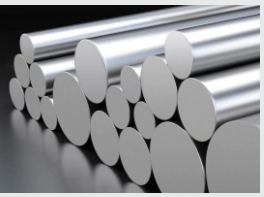
TGK

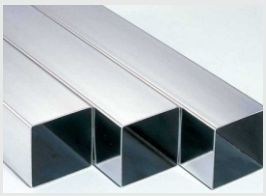
SPECIAL STEEL PVT. LTD.

The name you can trust...

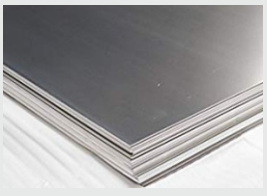


Roads

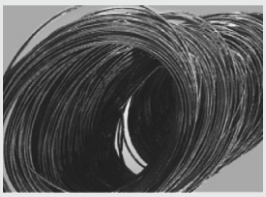
Blocks



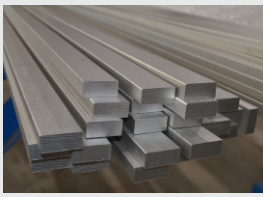
Square



Sheets



Coils



Flats

www.tgkssl.com

SCAN ME

TGK
SPECIAL STEEL PVT. LTD.

M/S TGK Special Steel Private Limited is a joint venture company between **Kushal Metal & Steel Industries and M/S Tiangong International Company Limited,** established in 2012, where TG means Tiangong and K stands for Kushal Metal. **M/S TGK Special Steel Private Limited** is in the business of providing high quality tool steel for the indian tool and die steel industry. We would like to introduce our parent organizations.

M/S Tiangong International Company Limited was established in August 1981 at Danyang, Danbei, Jiangsu, the "Hometown of Chinese Tools", located in the Yangtze River Delta and Shanghai Economic Circle Corridor. It covers an area of 1.3 million square meters and currently employs more than 3,000 people.. It was listed on the main board of the Hong Kong Stock Exchange in 2007. With total assets of nearly 10 billion yuan, the company is China's largest manufacturer of premium special steel, cutting tools and titanium alloys. According to SMR reports it is the second largest manufacturers of Tool steel in the world.

Tiangong mainly produces High speed steel(HSS), HSS cutting tools and steel. It is the largest manufacturer of High speed steel and HSS cutting tools in the world as per SMR reports. The company has setup a complete production line for HSS die steel and cutting tools.

Tiangong produces approximately 15% of the world's total high-speed tool steel; the annual production capacity of die steel is 250,000 tons, the annual output of cutting tools is about 300 million pieces, and the annual production capacity of titanium alloys is 10,000 tons. The four main products are widely used in aviation, automobiles, marine, high-speed trains, petrochemicals, and mechanical processing.

Kushal Metal & Steel Industries was founded as Dinesh hardware mart in 1968 and gradually in 1987 Kushal Metal & Steel industries was created. Kushal Metal and Steel Industries has been serving the Indian tool room industry for more than 40 years.

TGK Special Steel deals in the following tool steels

High Speed Steel
M2, TGM2A, TGM2B, M35, M35A, M42, W9, 4241, 4341

Hot Die Steel
H13, TGE13, TGGP13, TGE23, H11, H11M, TGGP11, 1.2367 SUP, H10, H21, 1.2714

Cold Work Steel
D2, D3, O1, S7, A2, A8M, 1.2767, TSFD2, TSFDC53,

Powder Metallurgy in High Speed Steel & Die Steel
TPM330, TPM558, TPM638, TPM6711, TPMM4, TSFD2, TSFDC53

Plastic Mould Steel
1.2311, 1.2738 (HH), 1.2316, 1.2083 ESR, TGP80, PHX SUPRA

Titanium Products
Gr1, Gr2, Gr3, Gr4, Gr5, Gr6, Gr7, Gr9, Gr11, Gr12, Gr 23

Cutting Tools
HSS Cutting Tools, Carbide Cutting Tools

To Service you better and to cater to all your needs we are expanding our network of representatives, branches and warehouses across India. We are at present located in **Mumbai, Bhiwandi & Ahmedabad,** we will soon be opening a branch in **Bangalore & Delhi.**

With our Hitech Warehouses in **Mumbai, Bhiwandi & Ahmedabad;** We can reach every part of India on time every time.

An overview of our ware houses we have the following infrastructure:

- **Cranes** - 25 ton's - 1 No, 15 Ton's - 3 Nos., 10 Ton's - 5 Nos. , 5 Tons's - 5 Nos.
- **Vertical Band Saw Machine** - 6 Nos. (Max 2500 x 1500, 2500 x 700)
- **Horizontal bandsaw Machine** - 16 Nos. (Max 2200 x 1000, 800 x 800, 550 x 300, 650 x 500, 360 x 360, 350 x 300, 260 x 260)
- **Circular Saw** - (4000 mm x 100 mm)
- **Magnet Lifter** - 3 Ton's, 2 Ton's, 1 Ton, 500 Kg.

Machine Shop:

- **Surface Grinder** - (Max 1300x2100)
- **Rotary Grinder** - (32" Across Corners)
- **Plano Miller** - (1400x2300 max)

OUR VISION

- Innovate and provide Best Steel Grades from reputed manufacturers around world
- Open up branches across India
- Contribute to India's Growth
- Provide value added services – material machining, cut pieces & tailor made material

OUR MISSION

- Our main aim is to provide quality tool steel for manufacturing units/tool rooms across India
- Provide service & material to take our clients into a non inventory module
- Being the first choice for our customers

CORE VALUES

- **Accountability:** We accept our individual and team responsibilities and we meet our commitments. We take responsibility for our performance in all of our decisions and actions.
- **Co-operation:** Good mutual cooperation across positions and departments is the basis for a pleasant working atmosphere in which employees feel good about themselves and what they are doing. The outmoded oppositions between production and maintenance, factory and administration, production and sales no longer have any places. A modern company must be based on teamwork and mutual trust, on striving together for continuous improvement.
- **Empowerment:** To empower our talented people to take the initiative and to do what's right.
- **Innovation:** We are creative in delivering value to our fellow associates, customers, shareowners, manufacturers and the community. We anticipate change and capitalize on the many opportunities that arise.
- **Leadership:** We encourage leadership among employees to develop and maintain a talent pool.
- **Life, Health and Environment:** We seek to improve our wellbeing, our working conditions and the surroundings in which we live in.
- **Open communication:** All team members are encouraged to openly share their opinions and views.
- **Positive Change:** Embracing and capitalizing on change, recognizing that every employee must be empowered to stimulate continuous improvement in all aspects of our business.
- **Professionalism:** We strive to fulfill our responsibilities to the highest possible standards throughout.
- **Teamwork:** Our team is supportive of each other's efforts, loyal to one another, and care for each other both personally and professionally.

ELECTRIC **ARC FURNACE**

LADLE **FINERY**

ELECTRIC **ARC FURNACE**

VOD

ELECTRIC **ANNEALING FURNACE**

ELECTROSLAG **REMELTING**

HSS **INGOT CASTING**

RADIAL **FORGING**

SX32 - 500T **PRECISION FORGING MACHINE**

1250 TON **QUICK FORING MACHINE**

1250 TON **QUICK FORGING MACHINE**

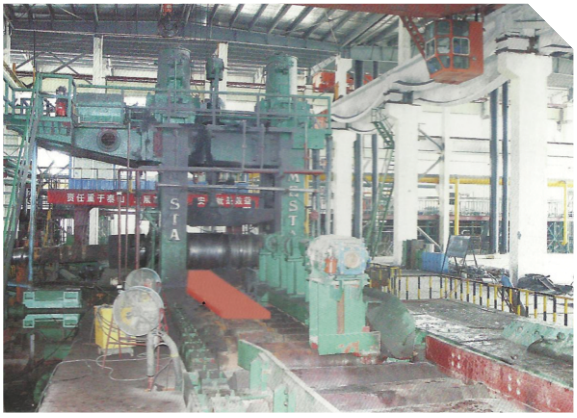
2000 TON **QUICK FORGING MACHINE**

FLAT BAR **ROLLING**







ULTRASONIC **INSPECTING**

LAB

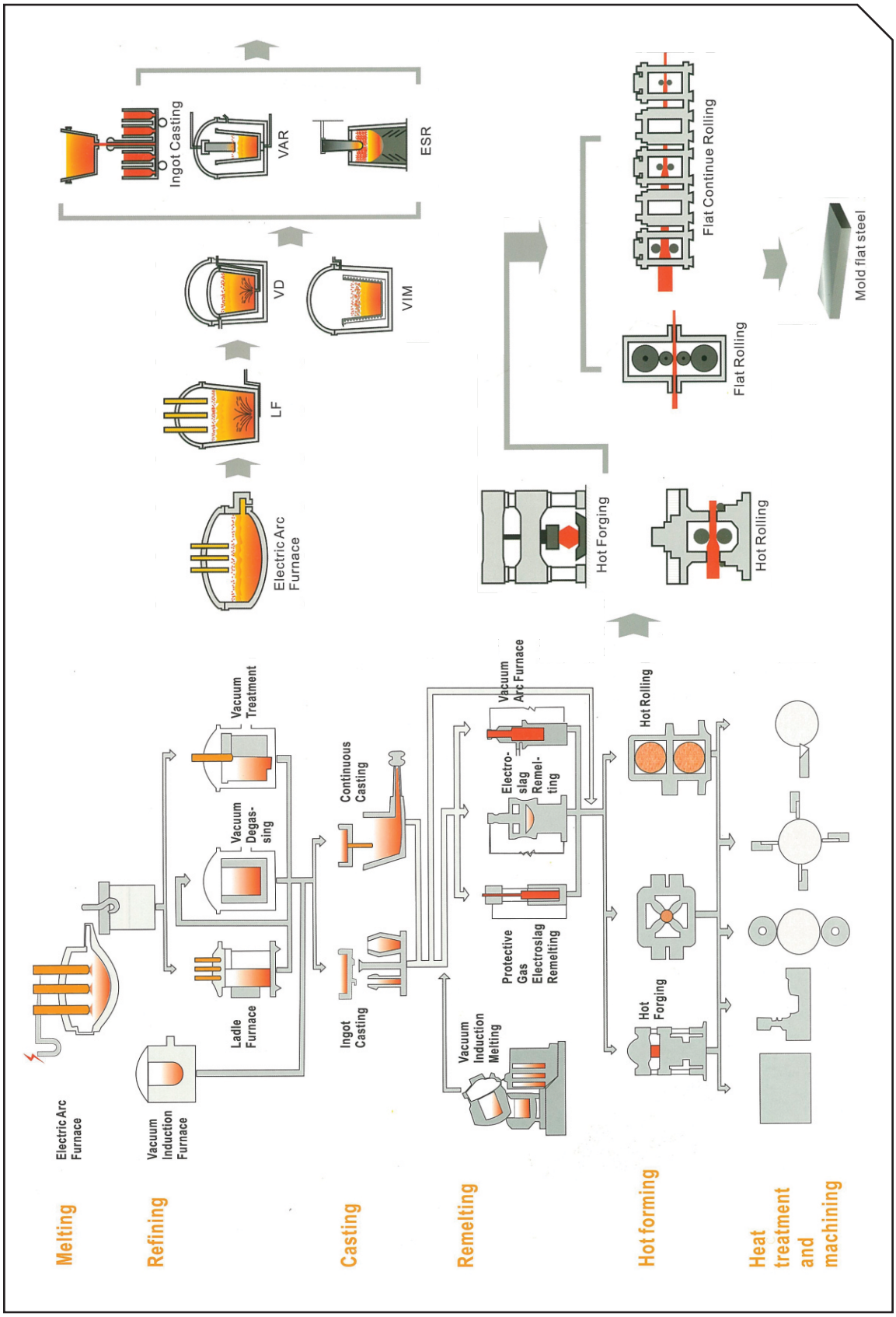
DIGITAL **ROCKWELL HARDNESS**

ELECTRONIC **BRINELL HARDNESS**

TYPE 2206 **SURFACE ROUGHNESS MEASURING APPARATUS**

AMERICAN AND SWISS SPECTROMETERS CONTENT OF **W, MO, CR, V, CO, S, P, N, NB AND SO ON.**

PRODUCTION **FLOW**



HIGH SPEED STEEL

TG M2 (DIN-1.3343) | TG M2A (Sp. Grade or taps) | TG M2B (Sp. Grade for hobs & broaches)

STEEL PROPERTIES

M2A M2A has Lower Carbon than M2 making it tougher than M2 and has added Niobium to obtain high strength and toughness.

M2B Favourable Tenacity, High red hardness and excellent abrasion resistance

APPLICATIONS

M2A This grade is especially suitable for tabs of tread tools

M2B Due to favourable hardness and abrasion resistance, its mainly used to fabricate tools to cut materials which are difficult to be cut. It is used as various cutting tools, for example, drilling bits, screws taps, milling cutters, drawing tools, roller cutters etc.

SIMILAR STEEL GRADE

CHINA	BRAZIL	AUSTRIA	GERMANY	SLOVANIA	JAPAN		
TG	VILLARES	BOHLER	DEW	RAVNE	HITACHI	NIPPON	SANYO
TGM2	VW/M2	S600	1.3343	BRM2	YXM1	H51	QH51

CHEMICAL COMPOSITION (%)

Indian	Chemical Analysis Typical Value % (Min - Max)										Delivery Condition	
IS	C	S	P	Si	Mn	Cr	Mo	V	W	Nb	Heat Treatment	Hardness
M2	0.86-0.94	<0.03	<0.03	0.20-0.45	0.20-0.40	3.80-4.50	4.70-5.20	1.70-2.10	5.90-6.70	***	Annealed	<255 HB
M2A	0.83-0.85	Max 0.010	Max 0.030	0.30-0.40	0.20-0.40	3.90-4.20	4.80-4.85	1.80-1.90	6.00-6.20	0.10-0.20	Annealed	<255 HB
M2B	0.89	<0.03	<0.026	0.30-0.40	0.20-0.40	4.15	4.80	1.90	6.20	0.10-0.20	Annealed	<255 HB

PRODUCTION PROCESS

EAF → LF → VD → ESR → BLOOM IN FOLLOWING MACHINE : QUICK FORGING (12.5MN), HAMMER, PRECISION FORGING →

- Precision Forging : Φ 81 - 255mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm
- Cold Drawn / Sand Blasted (Coil) : Φ 1.0 -13.5mm
- Cold Drawn / Centreless Ground : Φ 1.0 -14.4mm

UNDER ANNEALED CONDITION :
Hardness : HB205-255

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
As Cold drawn / Hot rolled / forged, in annealed condition.

SIZE: ROUND

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: FLATS

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: SQUARES

4mm to 100mm

SIZE: SHEETS

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

HEAT TREATMENT

ANNEALING :

Annealing temperature: 860-880°C, keep this temperature by 2-4 hours, then cooling to 600°C in the speed of less than 30°C/h if after cold drawn precess, suggest and stress relieving annealing process. Under the temperature of 600-700°C, keep this temperature by 2 houres. Quenching & Tempering (salt bath).

QUENCHING :

Pre-heating in two steps :

Heating temperature under : 400-500°C and 850-900°C

Austenitizing temperature : 1185-1225°C

Heating coefficient 10-15 sec/mm, quenching under 580-620°C, then cooling to room temperature.

TEMPERING :

Tempering temperature under : 540-560°C, tempering 3 times, each time 1 hour, then cooling to room temperature.

HIGH SPEED STEEL

TG M35 (DIN-1.3243) | TG M35A (Special for taps)

STEEL PROPERTIES

This kind steel is suitable for conditions involving thermal stresses and discontinuous cutting. Heavy-duty miling cutters of all kinds, gear cutter, highly stressed twist drills and taps, profile knives, machining of high-strength material, broaches.

M35A - Favourable tenacity, high red hardness and excellent abrasion resistance

APPLICATIONS

It is one of the W-Mo Co hss grade with good cutting character. The res hardness, hot hardness and wearing resistance are all better than W6M05Cr4V2.

M35A - M35A is suitable for fabricating various abrasion resistant and impact resistant tools for powerful cutting high level trimming dies, screw dies, tools of complicated shapes requiring tenacity, reamers milling cutters, punches etc. Mainly used for as roller cutters, drawing tools, end mills, Etc

SIMILAR STEEL GRADE

CHINA	BRAZIL	AUSTRIA	GERMANY	SLOVANIA	JAPAN	
TG	VILLARES	BOHLER	DEW	RAVNE	HITACHI	NIPPON
TGM35	VKSE	S700	1.3245	BRCMO	YXM4	HM35

CHEMICAL COMPOSITION (%)

Indian	Chemical Analysis Typical Value % (Min - Max)										Delivery Condition	
IS	C	S	P	Si	Mn	Cr	Mo	V	W	Co	Heat Treatment	Hardness
M35	0.88-0.96	<0.03	<0.03	0.20-0.45	0.20-0.40	3.80-4.50	4.70-0.52	1.70-2.00	6.00-6.70	4.55-5.50	Annealed	<255 HB
M35A	0.91	<0.03	<0.022	0.20-0.45	0.20-0.40	4.0	4.8	1.92	6.00	4.85	Annealed	<255 HB

NEW DEVELOPMENT M35A APPLICATION

• Suitable for fabricating various abrasion-resistant and impact-resistant tools for powerful cutting, high-level trimming dies, screw dies, tools of complicated shapes requiring tenacity, reamers, milling cutters, punches, etc. • Mainly used as roller cutters, drawing tools, end mills, etc.

PRODUCTION PROCESS

EAF → LF → VD → ESR → BLOOM IN FOLLOWING MACHINE : QUICK FORGING (12.5MN), HAMMER, PRECISION FORGING →

- Precision Forging : Φ 81 - 255mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm
- Cold Drawn / Sand Blasted (Coil) : Φ 1.0 -13.5mm
- Cold Drawn / Centreless Ground : Φ 1.0 -14.4mm

UNDER ANNEALED CONDITION :
Hardness : HB205-255

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
As Cold drawn / Hot rolled / forged, in annealed condition.

