

ABREX™

Abrasion resistant steel plate

NIPPON STEEL & SUMITOMO METAL

<http://www.nssmc.com/>

شرکت تجهیز صنعت هزاره (M.I.P)

تهران، خیابان شهید بهشتی، خیابان سرافراز

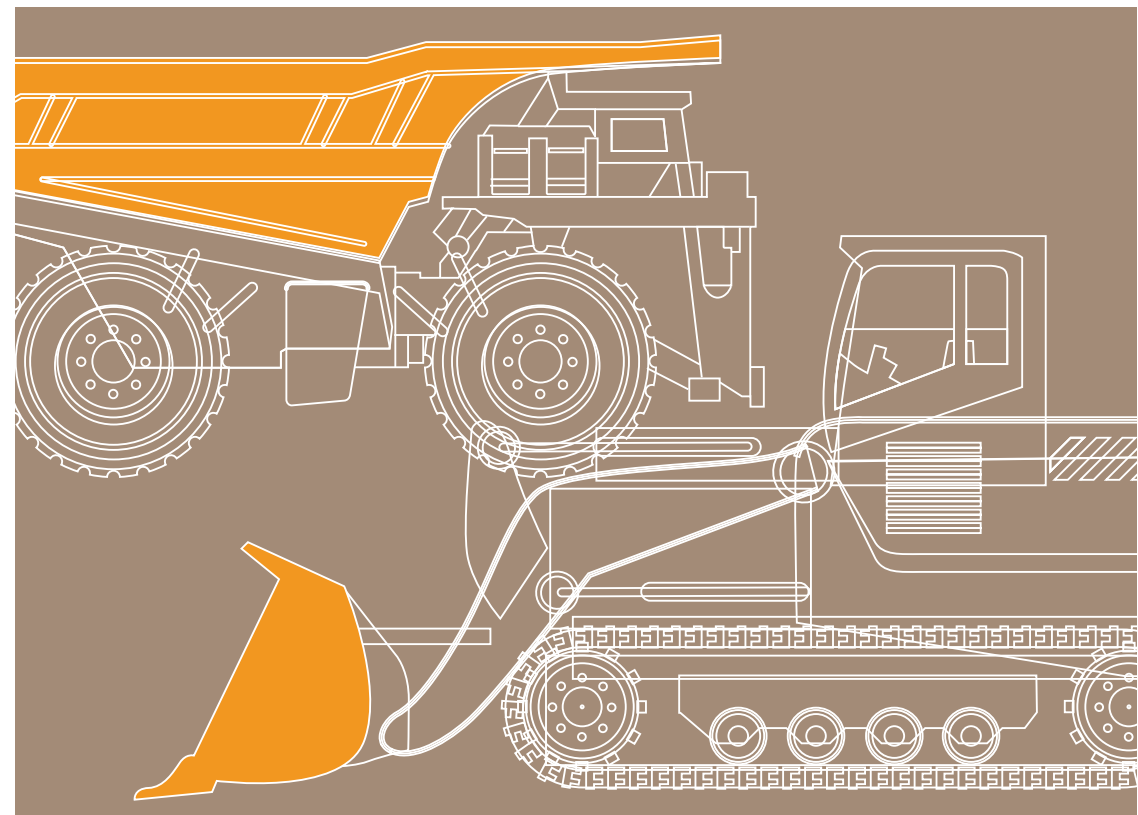
کوچه حق پرست، پلاک ۶، واحد ۱۰

تلفن: ۵۷ - ۵۶ ۱۴ ۵۴ ۸۸ (۰۲۱)

فکس: ۳۱ ۷۷ ۵۴ ۸۸ (۰۲۱)

پست الکترونیک: info@mip.ir

www.mip.ir www.mip-co.com



NIPPON STEEL &
SUMITOMO METAL

Nippon Steel & Sumitomo Metal Corporation
2-6-1 Marunouchi, Chiyoda-ku, Tokyo 100-8071 Japan
Tel: +81-3-6867-4111

