KMSI

KUSHAL METAL & STEEL INDUSTRIES PVT. LTD.

A LEGACY FORGED IN STEEL SINCE 1968

2360

PRIME

Tool steel for cold and hot work applications where high strength and hardness are combined with high toughness

2360 PRIME is a special alloyed Cr-Mo-V steel, secondarily hardenable, with very high toughness, good compressive strength, high wear resistance also at high temperatures.

Applications

2360 PRIME can be used for hot working: applications as hot stamping dies, press hardening dies for direct and indirect methods.

2360 PRIME can be used for all cold working applications requiring a combination of high hardness and toughness as in in automotive and white goods industries.

2360 PRIME can be used for industrial Knives and it is especially suitable for a use as chipping knives and all industrial knives such as those in the paper and wood industry and also for knives for cutting metals thicker than 5 mm.

If higher polish ability is required *(e.g. for mirror polish or higher toughness)* we recommend to use the SNAPPER ESR *(remelted steel with the highest cleanliness).*

Main properties

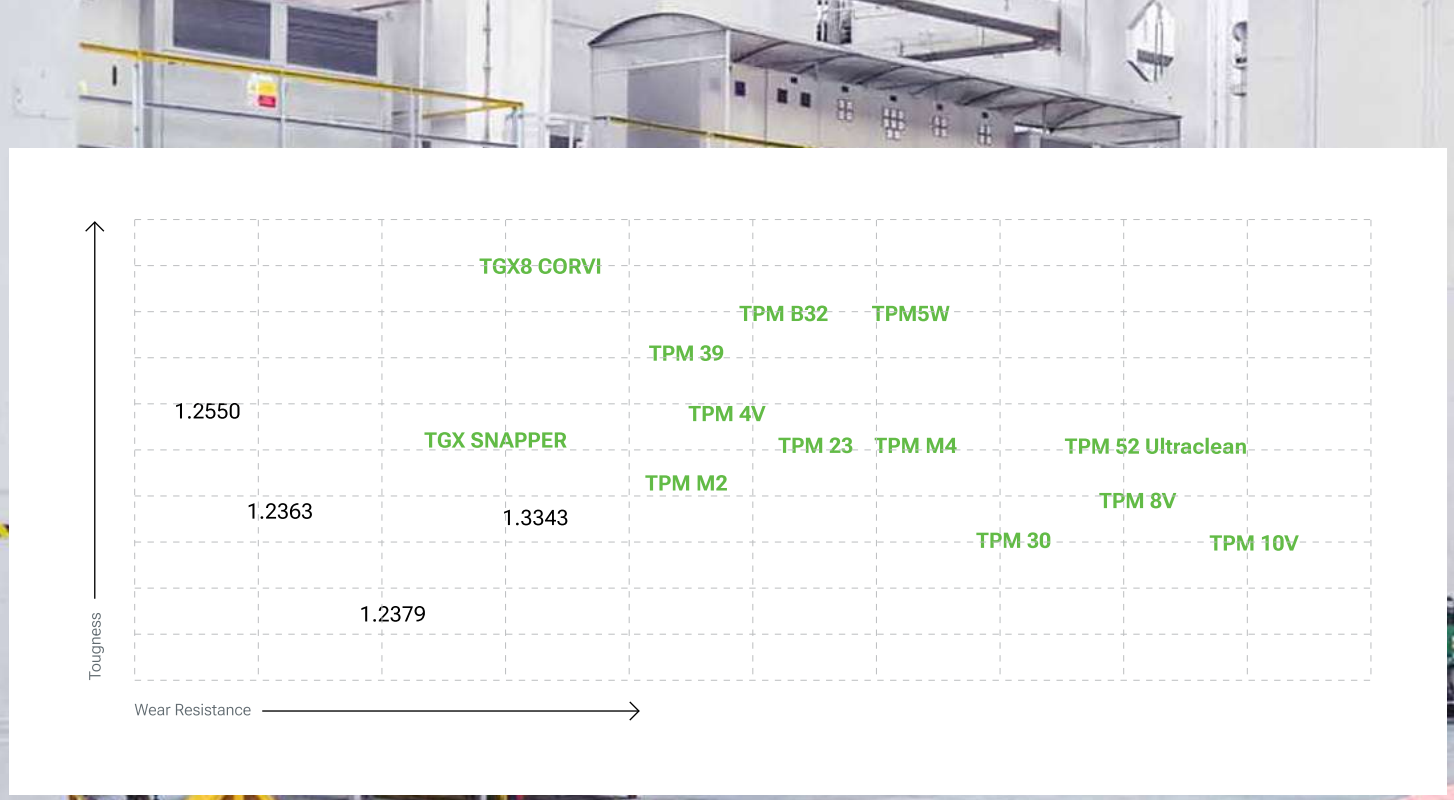
- Excellent wear resistance even at high temperatures
- Very good toughness
- Good compressive strength
- High hardenability

