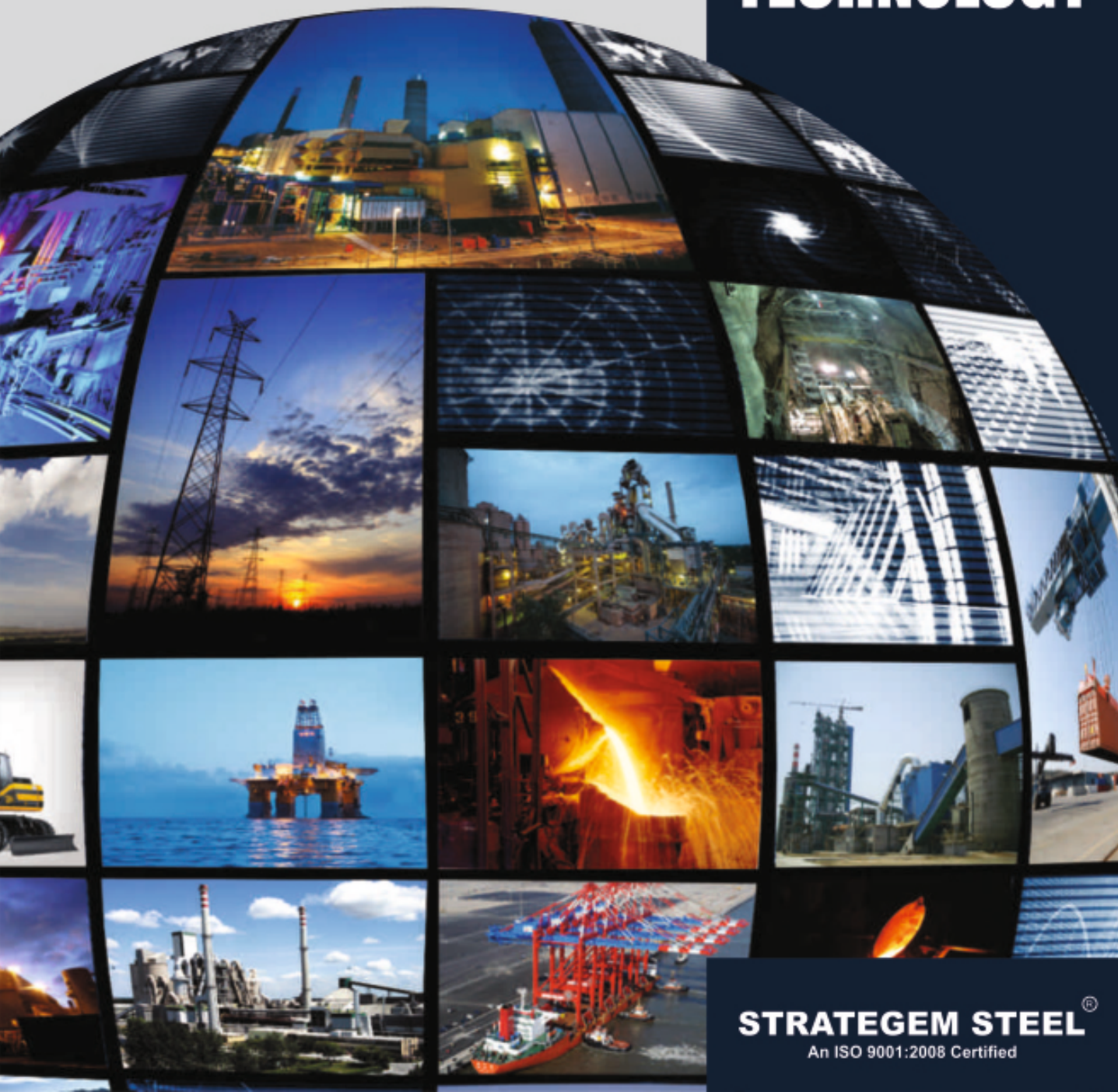
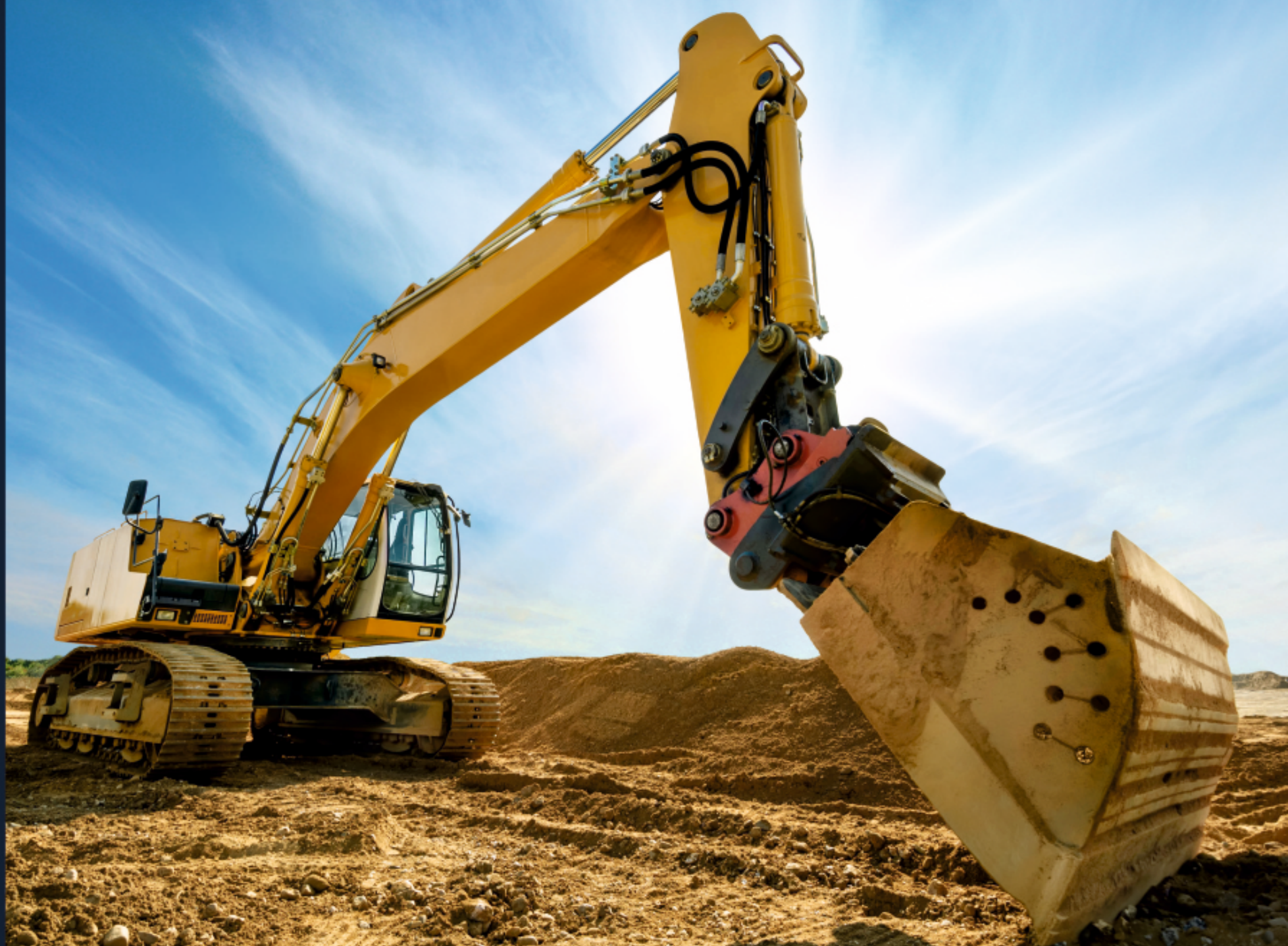
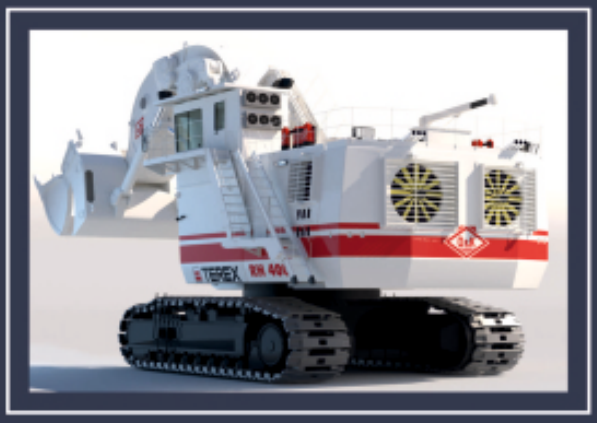
EMPOWERING FUTURE WITH TECHNOLOGY