ABREX™

A010en_01_201210f

© 2012 NIPPON STEEL & SUMITOMO METAL CORPORATION



**NIPPON STEEL &
SUMITOMO METAL**

هلدينگ (Nippon Steel & Sumitomo Metal Corporation (NSSMC) از ادغام دو فولادساز بزرگ و معتبر کشور ژاپن، Nippon Steel و Sumitomo Metal تشکیل شده است. این هلدينگ طیف گسترده ای از محصولات فولادی خاص را در کارخانه های فولاد خود در بیش از ۱۵ کشور جهان به همراه ۱۶ کارخانه در ژاپن و با تاکید بر سه حوزه کلیدی و استراتژیک خودرو، معادن و انرژی و همچنین ساخت و ساز و راه آهن تولید می کند. بخش تحقیق و توسعه این هلدينگ در سه مرکز عمده تحقیقاتی و شش آزمایشگاه در کارخانجات فولاد و همه در کشور ژاپن می باشد.

هلدينگ NSSMC با حدود ۸۳۰۰۰ نفر کارمند و تولید بالغ بر ۴۸ میلیون تن انواع فولاد، دومین تولید کننده بزرگ فولاد در جهان می باشد.

شرکت تجهیز صنعت هزاره (MIP) در بخش دیگری از فعالیتهای خود به عنوان نماینده بخش ورق های ضدسایش NSSMC ژاپن با برند تجاری ABREX اطلاعات کامل مربوط به این محصول را در صفحات پیش رو تقدیم می کند.

Foreword

The WEL-TEN AR Series and the WEL-HARD Series from the former Nippon Steel and the SUMIHARD Series from the former Sumitomo Metal are all widely used abrasion resistant steel plates which meet the needs for higher strength steel for applications in construction and other types of industrial machinery.

Here NSSMC is proud to introduce the new **ABREX*** Series, with 4 standard options of abrasion resistant steel plate in addition to 3 extra tough options.

We appreciate your support and look forward to receiving your orders for these products.

*ABREX stands for ABrasion Resistance EXcellent.



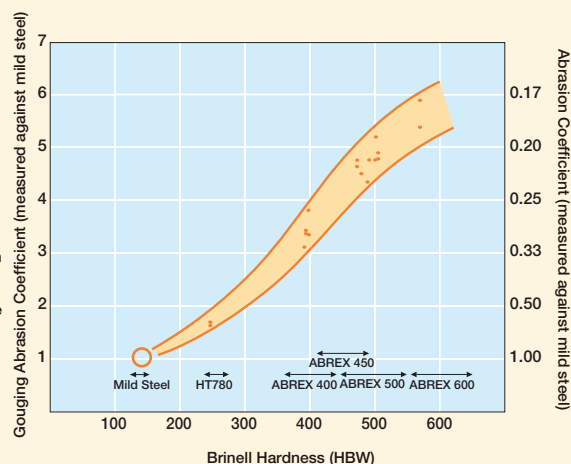
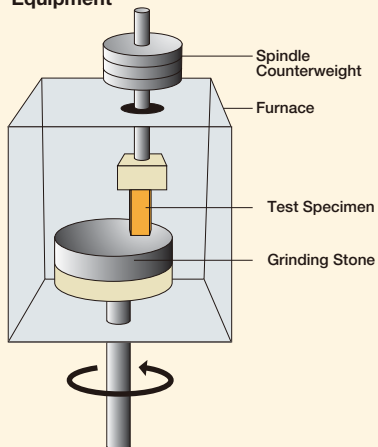
Abrasion Resistance

The loss in the mass of steel due to abrasion decreases as the surface hardness of steel increases. Accordingly, it is necessary for steel, for which abrasion resistance is required, to have higher surface hardness. NSSMC's abrasion resistant ABREX steel plate is designed by placing priority on resistance to abrasion caused by earth and sand. It offers excellent scratching abrasion resistance 2 to 5 times that specified for mild steel.

● Properties and Characteristics

Gouging Abrasion Test Results

Abrasion Test Equipment



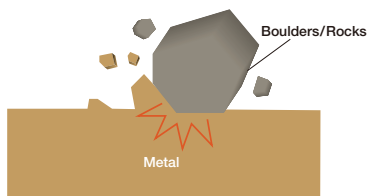
Test Conditions

The test specimen is pressed against the grinding stone and the grinding stone is rotated. The resulting abrasion is measured.