Chemical composition *(typical)*

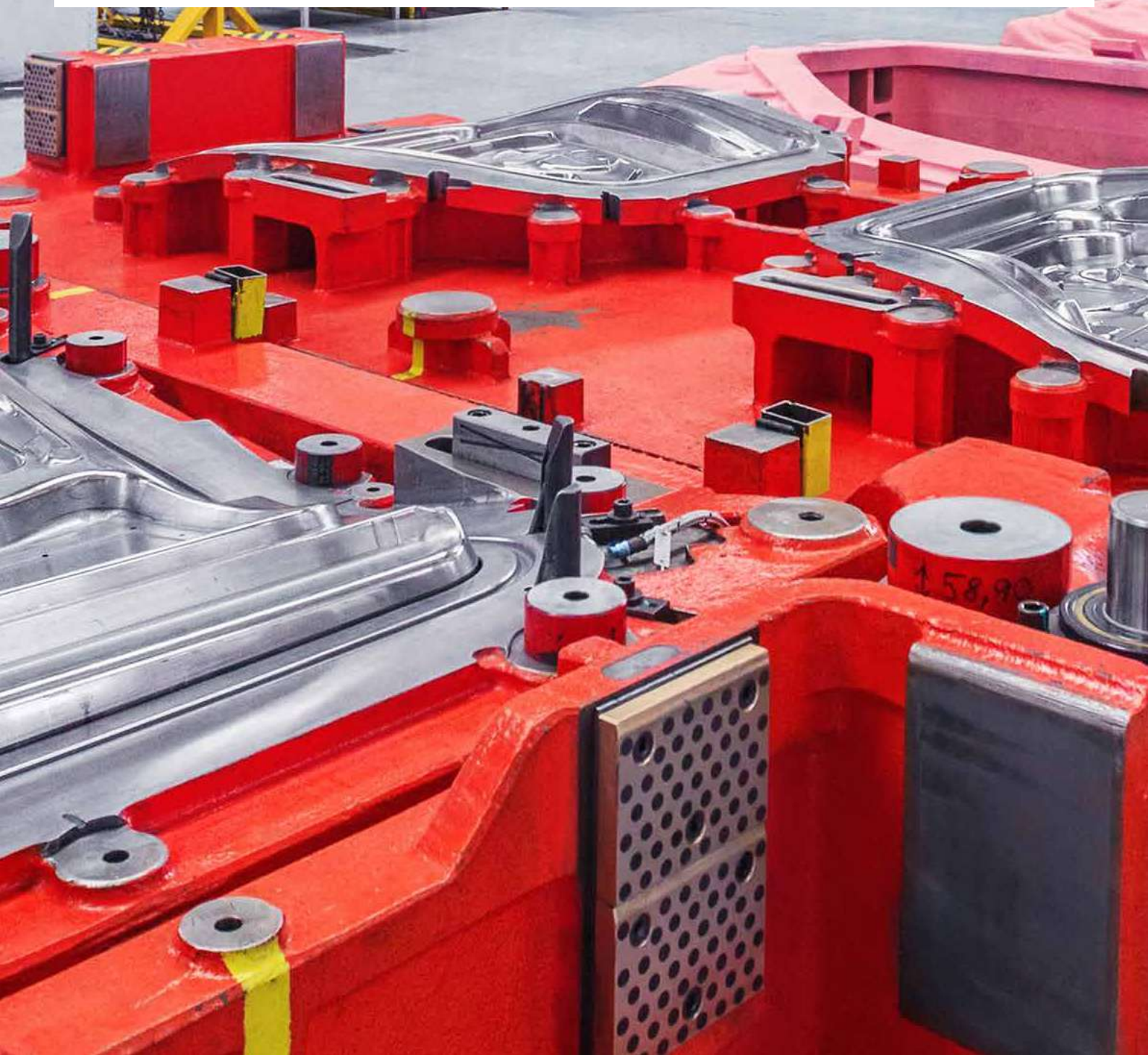
C	Mn	Si	P	S	Cr	Mo	V
0.47	0.50	0.80	χ 0.02	χ 0.003	7.55	1.50	1.40