SIZE: ROUND

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	**Φ 81.0 - 255.0mm**	**Φ 1.0 - 13.5mm**

SIZE: FLATS

Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: SQUARES

4mm to 100mm

SIZE: SHEETS

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

HEAT TREATMENT

ANNEALING : Annealing temperature: 860-880°C, keep this temperature by 2-4 hours, then cooling to 600°C in the speed of less than 30°C/h if after cold drawn precess, suggest and stress relieving annealing process. Under the temperature of 600-700°C, keep this temperature by 2 houres. Quenching & Tempering (salt bath).

QUENCHING :
Pre-heating in two steps :
Heating temperature under : 400-500°C and 850-900°C
Austenitizing temperature : 1180-1220°C
Heating coefficient 10-15sec/mm, quenching under 580-620°C, then cooling to room temperature

TEMPERING : Tempering temperature under : 540-560°C, tempering 3 times, each time 1 hour, then cooling to room temperature.

HIGH SPEED STEEL

TG M42

SMELTING METHOD
15T intermediate frequency furnace (EAF+LF+VD+ESR)

MAIN CHARACTERISTICS
High steel hardness, reaching 68HRC after quenching and tempering, favorable hot hardening, capable of manufacturing various complicated tools with high precision.

MAJOR APPLICATIONS
• Capable of manufacturing abrasion resistant and impact resistant tools for various types of powerful cutting. • High-level trimming dies, screw dies, formed punches of complicated shapes requiring tenacity, etc.; • Scrapers, hobs, drilling bits, etc. • Cold forging molds.

CHEMICAL COMPOSITION (%)

C	Si	Mn	W	Cr	Mo	V	Co	P	S
1.08	0.3	0.3	1.45	3.95	9.40	1.15	7.85	≤ 0.020	≤ 0.001

O (ppm)	N (ppm)	H (ppm)
≦ 1.08	≦ 100	≦ 2.5

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/mK)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
8.01	460	19.00	220,000	10.8	11.6

ULTRASONIC FLAW DETECTION: As per SEP1921 D/d or customer requirements.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

DELIVERY STATUS : Delivery under balling annealing state, delivery hardness ≤269HB.

PRODUCTION PROCESS
EAF → LF → VD → ESR → BLOOM IN FOLLOWING MACHINE : QUICK FORGING (12.5MN), HAMMER, PRECISION FORGING

- Precision Forging : Φ 81 - 255mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm
- Cold Drawn / Sand Blasted (Coil) : Φ 1.0 -13.5mm
- Cold Drawn / Centreless Ground : Φ 1.0 -14.4mm

UNDER ANNEALED CONDITION :
Hardness : HB205-255

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
As Cold drawn / Hot rolled / forged, in annealed condition.

SIZE: ROUND

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: FLATS

Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: SQUARES

4mm to 100mm

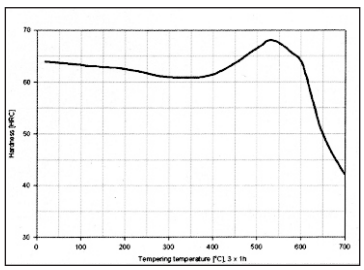
SIZE: SHEETS

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

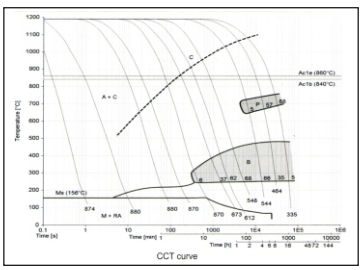
THERMAL TREATMENT

Softening Annealing
Heating to 850°C for heat insulation; cooling to 550°C slowly and then removing from the furnace
Quenching
1,175-1,180°C quenching; high-speed gas quenching or hot oil cooling
Tempering
Tempering temperature 540-570°C, at least three times of tempering

1,180°C quenching



Tempering temperature and harness relation curve



CCT curve

HIGH SPEED STEEL

TG W9

CHARACTERISTIC

It is current has developed in our country. Its service performance is equal to that of W18Cr4V(T1) and W6Mo5Cr4V2(M2).

APPLICATIONS

Can be used to produce different kinds of too instead of W18 and M2.

CHEMICAL COMPOSITION (%)

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
W9	0.82	≤0.02	≤0.03	0.30	0.30	***	4.10	3.00	1.50	9.00	***	Annealed	≤ HB255

PRODUCTION PROCESS

ROUND BAR:

EAF → LF → VD → ESR → (5TONS HAMMER) →
- Forged Annealed & Turned : Φ 81.0 - 1500mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm → ANNEALED CONDITION
- Cold Drawn / Centreless Ground : Φ 1.0 - 14.4mm

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD :
SEP 1921, (DEC.84)E/e

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
Soft annealed max. ≤ 255HB

SIZE: ROUND

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1500mm

SIZE: HOT ROLLED FLAT BARS / SAND BLASTED & MACHINED STRAIGHT

Thickness	Width
5mm - 410mm	10mm - 810mm

HEAT TREATMENT CONDITION

Hardening Temperature : 1190-1230°C
Quenching Medium : oil & salt bath
Tempering Temperature : 540-560°C
Tempering Times : 3times
Tempering Hardness : 63-65HRC.

LOWER ALLOY **HIGH SPEED STEEL**

TG **4241 / 4341**

STEEL **PROPERTIES**

It is mainly used to produce drill, tap, saw bit and high efficiency wood tool.

APPLICATIONS

It is an economical low alloy high-speed steel with good red hardness, good toughness and thermal plasticity. It is generally used soft and moderate intensity metal.

CHEMICAL **COMPOSITION (%)**

(Special grade)	C	S	P	Si	Mn	Cr	Mo	V	W
TG4241	0.90-0.95	≤ 0.020	≤ 0.030	0.80-1.20	0.25-0.40	4.00-4.50	1.00-1.20	0.80-1.00	1.80-2.50
TG4341	0.83-0.93	≤ 0.020	≤ 0.030	0.70-1.00	0.20-0.40	3.80-4.40	2.50-3.50	1.20-1.80	3.50-4.50

PRODUCTION **PROCESS**

EAF → LF → VD → ESR → BLOOM IN FOLLOWING MACHINE :
QUICK FORGING (12.5MN), HAMMER, PRECISION FORGING →

- Precision Forging : Φ 81 - 255mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm
- Cold Drawn / Sand Blasted (Coil) : Φ 1.0 -13.5mm
- Cold Drawn / Centreless Ground : Φ 1.0 -14.4mm

UNDER ANNEALED CONDITION :
Hardness : HB205-255

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
As Cold drawn / Hot rolled / forged, in annealed condition.

SIZE: **ROUND**

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: **FLATS**

Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: **SQUARES**

4mm to 100mm

SIZE: **SHEETS**

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

HEAT **TREATMENT**

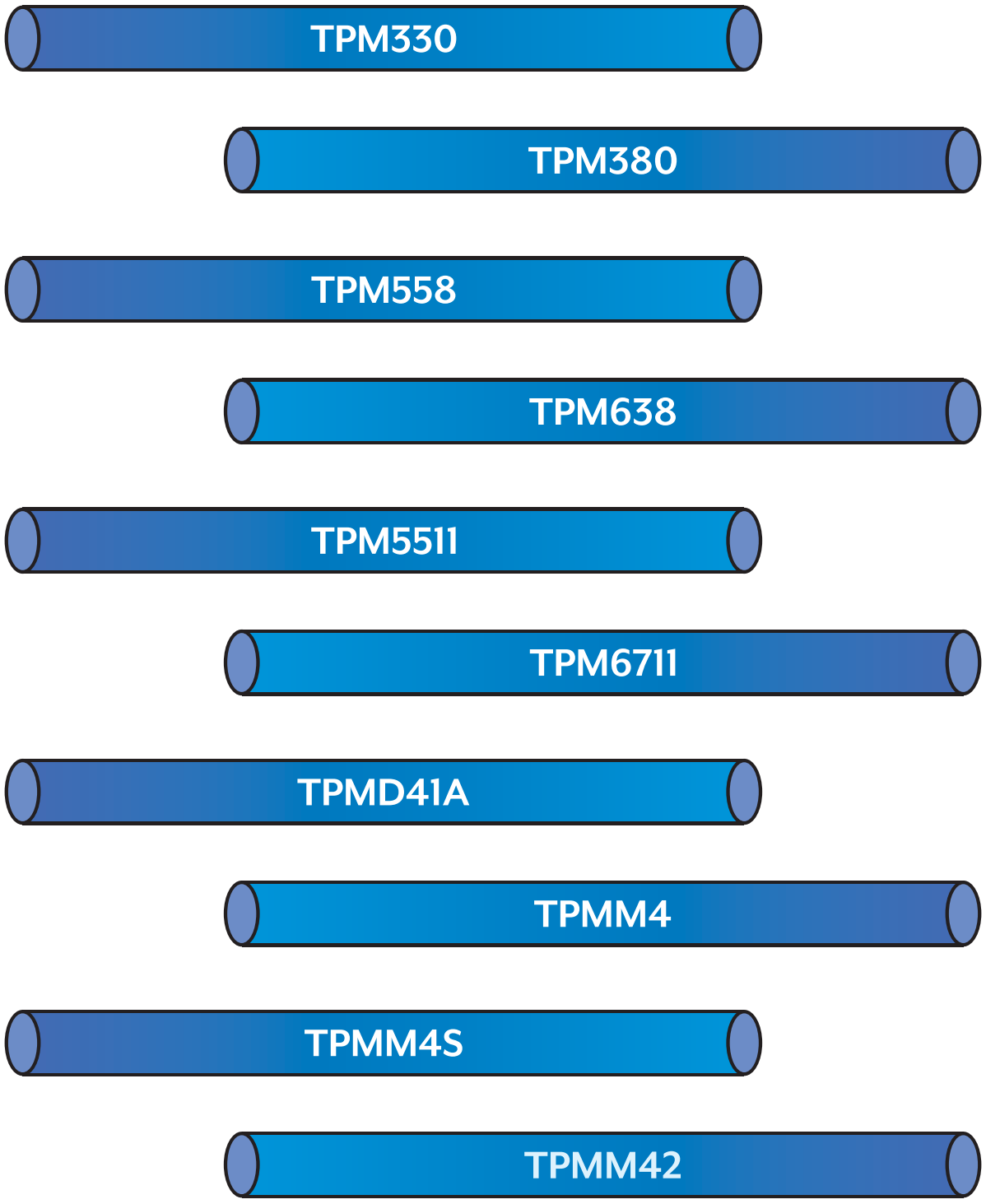
ANNEALING : Annealing temperature: 860-880°C, keep this temperature by 2-4 hours, then cooling to 600°C in the speed of less than 30°C/h If after cold drawn precess, suggest add stress relieving annealing process Under the temperature of 600-700°C, keep this temperature by 2 houres. Quenching & Tempering (salt bath)

QUENCHING :
Pre-heating in two steps :
Heating temperature under : 400-500°C and 850-900°C
Austenitizing temperature : 1150-1180°C
TG4241 austenitizing temperature: 1160°C-1190°C
Heating coefficient 10-15 sec/mm, quenching under 580-620°C, then cooling to room temperature.
Quenching temperature difference in 5-10°C between TGM2, TGM2A;
TGM2A's quenching temperature is higher than TGM2

TEMPERING :
Tempering temperature under : 540-560°C, tempering 3 times, each time 1 hour, then cooling to room temperature.

POWDER STEEL **SERIES**

PRODUCT CATALOGUE



POWDER STEEL **SERIES**

COMPARISON TABLE

No.	TG Grade	Bohler	Erasteel	Crucible	ASSAB	Carpenter	AISI/DIN /JAP	C	W	Mo	Cr	V	Co
1	TPMM35						M35	0.92	6	4.9	4.2	1.9	4.8
2	TPMM2						M2	0.9	6.1	4.9	4	1.83	-
3	TPMM3						M3	1.06	6.1	6	4	2.5	-
4	TPM330	S790	ASP2023				M3-2	1.3	6.4	5	4.1	3	-
5	TPMM4	S690	ASP2004					1.45	5.5	4.9	4.1	3.9	-
6	TPMM4S	S690	ASP2004					1.4	5.5	4.85	4.1	3.9	+S
7	TPMM42			CPM Rex M42				1.1	1.35	9.4	3.85	1.1	7.95
8	TPM638	S590	ASP2030	CPM Rex 45				1.3	6.4	5	4.2	3.1	8.5
9	TPM555		ASP2015	CPM Rex T15				1.63	12	0.25	4.25	4.75	5
10	TPM539						M48	1.54	9.6	5.1	3.8	3	9.2
11	TPM558	S390	ASP2052					1.6	10.4	2	4.8	5	8
12	TPM5511	S290						2	14.3	2.5	3.8	5.1	11
13	TPM5610					Maxamet		2.15	13	0.45	4.75	6	10
14	TPM692	K340						2.47	0.9	3.9	4.25	8.85	1.9
15	TPM380		ASP2053					2.48	4.2	3.1	4.2	8	-
16	TPM6711		ASP2060					2.3	6.5	7	4.2	6.5	10.5
17	TPMB43		ASP2005					1.5	2.5	2.5	4.2	4	-
18	TPMB13							0.55	-	3	4.15	1	-
19	TPMB31			CPM 3V				0.81	-	1.35	7.75	2.8	-
20	TPMB32						SB-WEAR	1.16	1.25	1.6	7.8	2.45	-
21	TPMB44			CPM 4V				1.4	-	3.5	4.7	3.7	-
22	TPMB91			CPM 9V				1.83	-	1.35	5.25	8.7	-
23	TPMB101S			CPM 10V				2.5	-	1.3	5.25	9.35	-
24	TPMD21							2.78	-	1.1	25	2.5	-
25	TPMD31				ELMAX			1.7	-	1	18	3	-
26	TPMD41A	M390						1.9	0.6	1	20	4	-
27	TPMD91			CMP S90V				2.36	-	1.06	14.23	8.62	-

POWDER METALLURGY **HIGH SPEED STEEL**

TPM **330**

(Equivalent to ASP 2023)

INTRODUCTION

The main characteristics of this steel are fine carbide particles, uniform distribution and good toughness. Main application: cold working parts, rollers, extrusion dies, and high-performance cutting tools.

CHEMICAL **COMPOSITION** (%)

C	Cr	Mo	V	W
1.28	4.10	5.00	3.00	6.40

COMPARABLE **STEELS**

TIANGONG	US STANDARD	ERASTEEL	BOHLER
TPM330	M3-2	APS2023	S790

DELIVERY **STATUS**

Delivery is annealed condition,
softening annealing hardness ⩽260HB.

MICROSTRUCTURE **AS POWDERED**

(1) The carbides are small and uniformly distributed. The size of carbides ⩽5um (the average size of 3 large carbides in 10 fields of view at 1000X).
(2) The unevenness of eutectic carbide is not more than level 1.

ULTRASONIC **FLOW DETECTION**

Flaw detection standard: according to SEP1921-E/e level of flaw detection and GB/T6402-2008 level 4 of assessment or upon customer-specific requirements.

CHEMICAL **CLEANLINESS**

A		B		C		D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0.5	0.5	1.5	1.0	1.5	1.0	1.5	1.0

SOFT ANNEALING:

Heating to 860°C~900°C for 3~5h in a protective atmosphere, followed by cooling down to 500°C at 10°C/h, and then air-cooling out of the furnace.

STRESS RELIEF ANNEALING: Heating to 750°C~800°C for 2h, then air-cooling out of the furnace.

SIZE: **ROUND**

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: **FLATS**

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: **SQUARES**

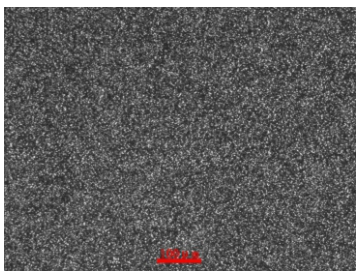
4mm to 100mm

SIZE: **SHEETS**

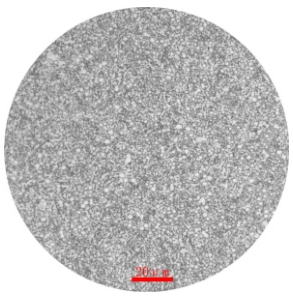
Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

MICROSTRUCTURE **AS ANNEALED**

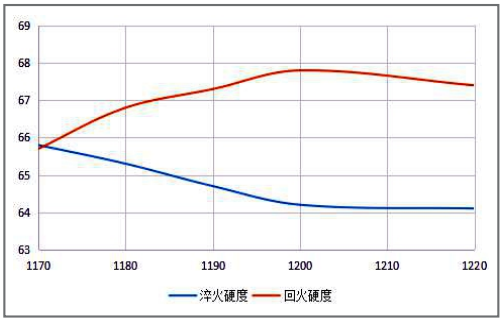
This third-generation powdered high speed steel is made by hot isostatic pressing of the nitrogen gas atomized powders followed by forging and heat treatment.



Eutectic Carbide Unevenness: 0.5
(TPM330, 205x305mm)



Large Carbide Size: 4.9um
(TPM330, 205x305mm)



Quench-Temper Curve

POWDER METALLURGY **HIGH SPEED STEEL**

TPM **558**

(Equivalent to ASP 2052)

INTRODUCTION

This steel is comparable to BÖHLER S390, high alloy, high wear resistance, high red hardness. Application areas: heavy-duty machining tools for processing steel, nickel-based and titanium alloy; can be used to produce hobs, milling cutters, and various kinds of cutting tools.

CHEMICAL **COMPOSITION** (%)

C	Cr	Mo	V	W	Co
1.65	4.82	2.10	4.90	10.50	8.10

COMPARABLE **STEELS**

TIANGONG	BOHLER	ERASTEEL
TPM558	S390	ASP2052

DELIVERY **STATUS**

Delivery is annealed condition, annealing hardness ⩽300HB.