Rotating speed	: 30rpm
Test duration	: 20min
Load	: 29.4kg/cm ²
Ambient temperature	: 200°C
Grinding Stone	: Special grindstone for use at high temperatures

Gouging Abrasion

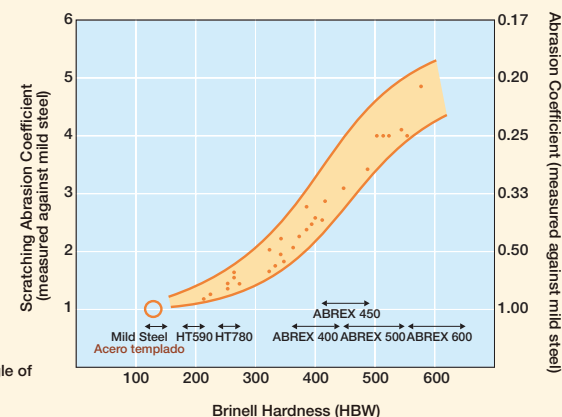
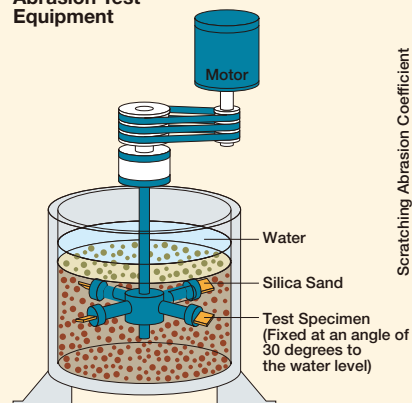
Boulders and rocks cause abrasion when they gouge and scrape a metallic surface. Due to repeated heavy loads and impacts, relatively large portions of the metallic surface can suffer damage, leading to the formation of grooves and dents. This can occur to shovels, etc. when tasked with excavating a rock face.



● Properties and Characteristics

Scratching Abrasion Test Results (Moisture Type Testing)

Abrasion Test Equipment



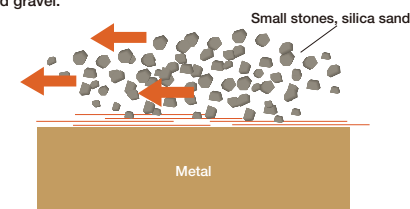
Test Conditions

Silica sand is suspended in water and the test specimen spun through this water. The resulting abrasion is measured.

Container	: 580mm in diameter
Sand	: The silica sand is in suspension in the water to a maximum level some 150mm above the test specimen.
Water	: Water is added until it reaches a level some 10mm above the level of the sand.
Test specimen	: 50mm x 50mm; 5mm thick
Rotating speed	: 3.7m/s

Scratching Abrasion

Comparatively small stones and silica sand caused abrasion when they come into contact with a metallic surface. As the load and force of impact is slight, any bumps and scrapes are relatively small. This can occur to the steel used in the load-bearing bay of a dump truck, etc. when filled with earth and gravel.



● Precautions for Use

The amount of abrasion will change depending on the usage environment.

Weldability

Abrasion resistant steel is extremely strong and as a result it has a high sensitivity to cracking at low temperatures. What this means in terms of welding is that it underlines the importance of selecting the most appropriate welding materials as well as managing the pre-heating process correctly. Moreover, the constraints on couplers as well as other weld criteria such as welding heat input and weld bead length, etc. in addition to weld time, environmental conditions and the management of weld materials all require special attention.

A Guide to Pre-Heating Temperatures

Steel Material		Plate Thickness (mm)					
		4.5~11	~20	~25	~36	~50	~100
ABREX 400	Normal Welding (Small Constraints)	RT	RT	50°C	50°C	75°C	125°C
	Repair Welding (Medium Constraints)	RT	RT	75°C	75°C	100°C	150°C
ABREX 450	Normal Welding (Small Constraints)	RT	RT	50°C	75°C	75°C	—
	Repair Welding (Medium Constraints)	RT	50°C	75°C	100°C	100°C	—
ABREX 500	Normal Welding (Small Constraints)	RT	50°C	75°C	100°C	125°C	—
	Repair Welding (Medium Constraints)	RT	100°C	100°C	150°C	150°C	—

RT: Room Temperature

In order to avoid low temperature cracking, the steel plate needs to undergo the required preheating. This can be approximated depending on various factors such as the carbon equivalent, the hydrogen content of the weld metal, the yield strength of the weld metal, the heat input and plate thickness to name but a few*1. The preheating temperatures shown in the table are calculations for temperatures used in gas-shield welding of soft joints, with a heat input of 1.7kJ/mm and assuming a weld metal hydrogen content dispersal of 3ml/100g*1.