Designation

Werkstoü Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1.2360	X48CrMoV8-1-1	-	-	-	-	-	-	-



TGX8 CORVI
TPM B32
TPM5W
TPM 39
1.2550
TPM 4V
TGX SNAPPER
TPM 23
TPM M4
TPM 52 Ultraclean
TPM M2
TPM 8V
1.2363
1.3343
TPM 30
TPM 10V
1.2379
Tougness
Wear Resistance



Structure

Because of the moderate carbon content and the medium chromium content the structure of the 2360 PRIME is óne and homogeneous without precipitation or alignments of carbides.

Hardness at the time of delivery

Annealed for 250 HB max.

Physical properties

Temperature	20°C	200°C	400°C
Volumic mass kg/m³	7800	7750	7700
Young Modulus N/mm²	210000	200 000	188000
Thermal conductivity W/m.K	26	24	27
Coeώcient of linear expansion 10^{-6}/K	11.5	11.9	12.5

Heat treatment

SOFT ANNEALING

820 - 850°C, duration 1h + 1h for 25 mm thickness. Slow cooling in the furnace *(10 to 20°C/h)*. The atmosphere in the furnace must be reducing to avoid decarburization of the steel.

STRESS RELIEVING

After machining, it is recommended to perform stress relieving at 650°C for a minimum of 2 hours, followed by slow cooling in the furnace to 450°C.

AUSTENITIZATION

In order to avoid any risk of cracking it is recommended to preheat in 2 steps.

- 1st preheating step:
  temperature: 600°C time: 30 s/mm of thickness
- 2nd preheating step:
  temperature: 850°C time: 30 s/mm of thickness

Recommended austenitizing temperature: 1030 - 1090°C. The holding time should not be too long to avoid a risk of grain coarsening and a loss of toughness. It is recommended to keep the part at the austenitizing temperature 30 minutes per inch of thickness as soon as the temperature of the surface reach the austenitization temperature.

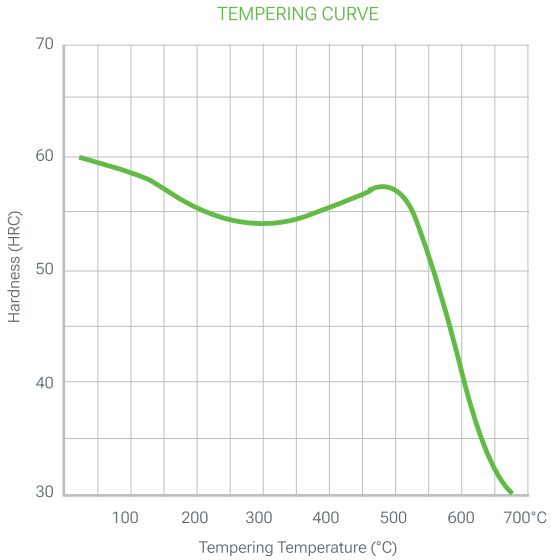
SUB ZERO TREATMENT

For parts that need to have high dimensional stability and to increase wear resistance without reducing toughness, it is recommended to perform a subzero treatment at a temperature between -70°C and -190°C for 1 hour for 25 mm of thickness of the part. The temperature range from -70°C up to -120°C *(named cold treatment of steel)* leads to the complete transformation of austenite into martensite and as a consequence to better stability associated with improved hardness and better wear resistance and the temperature range from -135°C down to -190°C *(named cryotreatment of steel)* leads also to the complete transformation of austenite and also the precipitation of ultraóne carbides improving a lot the wear resistance without modiócation of the toughness.