STRATEGEM STEEL®

An ISO 9001:2008 Certified





Abrasion Resistant steel
Strategem 400

STRATEGEM STEEL®

ABRASION RESISTANT STEEL

INTRODUCTION OF STRATEGEM STEEL RESISTANT

STRATEGEM wear Resistant steel plate is typically made in the as-rolled condition These types of steel plate products have been developed specifically for long service life in harsh conditions. Strategem products are suitable for a variety of applications in areas such as mining/quarrying, conveyors, material handling and construction, and earthmoving. The benefits of employing wear-resistant plate steel in applications involving impact and/or sliding contact with abrasive material are immense.
Strategem steel plates are suitable for applications that require a good level of abrasion resistance such construction equipment, and wear plates used in a variety of industries like mining, forestry and construction. This product will last up to four times longer than ordinary high-strength structural plate.

1 Steel description and applications

Strategem 400 is a martensitic abrasion resistant steel with an average hardness of 400 HBW. Due to its versatility in terms of high toughness, good cold formability and excellent weldability, Strategem 400 combines an outstanding work shop performance and a long lasting wear resistance.

Strategem 400 is recommended for the following applications :

- mining and earthmoving machinery
- crushing and pulverizing equipmt
- buckets, knives, crushers, feedeners
- presses
- skips
- excavators
- slurry pipe systems
- screw conveyors

2 Technical characteristics

Hardness guarantee

Hardness
HBW = 370 - 430

Brinell hardness test, HBW according to EN ISO 6506-1, is performed 1 - 2 mm below the plate surface once per heat and 40 tonnes.

Other mechanical properties (typical values)

Charpy-V notch impact test	Yield Strength (MPa)	Tensile Strength - Transverse - (MPa)	Elongation A5 (%)
40J (longitudinal at -40 °C)	1250	1400	10

Chemical composition The steel is grain refined.

Max ladle analysis , %								
C	Si	Mn	P	S	Cr	Ni	Mo	B
0,17	0,60	1,60	0,025	0,010	1,15	0,10	0,30	0,005
0,17	0,60	1,60	0,025	0,010	1,30	0,50	0,50	0,005

Carbon equivalent, typical values, %		
Plate thickness	CEV[1]	CET[2]
35 - 40 mm	0,57	0,33
40 - 50 mm	0,64	0,36

3 Dimensions

Strategem 400 at present is supplied in the following range: thickness: 4 - 50 mm (⅛" – 1½")
width: 1500 - 3100 mm (60" – 122")

Strategem Carries on the extensions of its dimensions program in order to propose as soon as possible a thickness range from 3 to 60 mm. For more information, please check our website or contact your local representative.

4 Flatness, tolerances & surface properties.

Strategem 400 is delivered with a unique combination of excellent flatness, tight thickness tolerances and superior surface finish.

Feature	Norm	
FLATNESS	· EN 10029: . Class N (standard) & . Class S	PLUS
THICKNESS tolerance	· meets and exceeds EN 10029 Class A · tighter tolerances upon request	PLUS
Shape, length, width tolerances	meets EN 10029	
	exceeds the usual market standards, EN 10163-2 Class B3	PLUS

5 Delivery conditions

Our Strategem plates are supplied as standard in the shot blasted and primed condition. In order to maintain a good weldabi- lity and laser cutting performance, a low zinc silicate primer is applied. Plates can also be delivered unpainted

6 Heat treatment

Strategem 400 receives its properties by quenching and when applicable by subsequent tempering. The properties of the delivery condition cannot be retained after exposure at service or preheating temperatures above 250 °C. Strategem 400 is not intended for any further heat treatment.

7 Ultrasonic testing

Ultrasonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks and porosity. In thickness from 8 mm and up, all plates are UT tested and controlled against class S2, E2, according to EN 10160

8 General processing recommendations

To obtain optimal work shop productivity when processing Strategem 400, it is essential to use the recommended proce-dures and tools given below.

Thermal cutting

Plasma and flame cutting can be performed without the need for preheating in thicknesses up to 40 mm, provided the ambient temperature is above 0 °C.

Subsequent to cutting, let the cut parts slowly cool down to room temperature. A slow cooling rate will reduce the risk of cut edge cracking (never accelerate the cooling of the parts).

Cold forming

Strategem 400 is very well suited for cold forming operations. The minimum recommended R/t ratio when bending of Strategem 400 is given in the table below:

Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
	2.5	3.0	8	10
8 ≤ t < 20	3.0	4.0	10	
t ≥ 20.0	4.5	5.0	12	12

R = Recommended punch radius (mm), t = Plate thickness (mm) , W = Die opening width (mm) (bending angle ≤ 90°)

Due to the homogeneous properties and narrow thickness tolerances of Strategem 400, variations in spring back is kept at a low level. Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

Welding

Strategem 400 has a very good weldability, granted by the low carbon equivalent of the steel. It can be welded using any of the conventional welding methods, both as manual or automatic.

Welding of Strategem 400 is recommended to be performed at ambient temperature not lower than +5°C. Subsequent to welding, let the welded parts slowly cool down to room temperature (never accelerate the cooling process of the weld).

If welding using a heat input of 1.7 kJ/mm, preheating is not required in single plate thickness up to 20 mm. The interpass temperature used should not exceed 225 °C.

Soft weld consumables, giving low hydrogen weld deposits (<= 5 ml/100g), are recommended. The consumable strengthshould be as soft as the design and wear mode allows. In general, the welding recommendation of Strategem 400 shouldbe in the accordance to EN-1011.

Machining

Strategem 400 offers good machinability with HSS and HSS-Co alloyed drills. The feed rate and cutting speed have to be adjusted to the high hardness of the material. Face milling, counter boring and countersinking are best performed using tools with replaceable cemented carbide inserts.

Abrasion Resistant steel
Strategem 450

STRATEGEM STEEL®

ABRASION RESISTANT STEEL

1 Steel description and applications

Strategem 450 is a martensitic abrasion resistant steels, with an average hardness of 450 HBW. The steel offers very highresistance to abrasive wear and impact granting a longer service life. The combination of very good cold forming properties and excellent weldability makes Strategem 450 an optimal choice for most wear applications.