However, appropriate preheating temperatures are also affected by external factors such as outdoor temperature, path numbers, groove form as well as the preheating method, etc. so please use these figures as a guide.

*1: pp347-357 No. 3 Volume 13, Collection of Papers from the Japan Welding Society (1995); N.Yurioka and T.Kasuya
Also: P163 Steel Materials and Welding, Welding Digest 10 (1999), Sanpo Publishing Inc.

Properties and Characteristics

CTS Cracking Test Results (JIS Z3154: Lap Joint Weld Cracking Test)

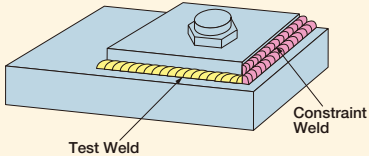
Designation	Plate Thickness (mm)	Cracking: Y/N	
		SMAW	GMAW
ABREX 400	25	○	○
ABREX 450	25	○	○
ABREX 500	25	○	○

○: No cracking

Test Method

Item	SMAW	GMAW
Temperature	Room Temperature	Room Temperature
Heat Input kJ/mm	1.73	0.85
Weld Material	LF52	SCH60
Hydrogen Content cc/100g	3.48	1.62

Test Specimen



Welding Materials

Recommended Welding Materials

General information

Due to their Chemical composition and low carbon equivalents, ABREX abrasion resistant plates are well-suited for welding. All tested fusion welding methods can be employed, but metal inert gas shielded arc welding has proved especially effective (low hydrogen input). For reasons of crack prevention, basic-coated electrodes with controlled hydrogen content should be used for manual electric arc welding. Prior to welding, the electrodes must be dried according to manufacturer instructions. The diffusible hydrogen content should be $HD \leq 5 \text{ ml/100 g WM}$.

Filler materials and welding conditions (preheating, welding parameters)

The selection of the fillers depends on the strength requirements made on the welded joint. The following filler materials have proved practically:

Recommended filler materials

Electrodes	Inert gas welding wire
E 7018-1 (e. g. Bohler FOX EV 50)	ER 80 S-G (e. g. Bohler DMO-IG)
for welded joints of higher strength	
E 10018-G (M) (e. g. Bohler FOX EV 75)	ER 110 S-G (e. g. Bohler X70-IG)

If the design requires that the welds have the same wear-resistance as the base material, the top layers can be welded with wear-resistant electrodes (e.g. UTP DUR 400 or UTP DUR 600) or equivalent inert gas welding wires.

Stainless steel welding consumables

Consumables of ausstenitic stainless steels can be used for the welding of all our products. They allow welding at room temperature without preheating. We recommend using of FOX A7, FOX A7-A or UTP 630.

With regard to welds involving ABREX 600, please use austenite type weld materials such as FOX A7, FOX A7-A or UTP 630.

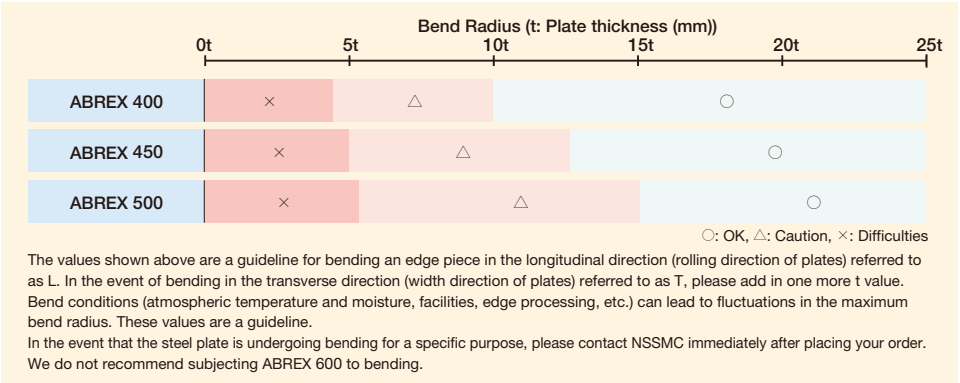
Precautions for Use

Take care when preheating – heating a steel plate over the recommended preheating temperature will cause the plate to lose its hardness. Please ensure that the steel plate is not heated over 200 degrees Celsius.