MICROSTRUCTURE **AS POWDERED**

(1) The carbides are small and evenly distributed. The size of carbides ⩽5um (the average size of 3 large carbides in 10 fields of view at 1000X).
(2) The unevenness of eutectic carbide is not more than level 1.

ULTRASONIC **FLOW DETECTION**

Detection standard: according to SEP1921-E/e level of flaw detection and GB/T6402-2008 level 4 of assessment or upon customer-specific requirements.

CHEMICAL **CLEANLINENESS**

A		B		C		D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0.5	0.5	1.5	1.0	1.5	1.0	1.5	1.5

SOFT **ANNEALING**

Soft annealing at 860°C~900°C for 3~5h in a protective atmosphere, followed by slow cooling down to 500°C at 10°C/h, and then air-cooling out of the furnace.

STRESS **RELIEF ANNEALING**

Heating to 750°C~800°C for 2h, then air-cooling out of the furnace.

SIZE: **ROUND**

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: **FLATS**

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: **SQUARES**

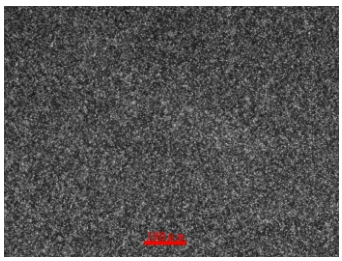
4mm to 100mm

SIZE: **SHEETS**

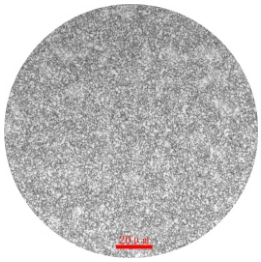
Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

MICROSTRUCTURE **AS ANNEALED**

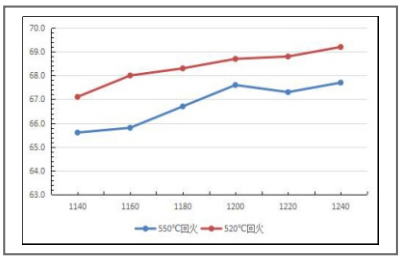
This third-generation powdered high speed steel is made by hot isostatic pressing of the gas atomized powders followed by forging and heat treatment.



Eutectic Carbide Unevenness: 0.5



Large Carbide Size: 2.4um



Quench-Temper Curve

QUENCHING TEMP. (°C)	1140	1160	1180	1200	1220	1240
GRAIN SIZE (LEVEL)	12	11.5	11.5	11.5	11.5	11

RECOMMENDED TEMPERATURES **OF HEAT TREATMENT**

TOTAL	Single - Edge Cutter	Multi - Edge Cutter	Mold
QUENCHING TEMP./°C	1180 - 1200	1160 - 1800	1140 - 1160
TEMPERING TEMP./°C	540 - 560	540 - 560	540 - 560

POWDER METALLURGY **HIGH SPEED STEEL**

TPM **638**

(Equivalent to ASP 2030)

INTRODUCTION

This steel has high wear resistance and high compressive strength under high hardness as well as good overall hardenability, heat treatment dimensional stability and excellent anti-tempering performance. Main application areas: high-performance cutting tools, such as end mills, hobs, planers, etc.

CHEMICAL **COMPOSITION** (%)

C	Cr	Mo	V	W	Co
1.28	4.2	5.0	6.4	3.1	8.5

COMPARABLE **STEELS**

TIANGONG	BOHLER	ERASTEEL
TPM638	S590	ASP2030

DELIVERY STATE

Delivery is annealed condition, Softening annealing hardness ⩽300HB.

MICROSTRUCTURE **AS POWDERED**

(1) The carbides are small and evenly distributed. The size of carbides ⩽5um (the average size of 3 large carbides in 10 fields of view at 1000X).
(2) The unevenness of eutectic carbide is not more than level 1.

ULTRASONIC **FLOW DETECTION**

Flaw detection standard: according to SEPI921-E/e level of flaw detection and GB/T6402-2008 level 4 of assessment or upon customer-specific requirements.

SIZE: **ROUND**

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: **FLATS**

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: **SQUARES**

4mm to 100mm

SIZE: **SHEETS**

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

CHEMICAL **CLEANLINENESS**

A		B		C		D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0.5	0.5	1.5	1.0	1.5	1.0	1.5	1.0

SOFT **ANNEALING**

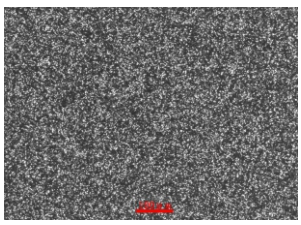
Heating to 860°C~900°C for 3~5h in a protective atmosphere, followed by cooling down to 500°C at 10°C/h, and then air-cooling out of the furnace.

STRESS **RELIEF ANNEALING**

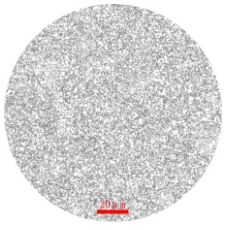
Heating to 750°C~800°C for 2h, then air-cooling out of the furnace.

MICROSTRUCTURE **AS ANNEALED**

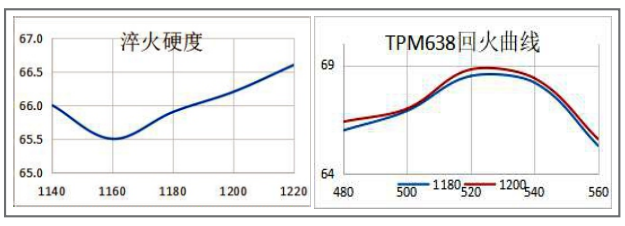
This PM HSS is made by hot isostatic pressing of the third-generation nitrogen gas atomized powders, followed by forging and heat treatment.



Eutectic Carbide Unevenness: 0 level



Large Carbide Size: 2.5um



Hardness - Quench-Tempering Temper Curve

GRAIN SIZE VS **QUENCHING TEMPERATURE:**

QUENCHING TEMP. (°C)	1140	1160	1180	1200	1220	1220
GRAIN SIZE (LEVEL)	10.5	10.5	11	11	11	10.5

POWDER METALLURGY **HIGH SPEED STEEL**

TPM **6711**

(Equivalent to ASP 2060)

INTRODUCTION

TMP6711 is a very high alloyed grade for applications requiring both hot hardness and wear resistance.

APPLICATIONS

Gear cutting tools, Broaches, Cold work tools, Bearing & other components, Taps, Drills, End mills.

CHEMICAL **COMPOSITION** (%)

C	Cr	Mo	W	Co	V
2.30	4.2	7.0	6.5	10.5	6.5

COMPARABLE **STEELS**

TIANGONG	EUROPE	GERMANY	SWEDEN
TPM6711	PMHS 7-7-7-11	1.3292	ASP 2060

DELIVERY STATE

Delivery is annealed condition, Softening annealing hardness ⩽345HB.

PHYSICAL **PROPERTY**

Temperature	20°C	400°C	600°C
Density g/cm^3 (1)	7.9	7.9	7.8
Modulus of elasticity kN/mm^2 (2)	250	222	200
Thermal expansion ratio per °C (2)	--	10.6 x 10^{-6}	11.1 x 10^{-6}
Thermal conductivity W/m°C (2)	24	28	27
Specific heat J/kg °C (2)	420	510	600

(1) = Soft annealed (2) = Hardened 1180°C and tempered 560°C, 3x1 hour

SIZE: **ROUND**

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: **FLATS**

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: **SQUARES**

4mm to 100mm

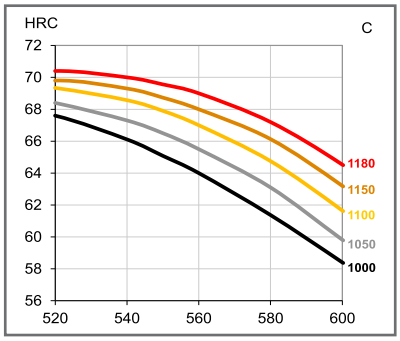
SIZE: **SHEETS**

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

HEAT TREATMENT

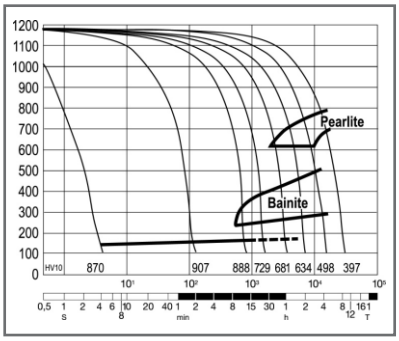
• Soft annealing in a protective atmosphere at 850-900°C for 3 hours, followed by slow cooling at 10°C/h down to 700°C, than air cooling. • Stress-relieving at 600-700°C for approximately 2 hours, slow cooling down to 500°C. • Hardening in a protective atmosphere with pre-heating in 2 steps at 450-500°C and 850-900°C and austenitising at a temperature, suitable for chosen working hardness. Cooling down to 40-50°C. • Tempering at 560°C three times for at lease 1 hour each time. Cooling to room temperature (25°C) between temperings.

GUIDELINES FOR HARDENING



Tempering Temperature °C
Hardness after hardening, quenching and tempering 3x1 hour

CCT CURVE



Continuous cooling transformation curve
Hardening Temperature 1180°C

POWDER METALLURGY **HIGH SPEED STEEL**

TPM **M4**

(Equivalent to ASP 2004)

INTRODUCTION

The powdered high speed steel with high content of vanadium has advantages of small carbide unevenness, high toughness, high hardness, and good wear resistance. Main application: Cold forging, fine punching, powder pressing C shearing machine, glass fiber-added plastic dies, etc.. Suitable for molds that bear vibration and impact load, such as deep-drawing or punching. Metal cutting blade, cold heading and extruding tool and so on.

CHEMICAL **COMPOSITION** (%)

C	Cr	Mo	V	W
1.33	4.15	4.60	3.95	5.60

COMPARABLE **STEELS**

TIANGONG	US STANDARD	ERASTEEL	BOHLER
TPMM4	M4	ASP2004	S690

DELIVERY STATE

Delivery is annealed condition, annealing hardness ⩽ 280HB.

MICROSTRUCTURE **AS POWDERED**

(1) The carbides are small and evenly distributed. The size of carbides ⩽5um (the average size of 3 large carbides in 10 fields of view at 1000X).
(2) The unevenness of eutectic carbide is not more than level 1.

ULTRASONIC **FLOW DETECTION**

Flaw detection standard: according to SEPI921-E/e level of flaw detection and GB/T6402-2008 level 4 of assessment or upon customer-specific requirements.

SIZE: **ROUND**

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: **FLATS**

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: **SQUARES**

4mm to 100mm

SIZE: **SHEETS**

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

CHEMICAL **CLEANLINENESS**

A		B		C		D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0.5	0.5	1.5	1.0	1.5	1.0	1.5	1.0

SOFT **ANNEALING**

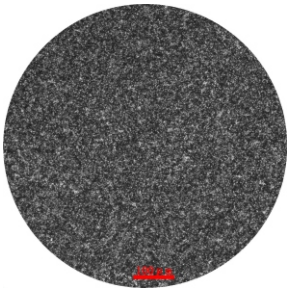
Heating to 860°C~900°C for 3~5h in a protective atmosphere, followed by cooling down to 500°C at 10°C/h, and then air-cooling out of the furnace.

STRESS **RELIEF ANNEALING**

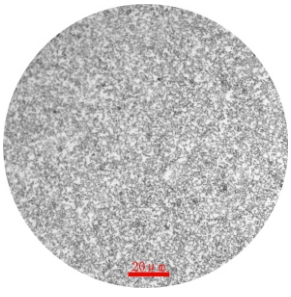
Heating to 750°C~800°C for 2h, then air-cooling out of the furnace.

MICROSTRUCTURE **AS ANNEALED**

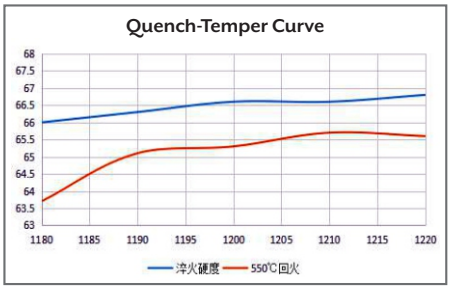
This third-generation powdered high speed steel is made by hot isostatic pressing of the nitrogen gas atomized powders followed by forging and heat treatment.



Eutectic Carbide Unevenness: 0, 100X



Large Carbide Size: 3.3um, 500x



Recommended quenching temperature: 1180°C-1200°C

HOT WORKING **TOOL STEEL**

TG **H13** (DIN-1.2344) | TG **H13M** (DIN-1.2345)

STEEL **PROPERTIES**

High hot-wear resistance, high hot tensile strength and toughness. Good thermal conductivity and insusceptibility to hot cracking. Can be water-cooled to a limited extent.

APPLICATIONS

Hot-work tool steel for universal use. Pressure casting dies and metal extrusion tools for processing light metals, forging dies, moulds, screws and barrels for plastic processing, nitrided ejectors, hot-shear blades. Suitable for Aluminium Extrusion Die & Aluminium Copper Forging Dies. H13 has high hard resistance and hardness. Suitable for Aluminium Extrusion Die, and Aluminium Copper forging Die.

SIMILAR **STEEL GRADE**

CHINA	BRAZIL	AUSTRIA	GERMANY		SLOVANIA	ITALY	JAPAN			S.KORIA	TAIWAN
TG	VILLARES	BOHLER	DEW	GRODITZ	RAVNE	LUCCHINI	HITACHI	NIPPON	SANYO	DOOSAN	GLORIA
H13	VH13IM	W302	1.2344	1.2344	UTOP M02-EFS	ESKY0S2344	DAC	KDA	QD61	STD 61	GMH13 (ESR)

CHEMICAL **COMPOSITION** (%)

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
H13	0.35-0.42	≤ 0.030	≤0.030	0.80-1.20	0.25-0.50	***	4.80-5.50	1.20-1.50	0.85-1.15	***	***	Annealed	≤HB235
H13M	0.47-0.52	≤ 0.030	≤0.030	0.80-1.20	0.25-0.50	***	4.80-5.50	1.20-1.50	0.85-1.15	***	***	Annealed	≤HB235

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → (5TONS HAMMER) →
- Forged Annealed & Turned : Φ 81.0 - 1500mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm → ANNEALED CONDITION
- Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1500mm

SIZE: **HOT ROLLED / FORGED FLAT BARS**

Thickness	Width
5mm - 410mm	10mm - 810mm

HEAT **TREATMENT CONDITION**

Quenching temperature : 1020-1050°C
Cooling Medium : air-cooling
Tempering temperature : 550-650°C
Tempering times : 2Times, the tempering temperature in the second time should be lower than in first time
Tempering Hardness : 47-48HRC.

Tempering °C	500°C	550°C	600°C
HRC	HRC56	HRC54	HRC50

MOLD STEEL SERIES

TGE 21

PRODUCT DESCRIPTION

This steel grade is a high toughness and high thermal stability hot work mold steel designed with optimized alloy composition, while also possessing high purity.

Application field: Suitable for various types of aluminium die-casting molds and high hardness plastic molds. Common applications include hot extrusion molds, forging molds and punches, plastic molds, etc. It is also commonly used in engine mold manufacturing.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	V	P	S
0.35	0.25	0.40	5.00	1.75	0.50	⩽0.010	⩽0.001

SIZE SUPPLIED

Product	Round (mm)	Plate (mm)
Forged	70~800	(120~800) x (600~1400)

DELIVERY STATUS

Typical soft annealing hardness is under ⩽220HB.

MECHANICAL PROPERTY

The sample was kept at 1010-1030 °C for 30 minutes and quenched in oil. Temper at least 2 times at 560-610 °C to ensure a hardness of 45 ± 2HRC. Remove the highest and lowest values from the 5 samples and calculate the average value. The average impact value of Charpy V-notch (10*10*55) should be ⩾ 23J.

MICROSTRUCTURE AS POWDERED

(1) Annealed microtissues were detected according to NADCA # 207-2016 standard to achieve acceptable tissue (AS1-AS4)
(2) Brand tissue: Test the strip tissue according to NADCA # 207-2016 standard to reach the acceptable level.

CHEMICAL CLEANLINENESS

Type A		Type B		Type C		Type D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0.5	0.5	1.0	0.5	1.0	0.5	1.0	0.5

SOFT ANNEALING:

Soft annealing in a protective atmosphere at 860 °C for 3-5h, followed by slow cooling at 10 °C /h down to 500°C, then air cooling.

