度 Temperature °C	结果 Result		B, mm	W, mm	a <sub>0</sub> , mm	δ <sub>m</sub> , mm	单值 Single		均值 Av.	
A517GrQ A514GrQ EQ70	88	-45	O No-break	O No-break					67	61	63	64
		-50	O No-break	O No-break								
		-55	× Break	O No-break								
	178	-45	O No-break	O No-break	20.12	39.9	20.5	0.647	60	59	60	60
		-50	O No-break	O No-break	20.14	39.95	20.5	0.528				
		-55	× Break	× Break	20.12	39.92	20.5	0.479				



## 可焊性

## Weldability Property

牌号 Grade	厚度 Thickness (mm)	可焊性-交叉焊缝拉伸试验 Weldability Testing - Cross Weld Tensile Test			可焊性-冲击试验 Weldability Testing - Impact Test				
		热输入量 Heat Input	厚度 Thickness Position	抗拉 强度 Rm MPa	热输 入量 Heat Input	状态 Status	厚内位置 Location in Thickness	冲击功 Impact Test, J(-40°C, Longitudinal)	
								单值 Single	均值 Av.
A517GrQ A514GrQ EQ 70	178	30KJ/cm	surface	850	30KJ/cm	As welded	weld centre	75 /95 /76	82
			1/4	858			FL	129 /136 /137	134
			1/2	837			FL+2	190 /190 /168	183
			1/4	853			FL+5	137 /105 /135	126
			surface	875			FL+20	90 /95 /116	100

## 工程应用案例

## Project Applications

用户 Customers	牌号 Grade	厚度 Thickness (mm)	供货量 Weight (ton)	供货时间 Year	平台类型 Type of Jack-up Platforms	船东 Final Customers
中海油服 China Oilfield Services	A517Q	127	1137	2009	200ft (Rack)	中海油 China National Offshore Oil Corp.
		152.4	416			
渤海装备辽河重工 Liaohe Petroleum Equipment Company (CNPC)	A517Q	127	765	2011	300ft (Rack)	中石油 China National Petroleum Corporation
		152.4	222			
		86.5	1284	2013	400ft (Chord)	
大连船舶重工 海洋工程有限公司 Dalian Shipbuilding Industry Offshore CO., LTD	A517Q	88	1410	2013	400ft (Chord)	挪威 Seadrill



## 5) 海底管线 / Subsea pipelines

X65MO/X70MO (厚度: 31.8mm) / X65MO/X70MO (Thickness: 31.8mm)

## 化学成分 (wt.%)

Chemical Composition (wt.%)



牌号 Grade	厚度 Thickness (mm)	规范 Specification	C	Si	Mn	P	S	Cu/Ni	Cr	Al	Nb/Ti	Ceq	Pcm
X65MO	28.6/30.2	API/DNV/GB 9711	0.04	0.20	1.52	≤0.015	≤0.002	添加 added	添加 added	0.03	添加 added	0.33-0.40	0.13-0.16
X70MO	31.8	API/DNV/GB 9711	0.04	0.20	1.68	≤0.015	≤0.002	添加 added	添加 added	0.03	添加 added	0.35-0.42	0.13-0.17

## 机械性能

Mechanical Property

牌号 Grade	厚度 Thickness (mm)	拉伸性能 Tensile Test, (Transverse-T, Longitudinal-L)					
		方向 Direction	厚内位置 Location in Thickness	屈服强度 YS MPa	抗拉强度 TS MPa	延伸率 EL %	屈强比 YR %
X65MO	28.6	T	1/2	520	576	49	90
		L	1/2	501	568	49	88
		T+L	客户要求 Customer Requirements	450-620	540-758	≥28	≤93
X65MO	30.2	T	1/2	524	582	49	90
		L	1/2	501	565	50	90
		T+L	客户要求 Customer Requirements	485-620	540-758	≥28	≤92
X70MO	31.8	T	1/2	530	595	54	89
		L	1/2	505	575	52	88
		T+L	客户要求 Customer Requirements	485-620	570-758	≥28	≤93

牌号 Grade	厚度 Thickness (mm)	夏比V型缺口冲击性能 Impact Test, (-20°C, Transverse-T) J				DWTT性能 DWTT(0°C, Transverse-T)			
		方向 Direction	厚内位置 Location in Thickness	单值 Single	均值 Av.	方向 Direction	厚内位置 Location in Thickness	单值 Single	均值 Av.
X65MO	28.6	T	1/4	436/437/439	437	T	1/4	89/89	89
			客户要求 Customer Requirements	≥120	≥160		客户要求 Customer Requirements	≥75	≥85
X65MO	30.2	T	1/4	451/451/450	451	T	1/4	91/90	91
			客户要求 Customer Requirements	≥120	≥160		客户要求 Customer Requirements	≥75	≥85
X70MO	31.8	T	1/4	443/453/437	444	T	1/4	86/88	87
			客户要求 Customer Requirements	≥120	≥160		客户要求 Customer Requirements	≥75	≥85

### 工程应用案例

#### Project Applications

用户 Customers	牌号 Grade	尺寸 (直径、 壁厚、长度) Dimensions (diam., WT, length)	供货量 Weight (ton)	供货 时间 Year	涂层类型 Coating Type Applicator	服役环境 Service Type (oil, gas, sour, non-sour)	项目 Project
中海油 CNOOC	X65MO X70MO	X65-762*28.6 /30.2 (MM) X70-762* 31.8 (MM) 12.2 (M)	43000	2011	光管 Bare Pipe	天然气输送管 非酸性服役环境 Gas Offshore, Non-sour Service	中国南海深水天然气 开发项目(海底管线) South China Sea Deep Water Gas Development Project (Offshore Pipeline)
中石油东南亚 天然气管道 有限公司 South-East Asia Gas Pipeline Company Limited	X70MO	1016*25.4 (MM) 12.2 (M)	3600	2011	光管 Bare Pipe	天然气输送管 非酸性服役环境 Gas Offshore, Non-sour Service	缅甸-中国天然气 管道工程(缅甸段) 海底管线 Offshore Pipeline Section of Myanmar-China Gas Pipeline Project (Myanmar Section)





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