Bending Formability

Compared to regular steel, abrasion resistant steel has a lower elongation value and as a result, it is important to take steps to prevent fabrication cracks. Please consider the bend radius, quality of gas cut surface and the bend direction when undertaking fabrication.

Guidelines for Maximum Bend Radii



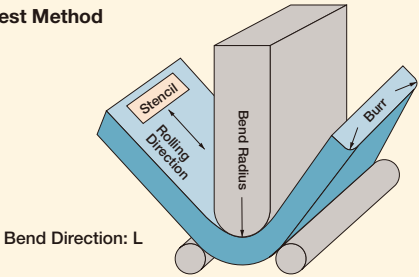
Properties and Characteristics

Wide Bend Test Results

Designation	Plate Thickness t (mm)	Test Specimen Width (mm)	Bend Direction	Bend Angle	Cracking: Y/N			
					1t	2t	3t	5t
ABREX 400	25	120	L	180°	×	×	○	○
ABREX 450	25	120	L	180°	×	×	○	○
ABREX 500	25	120	L	180°	×	×	△	○

○: No cracking, △: Some small, localized cracking, ×: Cracking

Test Method



Precautions for Use

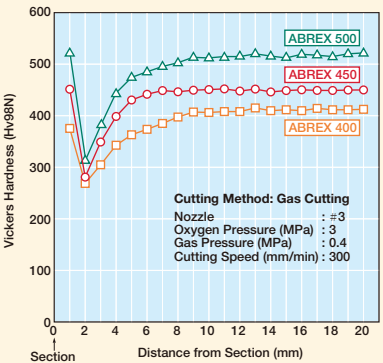
Because production of abrasion-resistant steel plate involves special heat treatment, the avoidance of hot working is recommended. Any notches or burrs on the sheared edge can lead to deterioration in the hardness of gas-cut sections, so it is recommended that any gas-cut sections be smoothed with a grinder, etc. In the event of bending abrasion-resistant steel to an extremely shallow bending radius, the corners should be beveled and care should be taken to ensure that the bend circumference be implemented in the L rolling direction. Please note that with abrasion-resistant steel plate, spring-back is greater than with conventional steel. In the event where the room temperature is less than 0 degrees Celsius, please avoid undertaking any bending procedures.

Thermal Cutting Performance

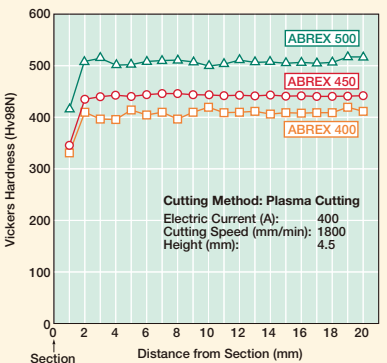
ABREX can be cut with gas, plasma and laser cutters, but the heat generated by these cutting techniques also affects the steel. Please select the best cutting solution to meet your needs once you have studied the affect of the cutting procedure and method.

Properties and Characteristics

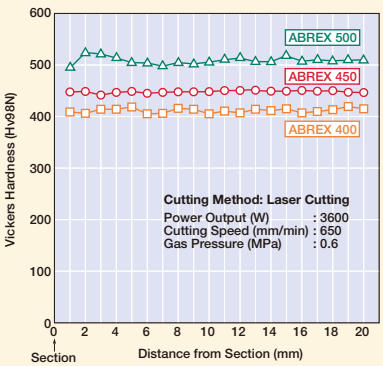
Hardness Distribution for Gas Cutting



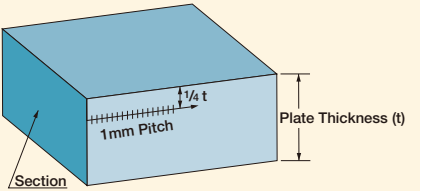
Hardness Distribution for Plasma Cutting