Strategem 450 is mainly recommended for the following applications:

- on road tipper and dumper bodies
- cement drum mixer barrels,
- refuse haulers, scrap containers
- buckets, knives
- feeders, skips, screw conveyors
- mining and earthmoving machinery

2 Technical characteristics

Hardness guarantee

Hardness
HBW = 420 - 480

Brinellhardnesstest, HBWaccordingtoENISO6506-1, is performed 1 - 2 mm below the plate surface once per heat and 40 tonnes.

Other mechanical properties (typical values)

Charpy-V notch impact test	Yield Strength (MPa)	Tensile Strength - Transverse - (MPa)	Elongation A5 (%)
35 J (longitudinal at -40°C)	1250	1400	10

Chemical composition The steel is grain refined.

Max ladle analysis , %								
C	Si	Mn	P	S	Cr	Ni	Mo	B
0,17	0,60	1,60	0,025	0,010	1,15	0,10	0,30	0,005
0,17	0,60	1,60	0,025	0,010	1,30	0,50	0,50	0,005

Carbon equivalent, typical values, %		
Plate thickness	CEV[1]	CET[2]
20 - 40 mm	0,56	0,37
40 - 64 mm	0,64	0,40

(1) CEV = C+Mn/6+ (Ni+Cu)/15+ (Cr+Mo+V)/5
(2) CET = C+(Mn+Mo)/10+Ni/40 +(Cr+Cu)/20

3 Dimensions

Strategem 450 at present is supplied in the following range:
thickness: 4 - 64 mm (⅛" – 1½")
width: 1500 - 3100 mm (60" – 122")

For more information, please check our website or contact your local representative.

4 Flatness, tolerances & surface properties.

Strategem 450 is delivered with a unique combination of excellent flatness, tight thickness tolerances and superior surface finish.

Feature	Norm
FLATNESS	- EN 10029: . Class N (standard) & . Class S PLUS
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request PLUS
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3 PLUS

5 Delivery conditions

Our Strategem plates are supplied as standard in the shot blasted and primed condition. In order to maintain a good weldabi- lity and laser cutting performance, a low zinc silicate primer is applied. Plates can also be delivered unpainted

6 Heat treatment

Strategem 450 receives its properties by quenching and when applicable by subsequent tempering. The properties of the delivery condition cannot be retained after exposure at service or preheating temperatures above 250 °C. Strategem 450 is not intended for any further heat treatment.

7 Ultrasonic testing

Ultrasonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks and porosity. In thickness from 8 mm and up, all plates are UT tested and controlled against class S2, E2, according to EN 10160

8 General processing recommendations

To obtain optimal work shop productivity when processing Strategem 450, it is essential to use the recommended proce-dures and tools given below.

Thermal cutting

Plasma and flame cutting can be performed without the need for preheating in thicknesses up to 40 mm, provided the ambient temperature is above 0 °C.

Subsequent to cutting, let the cut parts slowly cool down to room temperature. A slow cooling rate will reduce the risk of cut edge cracking (never accelerate the cooling of the parts).

Cold forming

Strategem 450 is very well suited for cold forming operations. The minimum recommended R/t ratio when bending of Strategem 450 is given in the table below:

Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
t < 8.0	3.5	4.0	10	10
8 ≤ t < 20	4.0	5.0	10	12
t ≥ 20.0	5.0	6.0	12	14

R = Recommended punch radius (mm), t = Plate thickness (mm) , W – Die opening width (mm) (bending angle ≤ 90°)

Due to the homogeneous properties and narrow thickness tolerances of Strategem 450, variations in spring back is kept at a low level. Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

Welding

Strategem 400 has a very good weldability, granted by the low carbon equivalent of the steel. It can be welded using any of the conventional welding methods, both as manual or automatic.

Welding of Strategem 450 is recommended to be performed at ambient temperature not lower than +5°C. Subsequent to welding, let the welded parts slowly cool down to room temperature (never accelerate the cooling process of the weld).

If welding using a heat input of 1.7 kJ/mm, preheating is not required in single plate thickness up to 20 mm. The interpass temperature used should not exceed 225 °C.

Soft weld consumables, giving low hydrogen weld deposits (<= 5 ml/100g), are recommended. The consumable strengthshould be as soft as the design and wear mode allows. In general, the welding recommendation of Strategem 450 shouldbe in the accordance to EN-1011.

Machining

Strategem 450 offers good machinability with HSS and HSS-Co alloyed drills. The feed rate and cutting speed have to be adjusted to the high hardness of the material. Face milling, counter boring and countersinking are best performed using tools with replaceable cemented carbide inserts.

Abrasion Resistant steel
Strategem 500

STRATEGEM STEEL®

ABRASION RESISTANT STEEL

1 Steel description and applications

Strategem 500 is a martensitic abrasion resistant steels, with an average hardness of 500 HBW. The steel offers very highresistance to abrasive wear and impact granting a longer service life. The combination of very good cold forming properties and excellent weldability makes Strategem 500 an optimal choice for most wear applications.