ULTRASONIC INSPECTION

According to SEPI921-E/e standard
According to GB/T6402-2008 standard grade 4
According to customer requirements

PHYSICAL PROPERTIES

(1) Density (ρ) : 7.8g/cm^3

(2) Modulus of Elasticity (E) (KN /mm^2)

Temperature/°C	25	400	600
0.5mm to 12mm	210	180	145

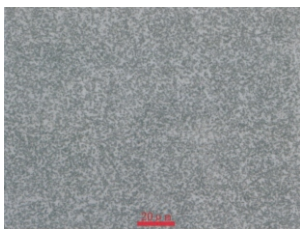
(3) Thermal Conductivity (λ) (W/m • K))

Temperature/°C	25	400	600
λ	31	31	32

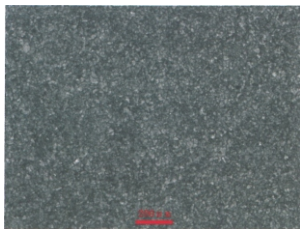
(4) Thermal Expansions (α_m) (X 10^{-6}/°C)

Temperature/°C	20	400	600
α_m	11.4	12.7	13.3

MICROSTRUCTURE

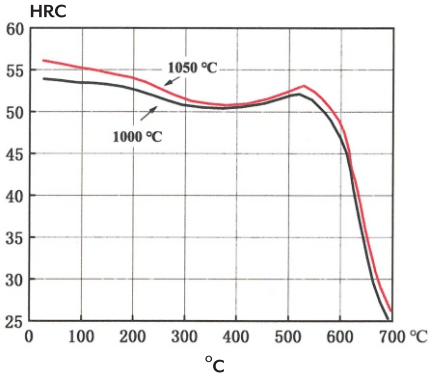


Annealed Structure: AS1

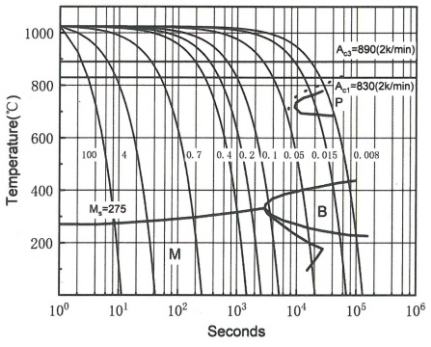


Segregation: SA1

GUIDELINES FOR HARDENING



CCT CURVE



HOT WORKING TOOL STEEL

PREMIUM GRADE TGE13

(Similar to ORVAR 2M)

SMELTING METHOD

EAF + LF + VD + ESR

MAIN CHARACTERISTICS

Excellent heat resistance and crack resistance, quite high tenacity, quite high ductility, favorable isotropic, favorable processability and polishability as well as favorable dimension stability during heat treatment.

MAJOR APPLICATIONS

• For various metal pressure casting molds, for example: automobile engine cylinder body, cylinder cover, gearbox shell molds; • Hot extrusion molds, mainly for hot extrusion of aluminium profiles; • High-quality plastic molds, for example, high abrasion resistance plastic molds for automobiles.

Equivalent Grade from BOHLER W302 ISOBLOC

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	V	P	S
0.38	0.90	0.35	5.0	1.35	0.95	≤ 0.015	≤ 0.002

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.80	430	22	215,000	11.3	11.9

ULTRASONIC FLAW DETECTION

As per SEPI921: E/e flaw detection or GB/T4162 Class AA flaw detection, i.e., flat bottom hole $\leq \Phi$1mm, no flaw detection noise wave shall appear or please comply with customer regulation.

DELIVERY STATUS

(1) Delivery hardness: delivery under annealing state, delivery hardness ≤255HB; (2) Organization state and impact power requirement: the organization and segregation shall comply with North American Die Casting Association No. 207 criterion; (3) Impact power sample: please sample according to the central part of steel. The samples shall be treated according to criteria in North American Die Casting Association, making sure that hardness of samples at 45±2HRC. Dimension of sample: 7*10*55. Gapless.

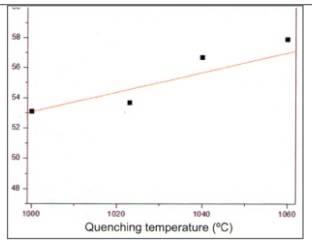
Specification (diameter, thickness mm)	Average impact power at the center part not less than (J)	Minimum impact power per sample not less than (J)
>60~300	240	150
>300	180	100

SUPPLY SPECIFICATION

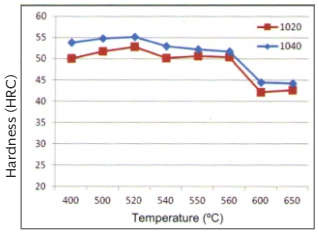
Product Name	Specification/mm	Material
Forged round bar	Φ 71~810	TGE13
Forged module	(120~400) x (300~800)	TGE13
Rolled round bar	Φ14.5~70	TGE13
Rolled flat bar	(12~120) x (200~810)	TGE13

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 850°C for heat insulation; cooling to 600°C at 10°C/h air cooling	1020~1040°C quenching; high-speed gas quenching or hot oil cooling	Selecting tempering temperature according to hardness requirements; please conduct tempering for 3 times; prevent tempering under 425~550°C

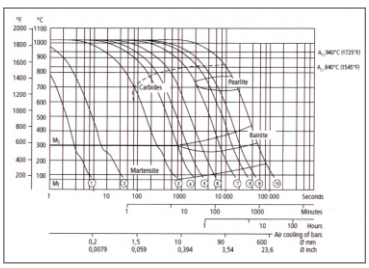


Quenching temperature and hardness relation curve



Tempering temperature and hardness relation curve

Austenite temperature: 1020°C, heat insulation for 30min



CCT curve

HOT WORKING TOOL STEEL

PREMIUM GRADE TGGP13

(Similar to ORVAR SUPREME)

SMELTING METHOD

EAF + LF + VD + ESR

MAIN CHARACTERISTICS

High ductility, high thermal fatigue resistance, high thermal erosion resistance, high isotropic property, high purity and small heat treatment distortion.

MAJOR APPLICATIONS

• Long-life Al, Mg and Zn alloy pressure casting molds, for example: automobile engine cylinder body, cylinder cover, gearbox shell molds. • Large-scale hot extrusion molds: for example, aluminium alloy extrusion molds for high-speed rails and metros. • Precise hot forging molds: for example, automobile engine crankshaft and connecting rod molds; gear molds of gear boxes.

Equivalent Grade from UDDEHOLM / ORVAR SUPREME

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	V	P	S
0.39	1.1	0.4	5.3	1.45	1.0	≤0.009	≤ 0.001

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.80	430	22	215,000	11.3	11.9

ULTRASONIC FLAW DETECTION

As per SEPI921: E/e flaw detection or GB/T4162 Class AA flaw detection, i.e., flat bottom hole ≤Φ1mm, no flaw detection noise wave shall appear or please comply with customer regulation.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
0.5	0	1.0	0.5	0.5	0	1.0	0.5

DELIVERY STATUS

(1) Delivery hardness: delivery under annealing state, delivery hardness ≤229HB; (2) Organization state and impact power requirement: the organization and segregation shall comply with North American Die Casting Association No. 207 criterion; (3) Impact power sample: please sample according to the central part of steel. The samples shall be treated according to criteria in North American Die Casting Association, making sure that hardness of samples at 45±2HRC. Dimension of sample: 7*10*55. Gapless.

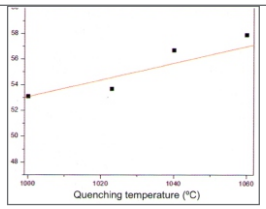
Specification (diameter, thickness mm)	Average impact power at the center part not less than (J)	Minimum impact power per sample not less than (J)
>60~300	300	250
>300	300	200

SUPPLY SPECIFICATION

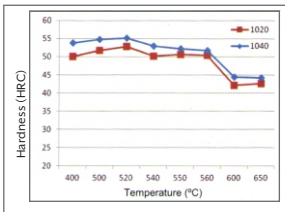
Product Name	Specification/mm	Material
Forged round bar	Φ 71~810	TGGPI3
Forged module	(120~400) x (300~800)	TGGPI3
Rolled round bar	Φ14.5~70	TGGPI3
Rolled flat bar	(12~120) x (200~810)	TGGPI3

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 850°C for heat insulation; cooling to 600°C at 10°C/h air cooling	1020~1040°C quenching; high-speed gas quenching or hot oil cooling	Selecting tempering temperature according to hardness requirements; please conduct tempering for 3 times; prevent tempering under 425~550°C

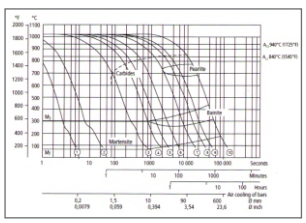


Quenching temperature and hardness relation curve



Tempering temperature and hardness relation curve

Austenite temperature: 1020°C, heat insulation for 30min



CCT curve

HOT WORKING TOOL STEEL

PREMIUM GRADE TGE23

(Similar to DIEVAR)

SMELTING METHOD

EAF + LF + VD + ESR + VMR

MAIN CHARACTERISTICS

High ductility, high thermal fatigue resistance, high thermal erosion resistance, high isotropic property, high purity and small heat treatment distortion.

MAJOR APPLICATIONS

• Mainly used for processing of light alloy - metal pipes, rods, extruded carrier rods, molds, and extruded molds, etc. ı Pressure casting equipment, molded trimming die, compression moulding inserts, etc. • Hot shearing blades, plastic molds, etc.

Equivalent Grade from UDDEHOLM / DIEVAR

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	V	P	S
0.37	0.3	0.4	5.0	2.2	0.45	≤0.015	≤ 0.001

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.85	460	29.7	215,000	12	12.5

ULTRASONIC FLAW DETECTION

As per SEP1921: E/e flaw detection or GB/T4162 Class AA flaw detection, i.e., flat bottom hole ≤Φ1mm, no flaw detection noise wave shall appear or please comply with customer regulation.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

DELIVERY STATUS

(1) Delivery hardness: delivery under annealing state, delivery hardness ≤229HB; **(2)** Organization state and impact power requirement: the organization and segregation shall comply with North American Die Casting Association No. 207 criterion; (3) Impact power sample: please sample according to the central part of steel. The samples shall be treated according to criteria in North American Die Casting Association, making sure that hardness of samples at 45±2HRC. Dimension of sample: 7*10*55. Gapless.

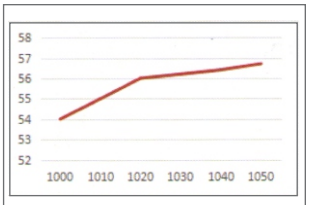
Specification (diameter, thickness mm)	Average impact power at the center part not less than (J)	Minimum impact power per sample not less than (J)
≥60~200	380	350
≥201~300	350	300
≥ 01	300	250

SUPPLY SPECIFICATION

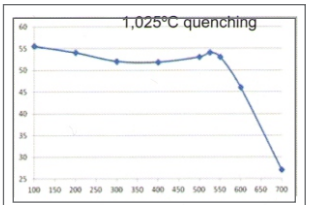
Product Name	Specification/mm	Material
Forged round bar	Φ 71~810	TGE23
Forged module	(120~400) x (300~800)	TGE23
Rolled round bar	Φ14.5~70	TGE23
Rolled flat bar	(12~120) x (200~810)	TGE23

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 850°C for heat insulation; cooling to 600°C at 10°C/h air cooling	1020~1040°C quenching; high-speed gas quenching or hot oil cooling	Selecting tempering temperature according to hardness requirements; please conduct tempering for 3 times; prevent tempering under 425~550°C

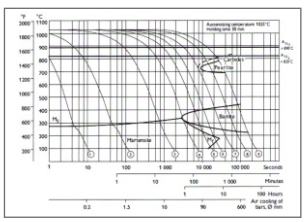


Quenching temperature and hardness relation curve



Tempering temperature and hardness relation curve

Austenite temperature: 1025°C, heat insulation for 30min



CCT curve

HOT WORKING **TOOL STEEL**

TG **H11** (DIN-1.2343) | TG **H11M** (DIN-1.2343M)

STEEL **PROPERTIES**

High hot tensile strength and toughness. Good thermal to hot cracking. Can be water-cooled to a limited extent.

APPLICATIONS

Hot-work tool steel for universal use. Pressure casting dies and metal extrusion tools for processing light metals, forging dies, moulds, screws and barrels for plastic processing, shrink rings, hot-shear blades.

SIMILAR **STEEL GRADE**

CHINA	BRAZIL	AUSTRIA	GERMANY		SLOVANIA	JAPAN	TAIWAN
TG	VILLARES	BOHLER	DEW	GRODITZ	RAVNE	SANYO	GLORIA
H11	TENAX 300	W300	1.2343	1.2343 VICTORY	UTOP M01-EFS	QDA61	GMH11

CHEMICAL **COMPOSITION** (%)

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
H11	0.33-0.41	≤0.030	≤0.030	0.80-1.20	0.20-0.50	***	4.80-5.50	4.70-5.20	1.10-1.50	***	***	Annealed	≤ HB235
H11M	0.47-0.52	≤0.030	≤0.030	0.80-1.20	0.20-0.50	***	4.80-5.50	4.70-5.20	1.10-1.50	***	***	Annealed	≤ HB235

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → (5TONS HAMMER) →
- Forged Annealed & Turned : Φ 81.0 - 1500mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm → ANNEALED CONDITION
- Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1500mm

SIZE: **HOT ROLLED / FORGED FLAT BARS**

Thickness	Width
5mm - 410mm	10mm - 810mm

HEAT **TREATMENT CONDITION**

Quenching temperature : 1020-1050°C
Cooling Medium : air-cooling
Tempering temperature : 550-650°C
Tempering times : 2Times, the tempering temperature in the second time should be lower than in first time
Tempering Hardness : 47-48HRC.

Tempering °C	500°C	550°C	600°C
HRC	**HRC56**	**HRC54**	**HRC50**

HOT WORKING TOOL STEEL

PREMIUM GRADE TGGP11

(Similar to VIDAR SUPERIOR)

SMELTING METHOD

EAF + LF + VD + ESR + VMR

MAIN CHARACTERISTICS

Excellent tenacity and ductibility along all direction; high thermal fatige resistance, favorable polishability, favorable dimension stability and favorable quenching.

MAJOR APPLICATIONS

• Pressure casting molds. • Hot extrusion molds of aluminium, copper and magnesium alloy. • High-polishing plastic injection molds.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	V	P	S
0.37	1.0	0.37	5.2	1.3	0.45	≤0.009	≤ 0.001

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.85	460	29.2	215,000	13.4	13.2

ULTRASONIC FLAW DETECTION

Flaw detection standard: as per SEP1921: E/e flaw detection or class 4 criterion in GB/T6402-2008, i.e., flat bottom hole ≤Φ2mm or as per customer requirements.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

DELIVERY STATUS

(1) Delivery hardness: delivery under annealing state, delivery hardness ≤229HB; **(2)** Organization state and impact power requirement: the organization and segregation shall comply with North American Die Casting Association No. 207 criterion; (3) Impact power sample: please sample according to the central part of steel. The samples shall be treated according to criteria in North American Die Casting Association, making sure that hardness of samples at 45±2HRC. Dimension of sample: 7*10*55. Gapless.

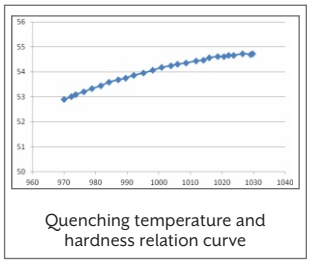
Specification (diameter, thickness mm)	Average impact power at the center part not less than (J)	Minimum impact power per sample not less than (J)
≥60~250	250	200
≥250	220	180

SUPPLY SPECIFICATION

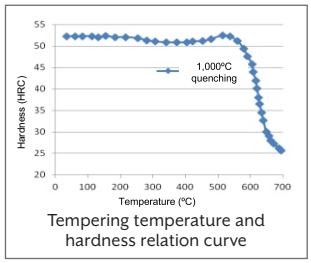
Product Name	Specification/mm	Material
Forged round bar	Φ 71~500	TGGP11
Forged module	(120~400) x (300~1000)	TGGP11
Rolled round bar	Φ 16~70	TGGP11
Rolled flat bar	(12~120) x (200~810)	TGGP11

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 850°C for heat insulation; cooling to 650°C at 10°C/h air cooling	980~1,000°C quenching; high-speed gas quenching or hot oil cooling	Selecting tempering temperature according to hardness requirements; please conduct tempering for 3 times; prevent tempering under 450~550°C

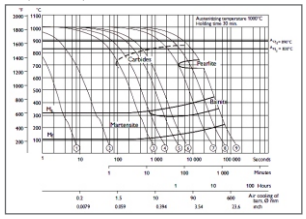


Quenching temperature and hardness relation curve



Tempering temperature and hardness relation curve

Austenite temperature: 1,000°C, heat insulation for 30min



CCT curve

HOT WORKING TOOL STEEL

1.2367 SUP

SMELTING METHOD

1) EAF + LF + VD + ESR

MAIN CHARACTERISTICS

High heat resistance, favorable high-termperature tenacity, high thermal fatigue resistance and abrasion performance, little change in heat treatment size, nitridation treatment, favorable polishability and favorable isotropic.

MAJOR APPLICATIONS

• Long-life pressure casting • Forged molds and inserts • Hot extrusion molds

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	W	V	P	S
0.37	0.4	0.45	5.0	2.0	***	0.55	≤ 0.015	≤0.001

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.83	***	25.0	215.000	12	12.5

ULTRASONIC FLAW DETECTION

Flaw detection standard: as per Class A of GB/T4162, i.e. flat bottom hole ⩽Φ 2mm, or as per customer requirements.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

DELIVERY STATE

1) Delivery hardness: delivery under annealing state, delivery hardness ⩽229HB;
2) Organization state and impact power requirement: comply with North American Die Casting Association No. 207 criterion;
3) Impact power sample: please sample according to the central part of steel. The samples shall be treated according to criterions in North American Die Casting Association, making sure that hardness of samples at 45 ± 2HRC. Dimension of sample: 7x10x55 Gapless.