This treatment is optional for common applications.

QUENCHING MEDIUM

Oil at 80°C, vacuum *(pressure > 6 bars)*, salt bath 500 - 550°C.
To ensure good toughness, treatment with oil or salt bath is preferable.
The hardness after quenching is 54 to 56 HRC.



TEMPERING

To ensure a minimum residual austenite rate as well as greater tool stability, it is essential to perform a double tempering. Each tempering is followed by a cooling under 100°C.

Each tempering time must be at least equal to 1h + 1h for 25 mm of thickness of the treated part *(equivalent thermal thickness)*.

Surface treatment

NITRIDING

2360 PRIME is not recommended to be nitrided since the nitriding temperature of the 2360 PRIME is quite low.

PVD, CVD

2360 PRIME is suitable for all kind of PVD and CVD treatment as soon as the treatment temperature is 30°C lower than the last tempering temperature.

Machining

The machining parameters below are given for information only and must be adapted according to the equipment and usual machining conditions.

TURNING

	Carbide tool		HSS tool
	Rough machining	Finishing	Finishing
Cutting speed m/min	130 - 170	170 - 220	17 - 22
Feed mm/r	0.15 - 0.3	0.1 - 0.15	0.1 - 0.3
Depth of cut mm	2 - 3	0.5 - 1.5	0.5 - 2

MILLING: SURFACING

	Milling with carbide tools		Solid tool
	Rough machining	½ Finishing	Finishing
Cutting speed m/min	160 - 180	180 - 200	210 - 280
Feed mm/r	0.40	0.4 - 0.35	0.10 - 0.05
Depth of cut mm	1 - 2.5	1 - 1.5	1 - 0.5

DRILLING: HSS TWIST DRILL

Drill diameter mm	Cutting speed m/min	Feed mm/t
< 5	13 - 15	0.05 - 0.15
5 - 10	13 - 15	0.15 - 0.20
10 - 15	13 - 15	0.20 - 0.25
15 - 20	13 - 15	0.25 - 0.30

DRILLING: CARBIDE DRILL

	Carbide type		
	Indexable insert	Solid carbide	Carbide tip
Cutting speed m/min	160 - 180	100 - 130	55 - 80
Feed mm/t	0.05 - 0.10	0.10 - 0.25	0.15 - 0.25

FINE GRINDING

General indications for grinding wheels to be used on 2360 PRIME in the heat treated condition Usually, rather soft vitrióed aluminum oxide grinding wheels *(grades G for plane grinding to K for cylindrical grinding)* are used.

Particular attention will be paid to eüective cooling of the surface during grinding to prevent degradation of the material surface.

ELECTRO-DISCHARGE MACHINING

2360 PRIME is also suitable for EDM machining *(wire or electrode)*. Preferably, the machining will be carried out with a low current density and a high frequency in order to limit the thickness of the white layer as much as possible.

Then it is necessary to carry out a stress relieving at 25°C below the last tempering in order to reduce the level of residual stresses *(which could lead to a risk of cracking)* and to carry out a polishing to completely remove the white layer formed during the discharge machining process.

Welding

It is not recommended to weld 2360 PRIME but if this is mandatory it could be welded in the heat treated condition.

- Method: TIG
- Filler wire: UTP67 *(56HRC)* or UTP69 *(62 HRC)*
- Preheating: 250°C.

Hold at 200°C during the welding operation with a maximum interpass temperature at 350°C.
Slow cooling *(max 20°C/h)* after welding.

- Post weld treatment: tempering at 20°C below the last tempering temperature with a tempering time at least equal to 1h + 1h for 25 mm of thickness of the treated part *(equivalent thermal thickness)*.

OUR PRESENCE

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