Strategem 500 is mainly recommended for the following applications:

- screeners
- crushing and pulverizing equipment
- conveyors belts
- grapples
- scrap presses

2 Technical characteristics

Hardness guarantee

Hardness
HBW = 470 - 530

Brinellhardnesstest, HBWaccordingtoENISO6506-1, is performed 1 - 2 mm below the plate surface once per heat and 40 tonnes.

Other mechanical properties (typical values)

Charpy-V notch impact test	Yield Strength (MPa)	Tensile Strength - Transverse - (MPa)	Elongation A5 (%)
30 J (longitudinal at -40°C)	1500	1700	8

Chemical composition The steel is grain refined.

Max ladle analysis , %								
C	Si	Mn	P	S	Cr	Ni	Mo	B
0,30	0,80	1,60	0,025	0,01	1,00	1,00	0,50	0,005

Carbon equivalent, typical values, %		
Plate thickness	CEV[1]	CET[2]
4 - 20 mm	0,57	0,40
20,01 - 40 mm	0,61	0,43

[1] CEV = C+Mn/6+ (Ni+Cu)/15+ (Cr+Mo+V)/5
[2] CET = C+(Mn+Mo)/10+Ni/40 +(Cr+Cu)/20

3 Dimensions

Strategem 500 at present is supplied in the following range: thickness: 4 - 40 mm (⅛" – 1½")
width: 1500 - 3100 mm (60" – 122")

For more information, please check our website or contact your local NLMK Clabecq representative.

4 Flatness, tolerances & surface properties.

Strategem 500 is delivered with a unique combination of excellent flatness, tight thickness tolerances and superior surface finish.

Feature	Norm
FLATNESS	· EN 10029: . Class N (standard) & . Class S **PLUS**
THICKNESS tolerance	· meets and exceeds EN 10029 Class A · tighter tolerances upon request **PLUS**
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3 **PLUS**

5 Delivery conditions

Our Strategem plates are supplied as standard in the shot blasted and primed condition. In order to maintain a good weldabi- lity and laser cutting performance, a low zinc silicate primer is applied. Plates can also be delivered unpainted

6 Heat treatment

Strategem 500 receives its properties by quenching and when applicable by subsequent tempering. The properties of the delivery condition cannot be retained after exposure at service or preheating temperatures above 250 °C. Strategem 500 is not intended for any further heat treatment.

7 Ultrasonic testing

Ultrasonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks and porosity. In thickness from 8 mm and up, all plates are UT tested and controlled against class S2, E2, according to EN 10160

8 General processing recommendations

To obtain optimal work shop productivity when processing Strategem 500, it is essential to use the recommended proce-dures and tools given below.

Thermal cutting

Plasma and flame cutting can be performed without the need for preheating in thicknesses up to 20 mm, provided the ambient temperature is above 0 °C.

Subsequent to cutting, let the cut parts slowly cool down to room temperature. A slow cooling rate will reduce the risk of cut edge cracking (never accelerate the cooling of the parts).

Cold forming

Strategem 500 is very well suited for cold forming operations. The minimum recommended R/t ratio when bending of Strategem 500 is given in the table below:

Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
t < 8.0	1.5	2.0	8	9
8 ≤ t < 20	2.0	3.0	8	9
t ≥ 20.0	3.0	4.0	9	10

R = Recommended punch radius (mm), t = Plate thickness (mm) , W – Die opening width (mm) (bending angle ≤ 90°)

Due to the homogeneous properties and narrow thickness tolerances of Strategem 500, variations in spring back is kept at a low level. Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

Welding

Strategem 500 has a very good weldability, granted by the low carbon equivalent of the steel. It can be welded using any of the conventional welding methods, both as manual or automatic.