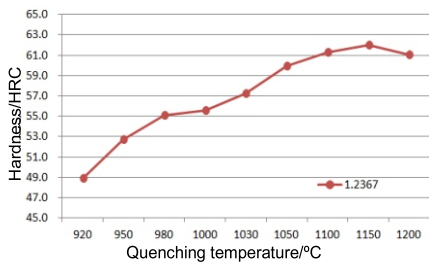
Specification (diameter, thickness mm)	Average impact power at the centre part not less than (J)	Minimum impact power per sample not less than (J)
> 60 ~ 300	300	250
> 300	280	220

SUPPLY SPECIFICATION

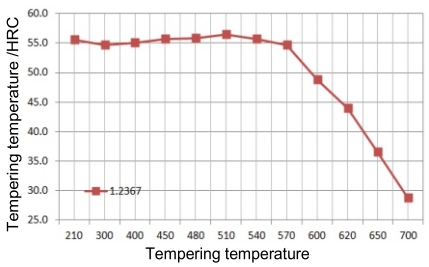
PRODUCT NAME	SUPPLY SPECIFICATION OF ELECTRIC FURNACE STEEL/mm	SUPPLY SPECIFICATION OF ELECTROSLAG STEEL/mm
Forged Round Bar	Φ **70 ~ 500mm**	**1.2356 SUP**
Forged Module	**(120~400) x (300~800)**	**1.2356 SUP**
Rolled Round Bar	Φ **16 ~ 70**	**1.2356 SUP**
Rolled Flat Bar	**(12~120) x (200~810)**	**1.2356 SUP**

THERMAL TREATMENT

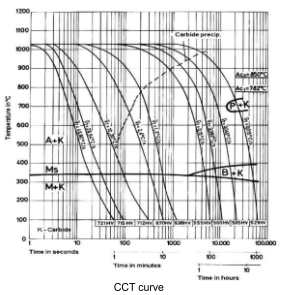
Softening annealing	Quenching	Tempering
Heating to 820~840°C for heat insulation; cooling 600°C at 10°C/h for air cooling	1030~1060°C high-speed gas quenching or hot oil cooling	Selecting tempering temperature according to hardness requirements; please conduct tempering for 3 times; prevent tempering under 450-550°C



Quenching temperature and hardness relation curve



Tempering temperature and hardness relation curve



CCT curve

HOT WORKING **TOOL STEEL**

TG **H-10**
(DIN-1.2365)

STEEL **PROPERTIES**

Good high-temperature strength and resistance to tempering, good thermal conductivity can be cooled with water, suitable for hobbing.

APPLICATIONS

Heavy-metal linings, extrusion rams, piercing mandrels, die inserts, heavy-metal diecasting tools. Good Tempering resistance Thermal conductivity and Hardness as compare with H13. Suitable for Aluminium Extrusion Die, and Aluminium Copper forging die.

SIMILAR **STEEL GRADE**

CHINA	BRAZIL	AUSTRIA	GERMANY	SLOVANIA	JAPAN	TAIWAN
TG	VILLARES	BOHLER	DEW	RAVNE	NIPPON	GLORIA
H10	VOM	W320	1.3265	UTOP33-EFS	KDH1	GMH10 (ESR)

CHEMICAL **COMPOSITION (%)**

Indian	Chemical Analysis Typical Value % (Min - Max)										Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
H10	0.28-0.35	≤0.02	≤0.03	0.10-0.40	0.15-0.45	***	2.70-3.20	2.50-3.00	0.40-0.70	***	***	Annealed	≤ HB230

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → (5TONS HAMMER) →
- Forged Annealed & Turned : Φ 81.0 - 1500mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm → ANNEALED CONDITION
- Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1500mm

SIZE: **HOT ROLLED / FORGED FLAT BARS**

Thickness	Width
5mm - 410mm	10mm - 810mm

HEAT **TREATMENT CONDITION**

Soft annealing°C : 750 - 800°C
Hardening°C : 1030-1050°C
Quenching : Oil or saltbath, 500-550°C

Tempering °C	100°C	200°C	300°C	400°C	500°C	550°C	600°C	650°C	700°C
HRC	51HRC	50HRC	50HRC	50HRC	52HRC	50HRC	47HRC	40HRC	34HRC

HOT WORKING **TOOL STEEL**

TG **H-21**
(DIN-1.2581)

STEEL **PROPERTIES**

Hot work steel with good toughness include tungsten Chromium Carbon Vanadium usually is working hardness is 40.0 to 55.0 HRC size available in round, flat and square.

APPLICATIONS

The H21 tungsten hot-work tool steels are mainly used for hot-working dies and toolings, e.g., die casting, extrusion and hot-forming of parts.

CHEMICAL **COMPOSITION** (%)

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
H21	0.26-0.36	***	***	0.15-0.50	0.15-0.40	***	3.00-3.75	***	0.30-0.60	9.0-9.50	***	Annealed	≤ HB240

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → (5TONS HAMMER) →
- Forged Annealed & Turned : Φ 81.0 - 810mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm → ANNEALED CONDITION
- Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD :
AISI H21 AFNOR 32CDV 21-28

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 810.0mm

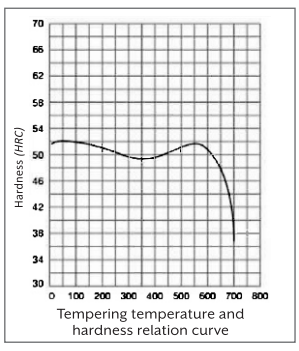
SIZE: **HOT ROLLED / FORGED FLAT BARS**

Thickness	Width
5mm - 410mm	10mm - 810mm

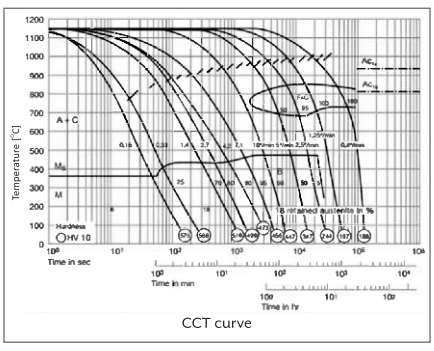
HEAT **TREATMENT CONDITION**

Soft annealing°C : 780 - 800°C
Hardening°C : max. 240°C
Quenching : Air, Oill or Warmbath, 600-650°C

Tempering °C	100°C	200°C	300°C	400°C	500°C	550°C	600°C	650°C	700°C
HRC	491HRC	49HRC	49HRC	49HRC	51HRC	51HRC	50HRC	46HRC	36HRC



Tempering temperature and hardness relation curve



CCT curve

HOT WORKING **TOOL STEEL**

Grade **1.2714**

CHARACTERISTICS

Classic die steel like grade 2713, but with better tempering properties and better through-hardening properties to a reference diameter of 450mm. For larger dimensions we recommend grade 2714 ISO-B MOD or hardening and tempering after contour roughing. For hardness up to 440 HB (≙ approx. 1500 MPa).

APPLICATIONS

Large press dies for forming aluminium, forging dies for large quantities regardless of die size and shape of cut, die and mould holders, tool holders and cold forging die holders, tool cassettes. Hydroforming moulds (IHU).

CHEMICAL **COMPOSITION** (%)

Standards	Chemical Analysis Typical Value % (Min - Max)										Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	other	Heat Treatment	Hardness
55NiCrMoV7	0.50-0.60	≤0.004	≤0.030	1.10-0.40	0.60-0.90	1.50-1.20	0.80-1.20	0.35-0.55	0.05-0.15	***	Quench & Tempered	≤ HB 360-400

PHYSICAL **PROPERTIES** (reference value)

Thermal expansion coefficient (10^{-6}/K)	20-100 °C | 12.2	20-250 °C | 13.1	20-500 °C | 14.2
Thermal conductivity (W/mK)	20 °C | 36.0	250 °C | 37.5	500 °C | 34.5
Young's modulus (GPa)	20 °C | 215	250 °C | 198	500 °C | 175

HIGH-TEMPERATURE **YIELD STRENGTH**

Quenched and tempered state	0.2% yield strength in MPa at temperature			
	450°C	500°C	550°C	600°C
~ 1570 MPa	900	740	460	220
~ 1370 MPa	810	590	390	200
~ 1180 MPa	610	460	280	150

PRODUCTION **PROCESS**

ROUND BAR:	102 , 112 , 122, 132 , 142 , 152, 162, 172, 182, 202, 212, 222, 232, 242 , 252, 262 ,272, 282 , 302, 322, 330, 342, 352, 382, 392, 402 , 412, 435 , 452, 482, 512 , 532 , 603 , 653
FLAT BAR:	EAF → LF → VD → HOT FORGED → ANNEALED → OIL QUENCH & TEMPERED → 2 TIMES TEMPERED → 6 SIDES MACHINED (Blocks) → TURNED BRIGHT (Rounds)

ULTRASONIC TEST:
OK According to SEP 1921, (DEC.84) D/d

CLEANLINESS STANDARD:
ASTM E-45-METHOD A

REDUCTION RATIO:
Min. 4/5 : 1

GRAIN SIZE ACC TO ASTM E112:
6 AND FINER

DELIVERY STATUS : In Quench & Tempered Condition

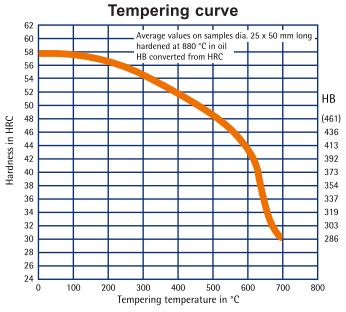
HEAT **TREATMENT**

Stress relieving	Temperature : Approx. 650 °C in the annealed state Duration : 1 hour per 50 mm wall thickness Cooling : furnace
Soft annealing	Temperature : 700 °C Duration : 1 hour per 25mm wall thickness Cooling : furnace
Hardening	Temperature : 880 °C Duration : 1 minute per mm wall thickness
Quenching hardness	Max. 58 HRC : in water/oil, protective atmosphere/oil, oil, hot bath or vacuum
Tempering	Temperature : See tempering curve Duration : 1 hour per 25mm wall thickness Cooling : Air
Working hardness	300-440 HB : depending on application

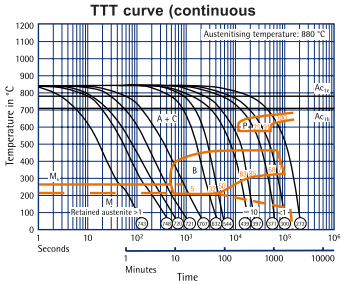
Note: Pre-heating of the tools to 250-280 °C is recommended.

Width / Thickness	210	260	310	360	410	460	510	560	610	660	710	810	1010	1500
210	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo
260		oo	oo	oooo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo
310			oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo
360				oo	oo	oo	oo	oo	oo	oo	oo	oo	oo	oo
410					oo	oo	oo	oo	oo	oo	oo	oo	oo	oo
460						oo	oo	oo	oo	oo	oo	oo	oo	oo
510														

Tempering curve



TTT curve (continuous



COLD WORKING **TOOL STEEL**

TG **D2**
(DIN-1.2379)

STEEL **PROPERTIES**

: 12% ledeburitic chromium steel. Maximum wear resistance, good toughness. Best cutting-edge endurance and resistance to tempering, can be nitrided after special heat treatment

APPLICATIONS

• Thread rolling rolls and thread rolling dies, cold extrusion tools, cutting and stamping tools for sheet thicknesses up to 6mm, precision cutting tools up to 12 mm. Cold pilger mandrels, circular-shear blades, deep-drawing tools. pressure pads and highly resistant plastic moulds. • E.S.R. materials, high compression strength and fine robustness. The spheroical annealed make it easily processed by shearing and cutting with no crake while processing. • Applied in thickness no less than 2mm punch mould, all kind of small mould for shearing and cutter together with screw rolled or slappered mould as well as some other forming mould like rulers.

SIMILAR **STEEL GRADE**

CHINA	BRAZIL	AUSTRIA	GERMANY		SLOVANIA	ITALY	JAPAN			S.KORIA
TG	VILLARES	BOHLER	DEW	GRODITZ	RAVNE	LUCCHINI	HITACHI	NIPPON	SANYO	DOOSAN
D2	VD2	K110	1.2379	1.2379	OCR12VM	DUYOS2379	SLD	KD11V	QCD2	STD 11

CHEMICAL **COMPOSITION** (%)

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
D2 (1.2379)	1.45-1.60	≤0.02	≤0.03	0.10-0.60	0.20-0.60	***	11.0-13.0	0.70-1.00	0.70-1.00	***	***	Annealed	≤ HB255

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → BLOOM FORGED (5tons Hammer) → Forged Annealed & Turned : Φ 81.0 - 1000mm; Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm; Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm → ANNEALED CONDITION

FLAT BAR:

EAF → LF → VD → FORGED (5TONS HAMMER) / HOT ROLLED (910) → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
As Hot rolled & forged, delivery condition : Annealed

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1000mm

SIZE: **FLATS**

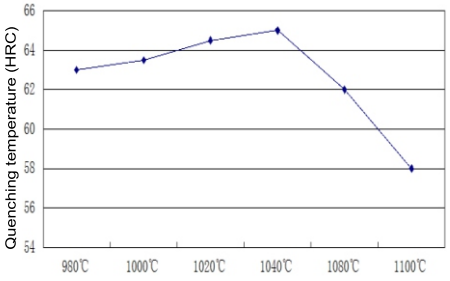
Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: **SHEETS**

Thickness	Width
5mm - 12mm	810mm - 2500mm

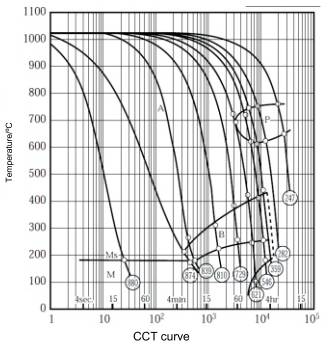
THERMAL **TREATMENT**

Softening annealing	Quenching	Tempering
Heating to 830~860°C for heat insulation and cooling slowly	1020~1040°C quenching; oil cooling or air cooling	150~250°C, twice tempering (Underlining tenacity) 500~530°C, twice tempering (Underlining hardness)



Quenching temperature and hardness relation curve

Tempering temperature and hardness relation curve



CCT curve

COLD WORKING **TOOL STEEL**

TG **D3**
(DIN-1.2080)

STEEL **PROPERTIES**

Ledeburitic-high-carbon high-chromium tool steel, very high wear-resistance.

APPLICATIONS

• Tools for cutting sheets up to 4mm thickness, trimming dies, blanking dies for paper and plastics, long- and round-section shear blades for sheet thicknesses up to 2 mm, drawing and deep drawing tools. • Woodworking tools, stone pressing tools, pressure pads and highly wear-resistant plastic moulds, profile rolls.

SIMILAR **STEEL GRADE**

CHINA	AUSTRIA	GERMANY	SLOVANIA	JAPAN
TG	BOHLER	DEW	RAVNE	SANYO
D3 (1.2080)	K100	1.2080	OCR12VM	QC1

CHEMICAL **COMPOSITION (%)**

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
D3 (1.2080)	1.90-2.20	≤0.02	≤0.03	0.10-0.40	0.15-0.45	***	11.0-12.0	***	***	***	***	Annealed	≤ HB250

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → BLOOM FORGED (5tons Hammer) → Forged Annealed & Turned : Φ 81.0 - 610mm; Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm; Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm → ANNEALED CONDITION

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD :
SEP 1921, (DEC.84)E/e

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 610.0mm

SIZE: **FLATS**

Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: **SHEETS**

Thickness	Width
5mm - 12mm	810mm - 2500mm

HEAT **TREATMENT**

Soft annealing °C	Cooling	Hardness HB
800 - 840	furnace	max. 250

Hardening form °C	in	Hardness after quenching HRC
930-960 950-980	oil, hot bath 500-500 °C air (up to 30 mm thickness)	64

Tempering °C	100°C	200°C	300°C	400°C	500°C	550°C	600°C
HRC	63	62	59	57	54	54	46

COLD WORKING **TOOL STEEL**

TG **O1**
(DIN-1.2510)

STEEL **PROPERTIES**

Good edge-holding ability, high hardenability, close tolerance on heat treatment.

APPLICATIONS

- Blanking and stamping dies for cutting sheet metals up to 6 mm thickness, threading tools, drills, broaches, measuring tools, plastic moulds, shear blades.

SIMILAR **STEEL GRADE**

CHINA	BRAZIL	AUSTRIA	GERMANY	SLOVANIA	JAPAN		
TG	VILLARES	BOHLER	DEW	RAVNE	HITACHI	NIPPON	SANYO
01 (1.2510)	VND	K460	1.2510	OW4	SGT	KS3	QKS3

CHEMICAL **COMPOSITION (%)**

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
01 (1.2510)	0.90-1.05	***	***	***	1.00-1.20	***	0.50-0.79	***	0.50-0.70	0.40-0.60	***	Annealed	≤ HB230

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → FORGED (5TONS HAMMER) →
- Forged Annealed & Turned : Φ 81.0 - 610mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm
- Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm

→ ANNEALED CONDITION

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ 2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 610.0mm

SIZE: **HOT ROLLED FLAT BARS / SAND BLASTED & MACHINED STRAIGHT**

Thickness	Width
14mm - 100mm	200mm - 710mm

SIZE: **SHEETS**

Thickness	Width	Length
0.5mm - 12mm	810mm	2500mm

HEAT **TREATMENT CONDITION**

Soft annealing °C	Hardening from °C	Cooling	in	Hardness and quenching HRC
740-770	780-820	Furance	Oil or hot bath 180-220 °C	64

Tempering °C	100°C	200°C	300°C	400°C
HRC	64	62	57	53

COLD WORKING **TOOL STEEL**

TG **S7**
(DIN-1.2357)

DESCRIPTION
S7 is a general purpose air hardening tool steel having high impact and sock resistance. it has good resistance to softening at moderately high temperatures. This combination of properties makes it suitable for many hot-work and cold-work applications.

APPLICATIONS
Chisels, rivet sets, punches, driver bolts. Hot punching and shearing.

PHYSICAL **PROPERTIES**
(average values) at ambient temperature : Density [gcm^3] : 7.86

EQUIVALENT **GRADES**

TG	RAVNE	MAT. NO.	DIN	EN	AISI/SAE
S7	OH253	1.2357	50CrMoV13-1	--	S7

CHEMICAL **COMPOSITION** (%)

Standards	Chemical Analysis Typical Value % (Min - Max)								
IS	C	Si	Mn	Cr	Mo	Ni	V	W	other
S7	0.50	0.50	3.25	3.25	1.50	***	0.25	***	***

COEFFICIENT OF **LINEAR THERMAL EXPANSION** $10^{-6}\,{}^{\circ}C^{-1}$

20-100°C	20-200°C	20-300°C	20-400°C	20-500°C	20-600°C	20-700°C
11.7	12.9	13.3	13.8	14.1	14.3	14.6

Soft Annealing : Heat 810-850°C, cool slowly in furnace. This will produce a maximum brinell hardness of 229.

Stress Relieving: To Relieve machining stresses for greater accuracy in hardening - first rough machine, then anneal below the critical 649/677°C a minimum of one hour at temperature and cool slowly, then finish machine.

Hardening: Harden from a temperature 930-960°C followed by air or oil quenching. Hardness after quenching is 59-61 HRC.

Tempering : Tempering temperature: 150-400°C

TERMPERING **TEMPERATURE** (°C) **vs HARDNESS** (HRC)

100°C	200°C	300°C	400°C	500°C	550°C	600°C	650°C
59	57	54	53	52	52	48	41

Forging Hot forming temperature: 1060-1121°C

Machinability : The machinability of S7 alloy may be rated at about 75/80 % of a 1% carbon tool steel.

Corrosion Resistance: Corrosion resistance of this alloy is better than that of plain carbon steels. However it will rust unless given protective treatment.

Forms manufactured: Please see Dimensional Sales Programe.

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → BLOOM FORGED (5tons Hammer) → Forged Annealed & Turned : Φ 81.0 - 1000mm; Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm; Cold Drawn / Centreless Ground : Φ 2.0 - 14.4mm → ANNEALED CONDITION

FLAT BAR:

EAF → LF → VD → FORGED (5TONS HAMMER) / HOT ROLLED (910) → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
As Hot rolled & forged, delivery condition : Annealed

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1000mm

SIZE: **FLATS**

Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: **SHEETS**

Thickness	Width
5mm - 12mm	810mm - 2500mm

COLD WORKING **TOOL STEEL**

TG **A2**
(DIN-1.2363)

STEEL **PROPERTIES**
Low change in size on heat treatment. High wear-resistance and toughness.

APPLICATIONS
- Blanking dies, rolls, shear blades, cold pilger mandrels, cold coining dies, Moulds for the processing of plastics.

SIMILAR **STEEL GRADE**

CHINA	BRAZIL	GERMANY	SLOVANIA	JAPAN
TG	VILLARES	DEW	RAVNE	NIPPON
A2 (1.2363)	VA2	1.2363	OA2	KD12

CHEMICAL **COMPOSITION (%)**

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
A2 (1.2363)	1.90-1.05	≤0.35	≤0.35	0.20-0.40	0.40-0.70	***	4.80-5.01	0.40-0.70	0.10-0.30	***	***	Annealed	≤HB231

PRODUCTION **PROCESS**

ROUND BAR:

EAF → LF → VD → ESR → (5TONS HAMMER) →
- Forged Annealed & Turned : ϕ 81.0 - 610mm
- Hot Rolled & Annealed Peeled (HRAP) : ϕ 14.5 - 80.0mm
- Cold Drawn / Centreless Ground : ϕ 2.0 - 14.4mm

→ ANNEALED CONDITION

FLAT BAR:

EAF → LF → VD → ESR → FORGED → HOT ROLLED (850) → ANNEALED CONDITION

UT STANDARD:
SEP 1921, (DEC.84)E/e

REDUCTION RATIO :
As 1:4 or 1:5

DELIVERY STATUS :
In Annealed Condition

SIZE: **ROUND**

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
ϕ 2.0 - 14.4mm	ϕ 14.5 - 80.0mm	ϕ 81.0 - 610.0mm

SIZE: **HOT ROLLED FLAT BARS / SAND BLASTED & MACHINED STRAIGHT**

Thickness	Width
14mm - 100mm	200mm - 710mm

HEAT **TREATMENT**

Soft annealing °C	Cooling	Hardness HB
800 - 840	furnace	max. 250

Hardening form °C	in	Hardness after quenching HRC
930-970	air, oil, hot bath 500-500 °C	63

Tempering °C	100°C	200°C	300°C	400°C	500°C	600°C
HRC	63	62	59	57	59	52

COLD WORKING TOOL STEEL

TG A8M

SMELTING METHOD

1) EAF + LF + VD ; 2) ESR + LF + VD + ESR

MAIN CHARACTERISTICS

Extremely high quenching, strong hardening, high abrasion performance and extremely high compression strength.

MAJOR APPLICATIONS

• Bearing small impact load during manufacturing, highly resistant cold punching, cold shearing cutting, drill sleeves, gages, wire drawing dies, screw plates, drawing dies, screw thread rolling dies, and other dies.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	W	V	P	S
2.05	0.25	0.3	11.5	***	***	***	≤ 0.030	≤0.010

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity (x10^{-6}K)	
				20 ~ 200°C	20 ~ 400°C
7.67	460	20	210,000	12	12.9

ULTRASONIC FLAW DETECTION

Electric furnace steel: flaw detection standard: as per SEP1921 - D/d flaw detection or GB/T6402-2008 Class 3, or as per customer requirements.
Electroslag Steel: flaw detection standard: as per SEP1921 - E/e flaw detection or GB/T6402-2008 Class 4, or as per customer requirements Purity.

ELECTRIC FURNACE STEEL

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.5	1.0	2.0	1.5	1.5	1.0	1.5	1.5

ELECTROSLAG STEEL

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

DELIVERY STATE

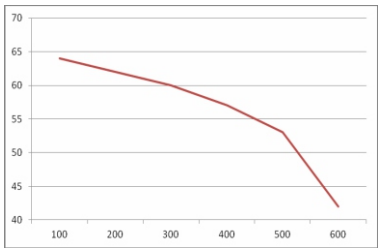
1) Delivery hardness: delivery under annealing state, ⩽255HB;
2) Unevenness of eutectic carbide shall comply with BOHLER standard.

SUPPLY SPECIFICATION

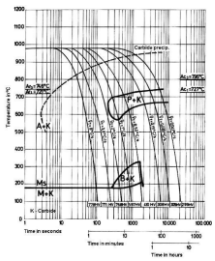
PRODUCT NAME	SUPPLY SPECIFICATION OF ELECTRIC FURNACE STEEL/mm	SUPPLY SPECIFICATION OF ELECTROSLAG STEEL/mm
Forged Round Bar	Φ 70 ~ 500mm	Φ 70 ~ 500mm
Forged Module	(120~200) x (300~620)	(120~350) x (300~810)
Rolled Round Bar	Φ 16 ~ 70	Φ 16 ~ 70
Rolled Flat Bar	(12~120) x (200~630)	(12~120) x (200~810)
Small Flat Steel	Small flat steel of various specifications with thickness under 30mm and width of 150mm	
Sheet Metal	Sheet metal with thickness under 10mm	

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 830~880°C for heat insulation; and cooling slowly	950~980°C quenching, oil cooling	180~200°C twice tempering, HRC60~62



Tempering temperature and hardness relation curve


CCT curve

COLD WORKING TOOL STEEL

1.2767

SMELTING METHOD

1) EAF + LF + VD + 2) EAF + LF + VD + ESR

MAIN CHARACTERISTICS

Nickel cold work tool steel is characterized by good harden ability and toughness; good polishing performance and anti corrosion treatment ability.

MAJOR APPLICATIONS

• Hot-forging die for metal processing and tool for extrusion; • Mold with various shapes and dimensions;
• Mold, axis sleeve, core rod, etc.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	Ni	V	P	S
0.45	0.35	0.35	1.35	0.25	4.05	≤ 0.1	≤ 0.03	≤ 0.03

PHYSICAL PROPERTY

Density at room temperature (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	Heat conductivity at the temperature of 200°C (W/m-K)	Elastic mouldus (N/mm^2)	Coefficient of Linear expansion (x10^{-6}K)	
				20 ~ 200°C	20 ~ 400°C
7.84	***	28	***	12.5	13.4

ULTRASONIC FLAW DETECTION

Electric furnace steel: detection standard: conduct flaw detection according to SEP1921-D/d grade, conduct grade assessment of 3 levels according to GB/T6402-2008 or conduct flaw detection according to clients' requirements.
Electro slag steel: detection standard: flow detection shall confirm to SEP1921-E/e grade, conduct grade assessment of 4 levels according to GB/T6402-2008 or conduct flaw detection according to clients' requirements.

DEGREE OF PURITY

ELECTRIC FURNACE STEEL

Class A		Class B		Class C		Class D	
Fine series	Rough series	Fine series	Rough series	Fine series	Rough series	Fine series	Rough series
1.5	1.0	2.0	1.5	1.5	1.0	1.5	1.5

ELECTRO SLAG STEEL

Class A		Class B		Class C		Class D	
Fine series	Rough series	Fine series	Rough series	Fine series	Rough series	Fine series	Rough series
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

DELIVERY STATE

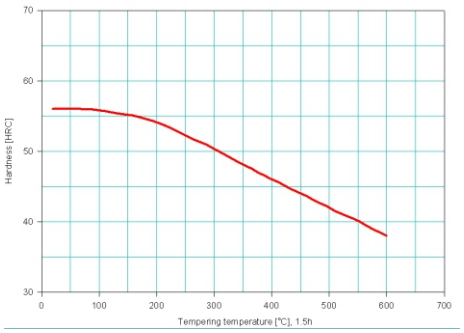
1) delivery under annealing conditions, annealing hardness≤ 260HB;

SPECIFICATION OF SUPPLY

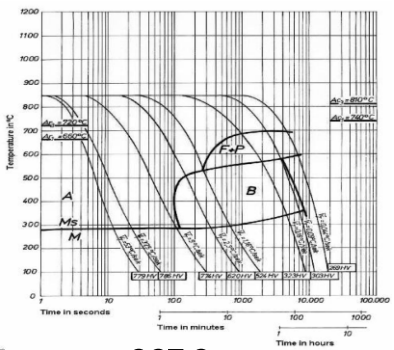
ROUND BAR	MODULE
≤ 500mm	THICKNESS ≤ 300mm, width ≤800

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 610~850°C carry out heat preservation and cooling in furnace	Hardening temperature is 840~870°C carry out air cooling	Select tempering temperature as per clients requirement



Relation Curve Between Tempering Temperature and Hardness



CCT Curve

POWDER METALLURGY COLD WORKING TOOL STEEL

TSFD2

SMELTING METHOD

Intermediate Frequency Furnace → Ladle Furnace → Vacuum Degassing → Spray Forming

MAIN CHARACTERISTICS

High purity, small size and uniform distribution of carbides, high harddenability, small deformation in heat treatment, good toughness, excellent wear resistance, and long service life.

MAJOR APPLICATIONS

• Long-life precision cold stamping die, cold shear die, thread rolling die, imprinting die; • Precision measuring tools, such as advanced guages; • Long-life cold heading mold; • Roller steel and parts with high segregation requirements.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	W	V	P	S
1.5	0.35	0.4	12.0	0.75	***	0.75	≤ 0.03	≤0.015

PHYSICAL PROPERTY

Density at room temperature (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	Heat conductivity at the temperature of 200°C (W/m-K)	Elastic mouldus (N/mm^2)	Coefficient of Linear expansion ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.70	450	20	210,000	11.3	12.1

ULTRASONIC FLAW DETECTION

Flaw Detection Standard : according to SEPI921-E/e level of flaw detection and GB/T6402-2008 level 4 of assessment or upon customer-specific requirements.

CLEANLINESS

Class A		Class B		Class C		Class D	
Thin	Thick	Thin	Thick	Thin	Thick	Thin	Thick
1.5	1.0	2.0	1.5	1.5	1.0	1.5	1.0

DELIVERY STATE

1) Delivery in annealing state, annealing hardness ⩽255HB;
2) The inhomogeneity of eutectic carbide is less than or equal to grade 2 or grade 3 for respectively diameter ⩽200mm or for diameter ⩽300mm

SIZE: ROUND

Cold Drawn/Ground Bar	Hot Rolled Annealed & Peeled Bard	Forged + Annealed + Turned Bar
Φ2.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 1000mm

SIZE: FLATS

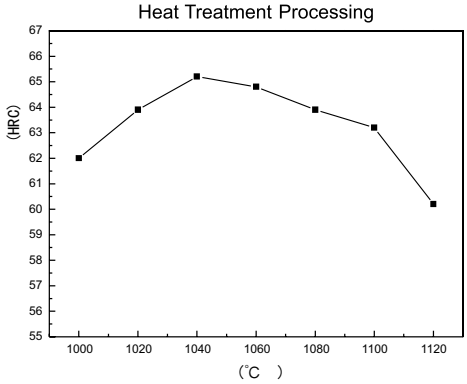
Thickness	Width
5mm - 150mm	5mm - 810mm

SIZE: SHEETS

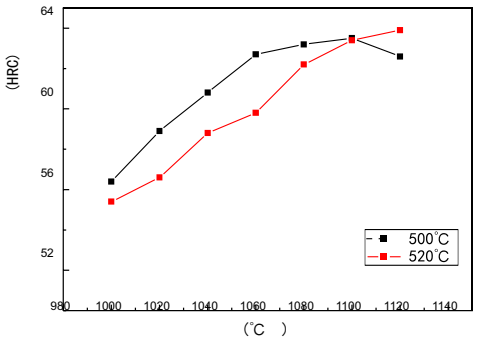
Thickness	Width
5mm - 12mm	810mm - 2500mm

SPECIFICATION

PRODUCT	SPRAY INGOT mm
Forged Round Steel	Φ 16 ~ 300



Quenching Hardness vs. Quenching Temperature of D2 Spray Ingot



Tempering Hardness vs. Quenching Temperature of D2 Spray Ingot

Remark: The quenching and tempering temperatures can be chosen depending on Customer's requirement.

POWDER METALLURGY COLD WORKING TOOL STEEL

TSFDC 53

SMELTING METHOD

Intermediate Frequency Furnace (15ton) - Ladle Furnace
Vacuum Degassing - Spray Forming

MAIN FEATURES

Improve Coarse carbides, small size deformation of heat treatment, high toughness, high wear resistance, superior processing performance.

MAIN APPLICATIONS

• Precious cold stamping des: precision blanking for wire cutting, stamping dies for various purposes; - Long-life automobile panel mold: insert molds for key parts; - Trimming, hemming, wire drawing, thread rolling die.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	W	V	P	S
0.93	0.95	0.40	7.8	1.90	--	0.25	≤0.003	≤ 0.010

ULTRASONIC FLAW DETECTION

Flaw Detection Standard: according to SEP 1921-E/e level of flaw detection and GB/T6502-2008 level 4 of assessment or upon customer specific requirements.

CLEANLINESS

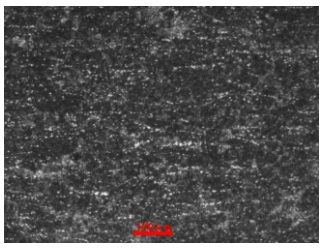
Class A		Class B		Class C		Class D	
Thin	Thick	Thin	Thick	Thin	Thick	Thin	Thick
1.5	1.0	2.0	1.5	1.5	1.0	1.5	1.0

DELIVERY STATUS

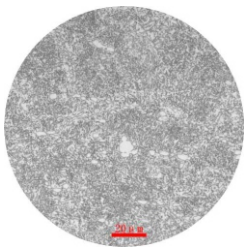
• Delivery in annealed state, hardness ≤255HB. • The in homogeneity of eutectic carbide is less than or equal to grade 2 or grade 3 for respectively diameter ≤200mm or for diameter ≤300mm.

SPECIFICATION

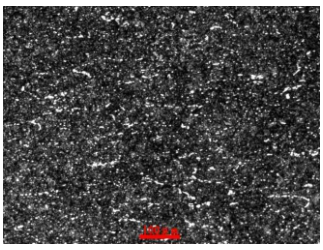
PRODUCT	ROUND STEEL	MODULE
SPECIFICATION	22-300	120x610 ~ 250x410



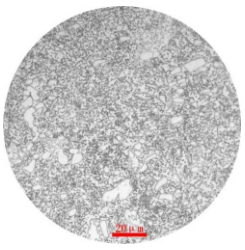
Φ241mm Spray Ingot
Eutectic Carbide Unevenness: Grade 1.5



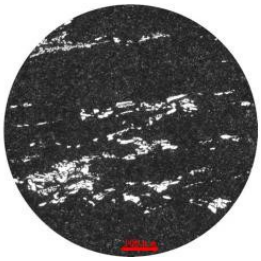
Φ241mm Spray Ingot
Large Carbide Size: 11.7um



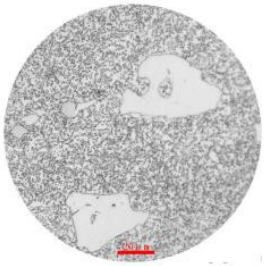
210x410mm Spray Ingot
Eutectic Carbide Unevenness: Grade 2



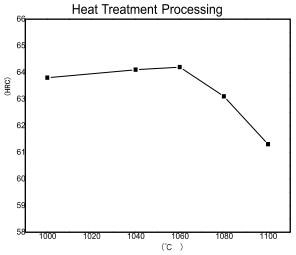
210x410mm Spray Ingot
Large Carbide Size: 14.2um



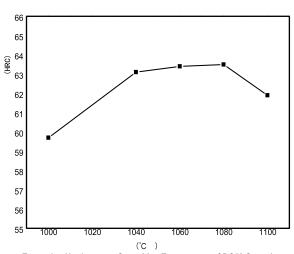
Φ141mm Electroslag Remelted Ingot
Eutectic Carbide Unevenness: Grade 4



Φ141mm Electroslag Remelted Ingot
Large Carbide Size: 45um



Quenching Hardness vs. Quenching Temperature of DC53 Spray Ingot



Tempering Hardness vs. Quenching Temperature of DC53 Spray Ingot
Remark: The quenching and tempering temperatures can be chosen depending on customer's requirement.

PLASTIC MOULD STEEL

1.2311

MAIN CHARACTERISTICS AND APPLICATIONS

Steel with excellent hardening penetration up to 400mm. Generally supplied in hardened and tempered condition with excellent polishing and photoengraving Properties. This steel is suitable for nitriding (around 800HV), chrome and nickel plating.