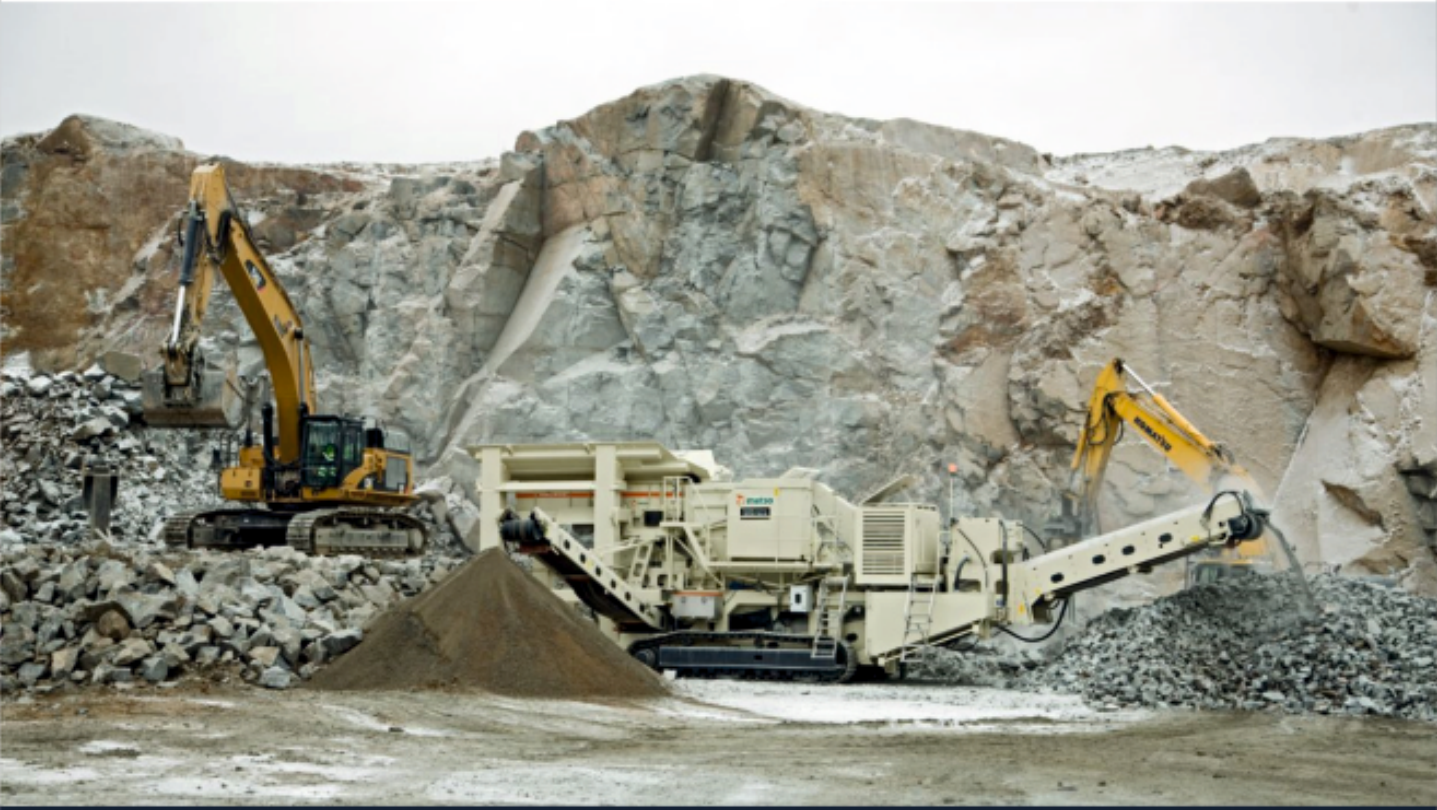
Welding of Strategem 500 is recommended to be performed at ambient temperature not lower than +5°C. Subsequent to welding, let the welded parts slowly cool down to room temperature (never accelerate the cooling process of the weld).

If welding using a heat input of 1.7 kJ/mm, preheating is not required in single plate thickness up to 20 mm. The interpass temperature used should not exceed 225 °C.

Soft weld consumables, giving low hydrogen weld deposits (<= 5 ml/100g), are recommended. The consumable strengthshould be as soft as the design and wear mode allows. In general, the welding recommendation of Strategem 500 shouldbe in the accordance to EN-1011.

Machining

Strategem 500 offers good machinability with HSS and HSS-Co alloyed drills. The feed rate and cutting speed have to be adjusted to the high hardness of the material. Face milling, counter boring and countersinking are best performed using tools with replaceable cemented carbide inserts.



Extra High Strength Structural Steel
Strategem 700

STRATEGEM STEEL®

ABRASION RESISTANT STEEL

1 Steel description and applications

Strategem 700 is extra high strength structural steel produced as quenched and tempered with a minimum yield strength of 700 MPa. Strategem 700 complies with the requirements corresponding to the S690QL given in the EN 10025-6 standard, where a minimum impact thoughness of 27 J is guaranteed at -40°C.

Strategem 700 is mainly recommended for the following applications:

- truck chassis
- lifting and hoisting equipment
- handling equipment
- trailers …

2 Technical characteristics

Tensile properties

TRANSVERSE TESTING		
Yield strength Rp 0.2	Tensile Strength Rm	Elongation A5
700 MPa min	780 - 930 MPa	14% min

Impact toughness

Minimum values at		
0 °C	-20 °C	-40 °C
35 J	30 J	27 J

Transverse testing according to EN 10025 option 30. Thickness < 12 mm subsized charpy V specimen have been used.

Testing according to EN 10025.

Chemical composition The steel is fine grain treated.

Max ladle analysis , %													
C	Si	Mn	P	S	Nb	Cr	V	Ti	Ni	Al	Mo	N	B
0,20	0,60	1,50	0,020	0,010	0,040	0,60	0,070	0,040	1,00	0,070	0,50	0,014	0,005

Carbon equivalent, typical values, %		
Plate thickness	CEV	CET
4 - 15 mm	0.45	0.29
15.01 - 25 mm	0.44	0.30
25.01 - 40 mm	0.45	0.30
40.01 - 64 mm	0.54	0.33

[1] CEV = C+Mn/6+ (Ni+Cu)/15+ (Cr+Mo+V)/5
[2] CET = C+(Mn+Mo)/10+Ni/40 +(Cr+Cu)/20

3 Dimensions

Strategem 700 is currently supplied in the following range:
thickness: 4 – 64 mm (⅛" – 2 ½")
width: 1500 - 3100 mm (60" – 122")

4 Flatness, tolerances & surface properties.

Strategem 700 is delivered with a unique combination of excellent flatness, tight thickness tolerances and superior surface finish.