Used for plastic dies with excellent surface finish properties. It is also used for dies of light alloys with low melting point, plates, dies box, etc.

COMPARABLE STANDARDS

UNI	W.Nr	DIN	AFNOR	AISI/SAE	BS
	1.2311	X40CrMnMo7	40CMD8	-P20	-P20

CHEMICAL COMPOSITION (%)

Indian	Chemical Analysis Typical Value % (Min - Max)											Delivery Condition	
IS	C	S	P	Si	Mn	Ni	Cr	Mo	V	W	other	Heat Treatment	Hardness
1.2311	0.35-0.45	≤0.030	≤0.030	0.20-0.40	1.30-1.60	***	1.80-2.10	0.15 0.25	***	***	***	Annealed	≤HB 280-325

CRITICAL POINTS: Acl : 740°C | Ms : 310°C **SUPPLY CONDITIONS:** Hardened and Tempered HB280-325 (950-1100N/mm²)

PRODUCTION PROCESS

EAF → LF → VD → ESR → BLOOM IN FOLLOWING MACHINE : QUICK FORGING (12.5MN), HAMMER, PRECISION FORGING →

- Precision Forging : Φ 81 - 255mm
- Hot Rolled & Annealed Peeled (HRAP) : Φ 14.5 - 80.0mm
- Cold Drawn / Sand Blasted (Coil) : Φ 1.0 -13.5mm
- Cold Drawn / Centreless Ground : Φ 1.0 -14.4mm

UNDER ANNEALED CONDITION:
Hardness : HB205-255

REDUCTION RATIO:
As 1:4 or 1:5

DELIVERY STATUS:
As Cold drawn / Hot rolled / forged, in annealed condition.

SIZE: ROUND

Cold Drawn/Centreless Ground Bar	Hot Rolled Peeled & Polish Bar	Forged & Turned bar	Coil
Φ 1.0 - 14.4mm	Φ 14.5 - 80.0mm	Φ 81.0 - 255.0mm	Φ 1.0 - 13.5mm

SIZE: FLATS

Thickness	Width
5mm - 205mm	5mm - 810mm

SIZE: SQUARES

4mm to 100mm

SIZE: SHEETS

Thickness	Width	Length
0.5mm to 12mm	810mm	2500mm

HEAT TREATMENT

ANNEALING :
- Heat to 720 - 750 °C for 2-4 h furnace cool

STRESS RELIEVING :
- Up to 560 - 600 OC, hold for 2-4 h
- Furnace or steel air cooling.

HARDENING :
- Preheating to 600-650 °C
- Heat to hardening temperature to 840-870°C and hold at temperature
- Cooling in oil
- Hardness after hardening : HRC 51

TEMPERING :
- To be carried out soon after the hardening in the range 580-650°C for 1 hour for 25mm of thickness minimum 2h

PLASTIC MOULD STEEL

TGP 40
(DIN - 1.2738 (HH))

SMELTING METHOD
EAF + LF + VD + ESR

MAIN CHARACTERISTICS
If futures excellent hardening penetration, good workability, polishing and photoengraving properties. This steel is used for plastic moulds of medium and big size. It can be subject to a nitriding treatment to imporve its wear resistance.

MAJOR APPLICATIONS
- Injections and thermoplastic extrusion moulds, rubber moulds, moulds carrier frames, container.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	Ni	P	S
0.35 / 0.45	0.20 / 0.40	1.30 / 1.60	1.80 / 2.10	0.15 / 0.25	0.90 / 1.20	≤ 0.030	≤ 0.030

COMPARABLE STANDARDS

UNI	W.Nr	DIN	AFNOR	AISI/SAE	BS
--	1.2738	40Cr/MnNiMo8-6-4	40 CMND8	P20 + Ni	P20 + Ni

CRITICAL POINTS

AC1	710°C
Ms	290°C

SUPPLY CONDITIONS
Hardened and Tempered Normal HB 280 - 320 & 380 - 400

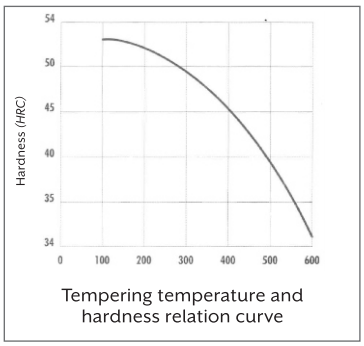
THERMAL TREATMENT
ANNEALING
- Heat to 710 - 740°, with hold at minimum rate for 3 hours
- Slow furnace cooling to 600 °C

STRESS RELIEVING
- To be carried out after machining and before the final heat treatment
- Heating to 530 - 580 °C for 2 h

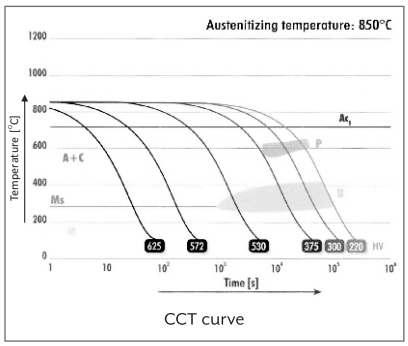
HARDENING

Preheating	500 - 550 °C
Austenitizing	840 - 880 °C
Cooling Medium	Oil or thermal bath cooling at 200 - 230 °C, then oil cooling according to the steel shape size
Quenched Hardness	52 - 54 HRC

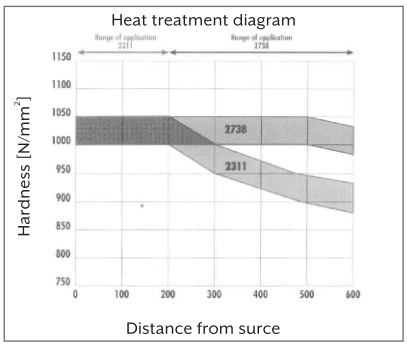
TEMPERING
- To be carred out after the hardening and when the steel is at 60 - 80 °C , at 500 - 600 °C according to the required hardness and with permanence for at least 2 h
- Cooling in air



Tempering temperature and hardness relation curve



CCT curve



Distance from surce

PLASTIC MOULD

TGS 136
(DIN - 1.2316)

SMELTING METHOD

EAF + LF + VD + ESR + VMR

MAIN CHARACTERISTICS

Extremely high mirroring performance, favorable corrosion resistance, high abrasion resistance and favorable machining performance.

MAJOR APPLICATIONS

• Super-mirror plastic molds: molds for optical Lens and other transparent plastic pieces; • Corrosion preventive high-resisting molds: Molds for fold vessels, cosmetics vessels, medical devices, light guiding plates, bottle covers, etc. • Formed resin materials: PC, PVC, PP, PE, PF, PMMA, adding fire retardant resin, etc.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	Ni	V	P	S
0.4	1.05	0.55	13.5	0.3	0.22	0.3	≤ 0.03	≤0.015

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.80	465	23	241,000	11.2	11.5

ULTRASONIC FLAW DETECTION

Flaw detection standard: as per GB/T 6402-2008 Class 4 flaw detection standard or as per customer requirements.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

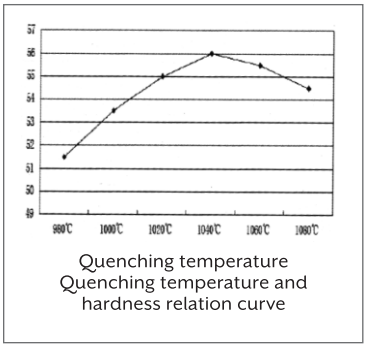
DELIVERY STATE: Delivery hardness: delivery under annealing state, ⩽ 255HB.

SUPPLY SPECIFICATION

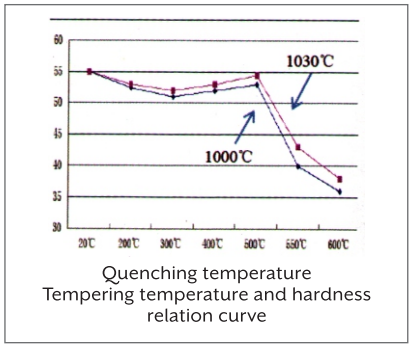
ROUND STEEL	FLAT STEEL	MODULE
Φ 16 - 500mm	16 - 120mm x 200 - 610mm	120 - 300mm x 300 - 1,000mm

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 850°C for heat insulation; cooling to 650°C at 10°C/h air cooling	1020~1030°C quenching; rapid air cooling	Tempering temperature 250°C (favorable tenacity and corrosion resistance) : selecting tempering temperature as per hardness requirements; tempering for twice.

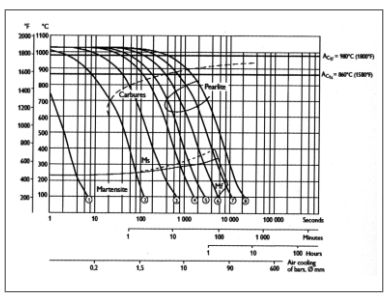


Quenching temperature Quenching temperature and hardness relation curve



Quenching temperature Tempering temperature and hardness relation curve

Austenite temperature: 1,030°C, heat insulation for 30min



CCT curve

PLASTIC MOULD

TGP 50
(DIN - 1.2083 ESR)

SMELTING METHOD
EAF + LF + VD + ESR

MAIN CHARACTERISTICS
Favorable corrosion resistance, abrasion resistance, quenching, cutting performance, and polishability as well as high surface fineness.

MAJOR APPLICATIONS
• Production of PVC molds; • Long-life molds; • Molds for disposable tableware; • Production of optics parts, for example, cameras, sunglasses lens, medical vessels, etc.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	W	V	P	S
0.42	≤ 1.00	≤ 1.00	13.5	--	--	--	≤ 0.03	≤ 0.005

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity (x10^{-6}K)	
				20 ~ 200°C	20 ~ 400°C
7.80	460	24	220,000	10.9	11.6

PURITY

ELECTRIC FURNACE STEEL

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.5	1.0	2.0	1.5	1.5	1.0	1.5	1.5

ELECTROSLAG STEEL

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0

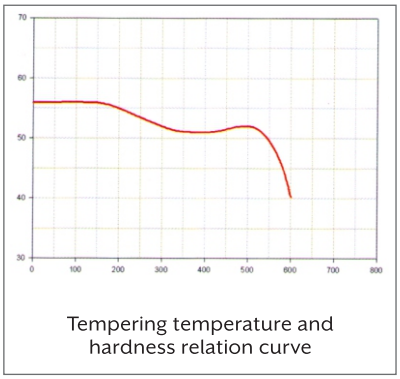
DELIVERY STATE : Delivery under annealing state, deliver hardness ⩽235HB;

SUPPLY SPECIFICATION

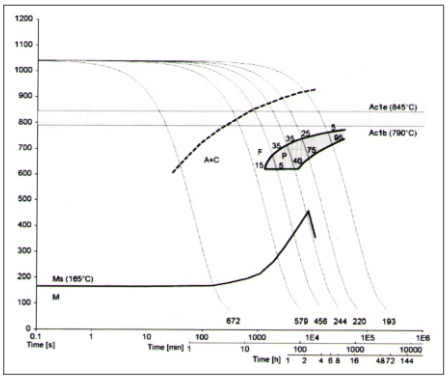
ROUND STEEL	FLAT STEEL	MODULE
Φ 16 - 500mm	16 - 120mm x 200 - 810mm	120 - 500mm x 300 - 1,200mm

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 850°C for heat insulation; cooling to 650°C at 10°C/h air cooling	1020~1030°C quenching; rapid air cooling	Tempering temperature 250°C (favorable tenacity and corrosion resistance) : selecting tempering temperature as per hardness requirements; tempering for twice.



Tempering temperature and hardness relation curve



CCT curve

PLASTIC MOULD

TGP 80

(Equivalent Grade of NAK80)

SMELTING METHOD

EAF + LF + VD + ESR

MAIN CHARACTERISTICS

High mirroring performance, even hardness, excellent discharging processing performance and texture processing performance. Molds can be used upon processing and no heat treatment is required.

MAJOR APPLICATIONS

• Mirror plastic molds: Transparent plastic molds: optical instrument parts, compact disks, medical devices, etc. • Molds underlining discharging processing surface quality.

CHEMICAL COMPOSITION (%)

C	Si	Mn	Cr	Mo	Ni	Ai	P	S
0.15	≤ 0.45	1.55	1.0	0.35	3.1	0.95	≤ 0.025	≤ 0.003

PHYSICAL PROPERTY

Room temperature density (Kg/m^3)	Specific heat of room temperature (J/Kg.K)	200°C thermal conductivity (W/m·K)	Elastic mouldus (N/mm^2)	Linear expansivity ($x10^{-6}K$)	
				20 ~ 200°C	20 ~ 400°C
7.80	460	22	218,000	12.3	13.2

ULTRASONIC FLAW DETECTION

Flaw detection standard: as per GB/T 6402-2008 Class 4 flaw detection standard or as per customer requirements.

PURITY

Class A		Class B		Class C		Class D	
Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse
0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.0

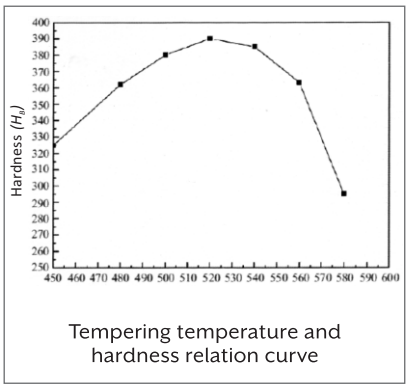
DELIVERY STATE: Delivery under pre-hardening state, deliver hardness 38-42 HRC.

SUPPLY SPECIFICATION

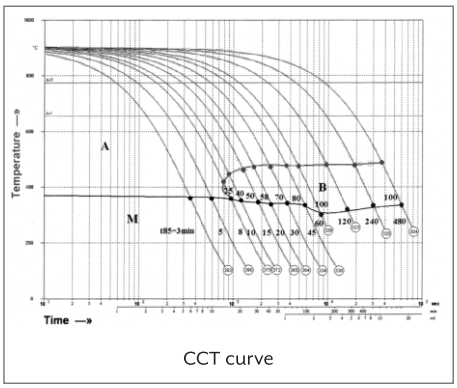
FLAT STEEL	MODULE
16 - 120mm x 200 - 810mm	120 - 400mm x 300 - 800mm

THERMAL TREATMENT

Softening annealing	Quenching	Tempering
Heating to 760°C for heat insulation and cooling to 600°C at 40°C/h	Delivery under pre-hardening state, no heat treatment, temperature of nitridation treatment 520°C	



Tempering temperature and hardness relation curve



CCT curve

PLASTIC MOULD

PH X SUPRA

DESCRIPTION

- PH X SUPRA is a corrosion-resistant, martensitic precipitation hardened stainless.
- PH X SUPRA is supplied in pre-hardened condition with a hardness of 38-42 HRC.

MAIN CHARACTERISTICS

- Excellent resistance to corrosion ı Excellent polishability • Excellent dimensional stability • Good strength • Good toughness.

MAJOR APPLICATIONS

- PH X SUPRA is recommended for tools / molds for the processing of corrosive plastics.

CHEMICAL COMPOSITION (%)

C	Cr	Ni	Cu	Nb
0.15	15.0	4.5	3.5	+

PHYSICAL PROPERTY (38-42 HRC)

Density : 0.285 lbs./in^3 (room temperature)

Coefficient of Thermal Expansion			Thermal Conductivity		
70°F - 200°F 5.9 x 10^{-6} /°F	70°F - 400°F 6.0 x 10^{-6} /°F	70°F - 750°F 9.2 x 10^{-6} /°F	70°F 115 Btu/in/ft^2/hr/°F	300°F 125 Btu/in/ft^2/hr/°F	940°F 155 Btu/in/ft^2/hr/°F

MECHANICAL PROPERTIES

Toughness (Charpy - V notch) : 25 ft-lbs. at 38 HRC

Hardness HRC	Y.S. (0.2%) Ksi	T. S. Ksi	EL (%)
38	160	162	12.8
40	170	172	12.2
42	175	180	12.2

POLISHING

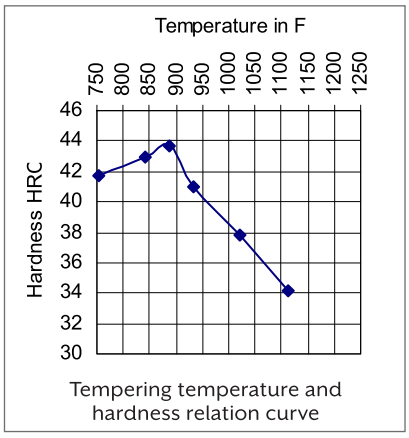
Tool should be polished using the guidelines for polishing stainless steel. When properly polished, an A-1 surface finish is achievable.

GENERAL NOTES

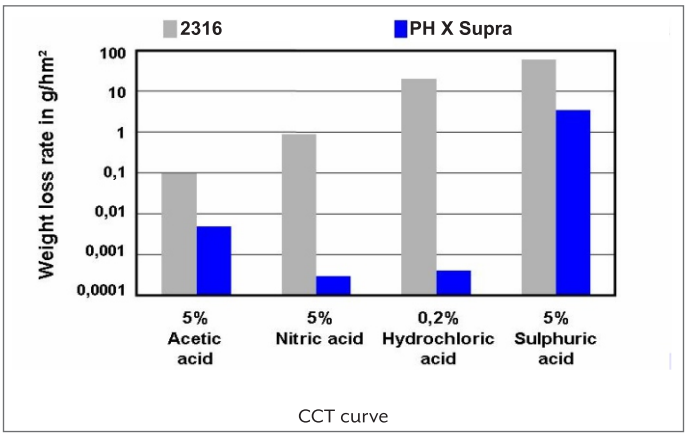
All statements regarding the properties or utilization of the materials or products mentioned are for the purposes of description only. Guarantees regarding the existence of certain properties or a certain utilization are only valid if agreed upon in writing.

GENERAL NOTES

- Refer to again diagram below for aging temperatures. • Aging is performed by uniformly heating to aging temperature, equalizing temperature from surface to center, holding for 4 hours at specified temperature, and air cooling.



Tempering temperature and hardness relation curve



CCT curve

MOLD STEEL **SERIES**

TGP **32**

PRODUCT **DESCRIPTION**

This steel grade is a martensitic stainless steel that combines toughness, corrosion resistance, high wear resistance, and high polishing performance.

Application fields: Plastic molds with extremely high surface finish for products, corrosive plastic molds such as flame retardants, deep frame plastic molds, complex plastic molds, and car lamp molds.

CHEMICAL **COMPOSITION** (%)

C	Si	Mn	Cr	Ni	Mo	V	N
0.25	0.30	0.60	13.0	+++	0.60	0.2	++

SIZE **SUPPLIED**

Product	Round (mm)	Plate (mm)
Rolled/Forged	16~900	(120~800) x (600~1400)

DELIVERY **STATUS**

Typical soft annealing hardness is under ⩽220HB.

CHEMICAL **CLEANLINESS**

Type A		Type B		Type C		Type D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0	0	1.0	0.5	0.5	0.5	1.0	0.5

ULTRASONIC **INSPECTION**

According to SEPI921-E/e standard
According to GB/T6402-2008 standard grade 4
According to customer requirements

SOFT **ANNEALING:**

Soft annealing in a protective atmosphere at 820 °C for 3-5h, followed by slow cooling at 10°C /h down to 500°C, then air cooling.

PHYSICAL **PROPERTIES**

(1) Density (p) : 7.8g/cm^3

(2) Modulus of Elasticity (E) (KN /mm^2)

Temperature/°C	25	200	400
E	241	210	175

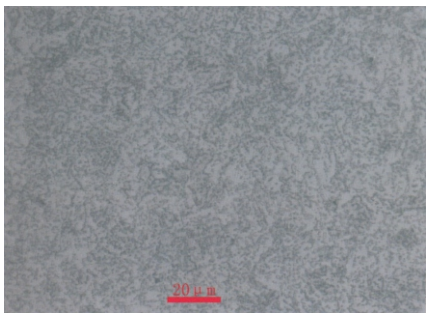
(3) Thermal Conductivity (λ) (W/m • K))

Temperature/°C	25	200	400
λ	20	22	23.8

(4) Thermal Expansions (α_m) (X 10^{-6}/°C)

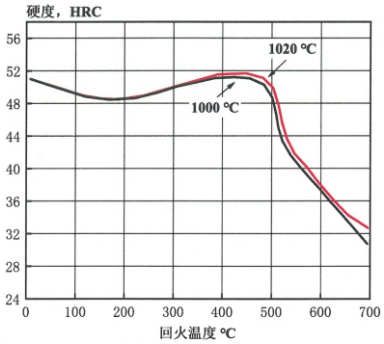
Temperature/°C	20	400	600
α_m	11.1	11	11.5

MICROSTRUCTURE

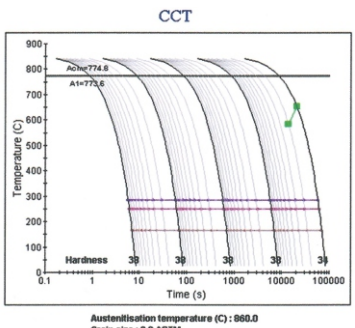


Annealed Structure: A2

GUIDELINES FOR HARDENING



CCT CURVE



MOLD STEEL **SERIES**

TGP **16**

PRODUCT **DESCRIPTION**

This steel is a acid resistant and wear-resistant plastic mold steel with high polishing performance, which can resist corrosion from water vapor, moisture, and weak acids. Working and storing in a humid environment, with good corrosion resistance.

Application fields: templates, clamps, and general corrosive plastic molds.

CHEMICAL **COMPOSITION (%)**

C	Si	Mn	Cr	Mo	Ni	V
0.40	1.05	0.55	13.5	0.30	0.22	0.30

SIZE **SUPPLIED**

Product	Round (mm)	Plate (mm)
Rolled/Forged	16~900	(120~800) x (600~1400)

DELIVERY **STATUS**

Typical soft annealing hardness is under ≤220HB.

CHEMICAL **CLEANLINENESS**

Type A		Type B		Type C		Type D	
THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
0.5	0.5	1.0	1.0	0.5	0.5	1.0	1.0

ULTRASONIC **INSPECTION**

According to SEP1921-E/e standard
According to GB/T6402-2008 standard grade 4
According to customer requirements

SOFT **ANNEALING:**

Soft annealing in a protective atmosphere at 860 °C for 3-5h, followed by slow cooling at 10°C /h down to 500°C, then air cooling.

PHYSICAL **PROPERTIES**

(1) Density (p) : 7.8g/cm^3

(2) Modulus of Elasticity (E) (KN /mm^2)

Temperature/°C	25	200	400
E	239	211	181

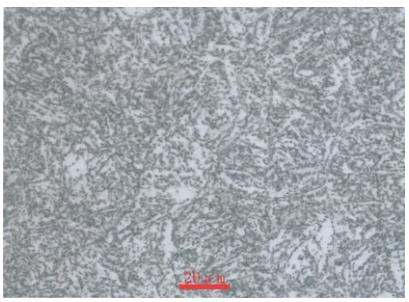
(3) Thermal Conductivity (λ) (W/m • K))

Temperature/°C	25	200	400
λ	21.2	23	24.2

(4) Thermal Expansions (α_m) (X 10^{-6}/°C)

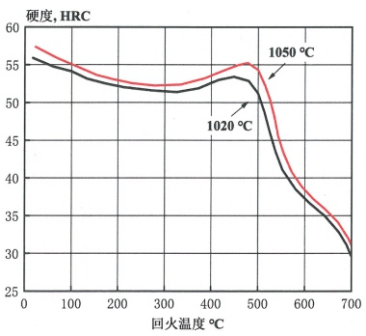
Temperature/°C	20	400	600
α_m	11.2	11.2	11.5

MICROSTRUCTURE

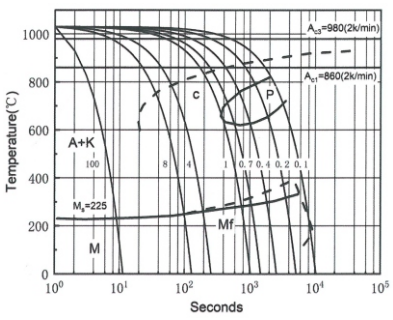


Annealed Structure: B1

GUIDELINES FOR HARDENING



CCT CURVE



HSS CUTTING TOOLS

- HSS STRAIGHT SHANK TWIST DRILL
- HSS TAPER SHANK TWIST DRILL
- HSS TAPS
- HSS END MILL
- REAMERS
- OTHER GENERAL TOOLS
- CARBIDE TIP DRILLS
- HSS DRILL BLANKS
- DRILL SET

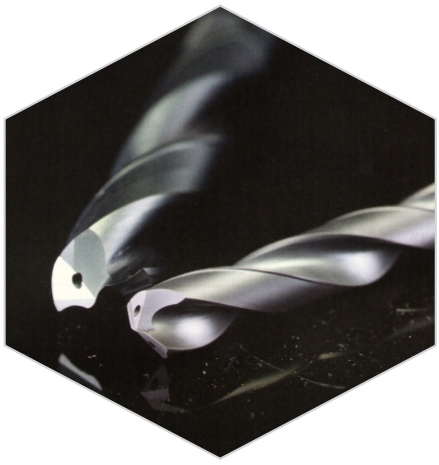
CARBIDE CUTTING TOOLS

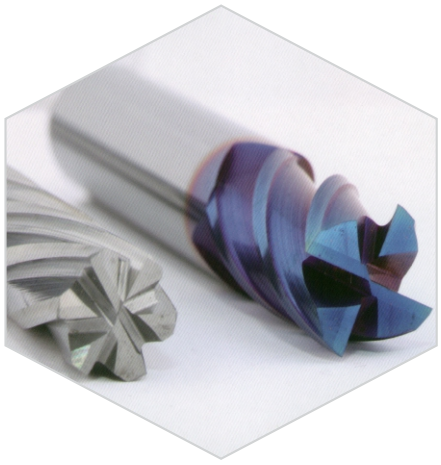
BRIEF INTRODUCTION

The world leading supporting production line for cemented carbide cutting tools is introduced into Taifeng International for the purpose of producing special cutting tools featuring strong market competitiveness, efficiency, precision and quality, thus Taifeng International can produce the cemented carbide products, including and mill, drill, reamer, molding knife and other cutting tools. The cemented carbide cutting tools produced have been widely applied in aviation, aerospace, shipbuilding, automobile, medical apparatus and instruments, chemical engineering. molding, IT mobile telephone shell and other fields.

With the most advanced German Walter five-axis linkage grinding machine and Walter six-axis full-automatic CNC measuring instrument is adopted, with the measuring precision reaching 0.001mm. The measuring instrument shows more prominent performance in measurement of non-standard cutting tools, which can scan the outline of the profile cutting tool produced and then compare with the profile required by clients after profile scanning to ensure no error between the profile precision and the actual precision of the products processed.

In recent years the production of cemented carbide cutting tool in China has witnessed rapid development, but such tool only occupies about 40% of the market share; the medium and low end cutting tools are the majority, and the imported cutting tools are mainly used for military industry and automobile processing industry. Taifeng International seizes this opportunity and develops imported on itself to bring “Chinese” cutting tools to the world.





DRILL SERIES
• NC Centre Drills
• DC2MU Twist Drills for General Purpose
• DS2MU Twist Drills for Stainless Steel
• DH2MU Twist Drills for Hardened Steel
• DZ2MN Inner Straight Flute Drills for Cast Iron

ENDMILLS SERIES
• Endmills for Stainless and Cast Iron
• Endmills for Hardened Steels
• Endmills for Stainless Steels
• Endmills for Aluminium Alloys
• Endmills for Graphite

TITANIUM

INTRODUCTION

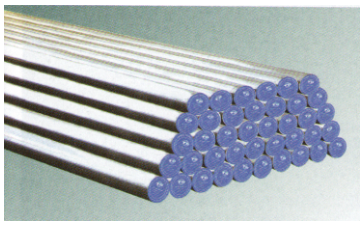
Jiangsu Tiangong Titanium Industry Technology Co., Ltd was invested and founded by Jiangsu Tiangong Tools Co., Ltd and Danyang Tianfa precise Forging Co., Ltd in January, 2010, which mainly manufactures and sell titanium and titanium alloy, and is located in Lingang industrial park in Xiashu town, Jurong, Jiangsu.

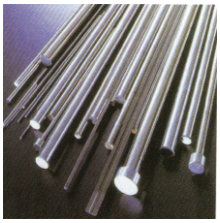
Due to its light weight, high specific strenght, corrosion resistance nonmagnetism, good performance at high and low temperature low damping and good biocompatibility, as well as superconductivity, shape memory and hydrogen storage, titanium and its alloy, whose performances are much superior to all special steels, aluminium alloy and any other alloy, are extensively used in aerospace, ships, ocean engineering, chemical industry, electric power, medical treatment and sports leisure and so on. Moreover they are also called space metal and ocean metal, which are considered as sophisticated and strategic materials.

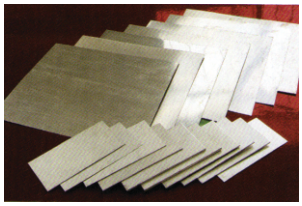
Titanium is the modern metallic material, and is essential for new technology, The higher social modernized degree is, the bigger the dosage of the material is.

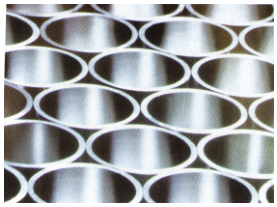
With the rise of China's manufacturing and the unceasing development of Chinese aviation industry, as well as the enhancement of the national living standards, China's titanium material consumption ascends day by day, and China's big airplane project has injected the stimulant into the titanium industrial enterprise undoubtedly, therefore, the titanium industry is a good non-ferrous metal project, which has a promising market.

Tiangong starts to invest the modern equipments for titanium and the titanium alloy, fully making used of the similarities of titanium processing and special steel processing, so Tiangong has advantage in producing titanium alloy bars, Furthermore, Tiangong will holds share with an upstream enterprise which manufactures sponge titanium, and a downstream enterprise of manufacturing titanium and titanium alloy seamless tubing, and the product mainly are forging materials and rolledproducts, with the specification from 8~200mm. On the other hand, we plan to build up Tiangong Titanium Industry into a chained enterprise which produces ingots, slabs and tubular products in 5 years, making it a brand enterprise in China.



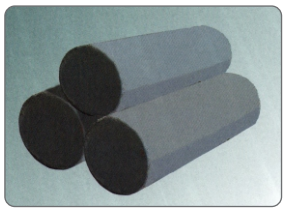






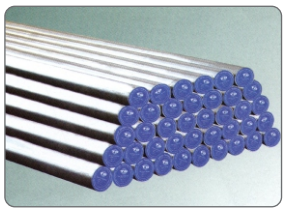
TITANIUM

INGOT **CASTING** | TITANIUM **BAR**
TITANIUM **SHEET** | TITANIUM **TUBE**



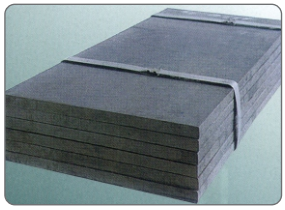
INGOT CASTING : The titanium bar we offer are using the domestic high-quality sponge as a raw mattly, forging and machining processes, products in full compliance with GB/T2965, ASTMB348 standard, chemical composition uniform and mechanical properties stable, meeting the user's application requirements. Products used in various types of titanium and titanium alloy tube manufacturers for hor-rolling, but also the chemical industry, energy, medical equipment and other related industries, typical applications: Titanium and titanium alloy bar for hot-rolling: composits rod with bar (the compound of titanium rods, etc.); Medical devices and surgical implants; Titanium and titanium alloys standard parts (screws, nuts, etc.) Leisure Products (golf success, etc.)

Commodity name	Designation number	Dimensions (mm)	Carries out the standard
Ingot casting	TA1-TA3, TA5-TA7, TA8-TA9, TA10, TC1-TC2, TC3-TC4, TC9, TC10, Gr1-Gr5, Gr7, Gr9, Gr11, Gr12, Gr13	Φ 300 -Φ600	A9TM, JIS, AMS, MIL, GB/T36201



TITANIUM BAR: The titanium bar we offer are using the domestic high-quality titanium sponge as a raw mattly, strictly control and quality such as ingot, forging and machining processes, products in full compliance with GB/T2965, ASTMB348 standard, chemical composition Uniform and mechanical properties stable, meeting the user's application requirements. Products used in various types of titanium alloy tube manufacturers for hor-rolling, but also the chemical industry, energy, medical equipment and other related industries, typical applications: Titanium and titanium alloy bar for hot-rolling: composits rod with bar (the compound of titanium rods, etc.); Medical devices and surgical implants; Titanium and titanium alloys standard parts (screws, nuts, etc.) Leisure Products (golf success, etc.)

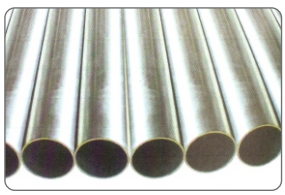
Commodity name	Designation number	Dimensions (mm)	Carries out the standard
Titanium Bar	TA1-TA3, TA5-TA7, TA8-TA9, TA10, TC1-TC2, TC3-TC4, TC9, TC10, Gr1-Gr5, Gr7, Gr9, Gr11, Gr12, Gr13	Φ8 - Φ600	A9TM, JIS, AMS, MIL, GB/T2965, GB/T13810



TITANIUM SHEET: The titanium sheet we offer are using the domestic high-quality titanium sponge as a raw mattly ricterial, strictly control the quality from raw materials selection, ingot, billet to forging eolling processes, products in full compliance with GB/T3621, ASTMB265 standard, related technical indicators have reached the advanced level in the industry, meeting the user's application requirements.

Product are widely used in petrochemical, sait, offshore industry, energy generation and other industries, typical applications include: Various types of titanium equipment; Ion-exchange membrane, divide slot; Titanium anodes of boards, basket; Leisure Products(Titanium Case, first-class golf); Used with other metals (copper) composite sheet; Titanium and titanium alloys in construction board.

Commodity name	Designation number	Dimensions (mm)	Carries out the standard
Titanium Sheet	TA1-TA3, TA5-TA7, TA8-TA9, TA10, TC3-TC4, TC9, TC10, Gr1-Gr5, Gr7, Gr9, Gr11, Gr12	(0.5-60) x (400-2000) x (1000-3000)	ASTM, JIS, GB/T3621, GB/T14845



TITANIUM TUBE: Our company used high quality titanium rods as raw materials, strictly according to the production quality control standards, products in full compliance with GB/T3624, GB/T3625, ASTMB337, ASTMB338 standard, related technical indicators have reached the advanced level in the industry, meeting the user's application requirements.

Products are widely used in petrochemical, salt, offshore industry, energy generation and other industries, typical applications include: Heat exchangers and condensers; All kinds of corrosive fluid transmission pipeline system; Titanium bicycle tube, automobile exhaust pipe; offshore aquaculture.

Commodity name	Designation number	Dimensions (mm)	Carries out the standard
Titanium Tube	TA1-TA3, TA5-TA7, TA8-TA9, TA10, Gr1-Gr2, Gr7, Gr9, Gr11, Gr12	(6-120) x (0.5-10) x (1000-15000)	ASTM, AMS, JIS, GB/T2624, GB/T3625


兰石重工
LS HEAVY INDUSTRY
70MN自由锻液压机组
2022.11

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