Feature	Norm
FLATNESS	· EN 10029: . Class N (standard) & . Class S PLUS
THICKNESS tolerance	· meets and exceeds EN 10029 Class A · tighter tolerances upon request PLUS
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3 PLUS

5 Delivery conditions

Strategem 700 is delivered as quenched and tempered. Our Strategem plates are supplied as standard in the shotblasted and painted condition. In order to maintain a good weldability and laser cutting performance, a low zinc silicate primer is applied. Plates can also be delivered unpainted.

6 Heat treatment

The mechanical properties of Strategem 700 has been obtained by quenching and tempering. For not losing the guaranteed properties of Strategem 700, the plate should not be used in applications requiring hot working and service temperatures above 550 °C.

7 Ultrasonic testing

Ultrasonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks and porosity. In thickness from 8 mm and up, all plates are UT tested and controlled against class S2, E2, according to EN 10160

8 General processing recommendations

To obtain optimal work shop productivity when processing Strategem 700, it is essential to use the recommended proce-dures and tools given below.

Thermal cutting

Strategem 700 may be cut either by oxygen fuel, plasma and lase rcutting without any restrictions. Subsequent to cutting, let the cut parts slowly cool down to room temperature. Do never accelerate the cooling of the parts. A slow cooling rate will reduce the risk of cut edge cracking.

Cold forming

Strategem 700 is very well suited for cold forming operations. Strategem 700 complies with the S690QL bending requirements but offer even closer R/t ratios:

Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
t < 8.0	2.5	3.0	8	10
8 ≤ t < 20	3.0	4.0	10	10
t ≥ 20.0	4.5	5.0	12	12

R = Recommended punch radius (mm), t = Plate thickness (mm) , W = Die opening width (mm) (bending angle ≤ 90°)

Due to the homogeneous properties and narrow thickness tolerances of Strategem 700, variations in spring back is kept at a low level. Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

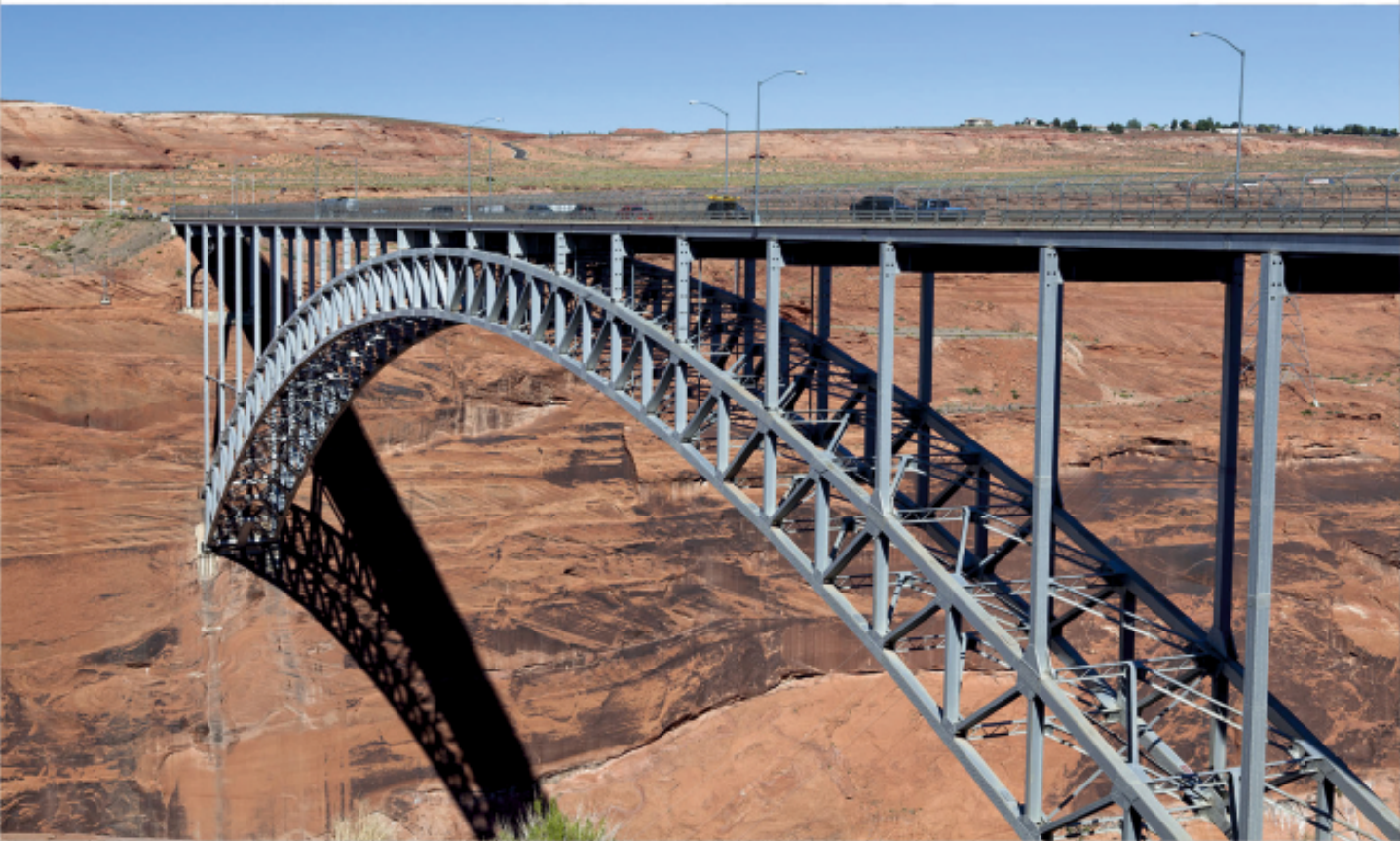
Welding

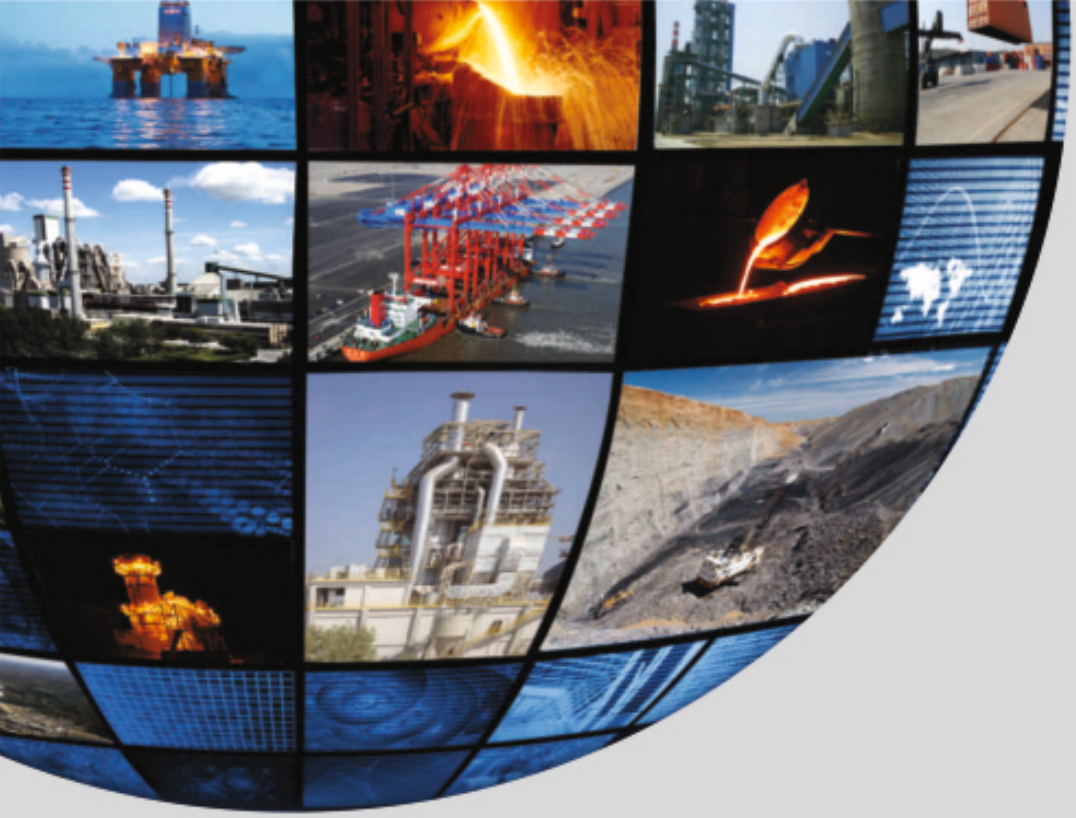
Welding of Strategem 700 can be performed using any of the conventional welding methods available both as manual or automatic

.In the thickness range up to 30mm, preheating prior to welding is normallynot needed, if a heat input of 1,7 kJ/mm is used. Welding of Strategem 700 is recommended to be performed ' at ambien temperature lower than + 5C. Subsequent to welding, let the welded parts slowly cool down to room temperature. Do never accelerate the cooling process of the weld. It is always recommended to use low hydrogen electrodes when welding Strategem 700.

Machining

Strategem 700 provides a very good machinability and can be drilled, counter sinked and milled in the same way as any other 700MPa or S690QL Q&T steel.





STRATEGEM STEEL®

STRATEGEM ENGINEERS INDIA PRIVATE LIMITED
5, Gulmohar Complex, Nr. Post Office, Wadagaon Sheri, Pune 411 014. (India)
Tel.: +91 20 27034860, 27030549 T elefax: +91 20 27030549
Email: info@strategemindia.com Website: www.strategemindia.com

Distributers & Channel Partners