Hardness Distribution for Laser Cutting



Measuring Location



Thickness of Test Specimen

Designation	Thickness t (mm)
ABREX 400	25
ABREX 450	25
ABREX 500	25

Precautions for Use

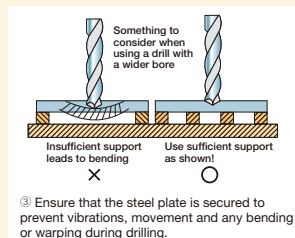
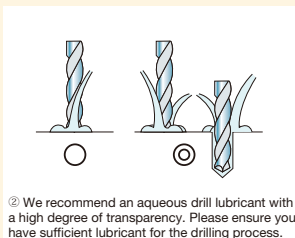
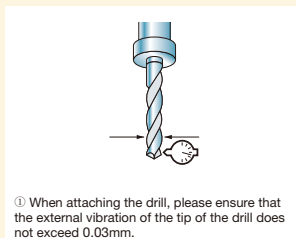
In the event that room temperature is 5 degree Celsius or below, some preheating will be required. Please avoid the use of cold water during cutting. Please take special care when cutting small pieces or thin widths, as the hardness of the steel can deteriorate. Notches that result after cutting should be smoothed away with a grinder. As ABREX 600 steel plate can crack easily, we recommend preheating to 50 degrees Celsius and then cutting with an acetylene gas cutter.

Drilling Workability



As ABREX steel plate is extremely hard and this can make it difficult to form and process, we recommend any drilling take place in a machining center using an ultra-hard metal alloy drill. However, for smaller jobs and working with components, it is often the case that boor-bank drilling machines and high-speed steel drills are used, so here we will introduce our recommended approach to drilling ABREX steel plate using a high-speed steel drill.

(1) Points to Note when Drilling



(2) Recommended Conditions for Drilling

These are the recommended conditions for using a radial boor bank drilling machine with ABREX steel plate.

Type of Steel	Type of Drill	Drilling Speed (m/min)	φ5		φ10		φ15		φ20		φ25		φ30	
			Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)	Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)	Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)	Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)	Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)	Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)
ABREX 500	Powder High Speed Steel	5	320	0.05	160	0.10	110	0.15	80	0.15	65	0.15	55	0.15
		8	510	0.10	250	0.20	170	0.30	130	0.30	100	0.30	85	0.30
ABREX 400	Powder High Speed Steel	6	380	0.05	190	0.10	130	0.15	95	0.15	75	0.15	65	0.15
		10	640	0.10	320	0.20	210	0.30	160	0.30	130	0.30	110	0.30
	Cobalt High Speed Steel	5	320	0.05	160	0.10	110	0.15	80	0.15	65	0.15	55	0.15
		8	510	0.10	250	0.20	170	0.30	130	0.30	100	0.30	85	0.30

- These values are a guide. Depending on how the steel plate is secured and the hardness of the machining tool, sometimes the appropriate settings will fall outside of this range, so before performing the actual drilling required, we recommend test drilling under the same conditions.
- We do not recommend using a Cobalt High Speed Steel for drilling ABREX 500 steel plate.
- Generally speaking, in terms of performance we recommend high settings for both the drilling speed (rotation speed) and the feed rate. However, this will have an impact on the working life of the drill. Conversely, if you wish to prioritize the working lifespan on the drill as well as the precision of the work, we recommend low settings for both the drilling speed (rotation speed) and the feed rate.
- During drilling, the turnings from the drilling process can sometimes become very long and yet still be attached to the steel plate. When this occurs, trimming these turnings will reduce the burden on the drill.
- These recommendations are made with the proviso that an aqueous drill lubricant is being used. We recommend a good quality aqueous drill lubricant used at less than 20x dilution.
- When using a non-aqueous drill lubricant or when an emulsion lubricant has been diluted over 20 times, please reduce the drilling speed by 20%.

(3) Examples of Drill Process Data (for reference purposes)

This table shows reference data for drilling using a radial boor bank drilling machine.

Type of Steel	Type of Drill	Drilling Depth (mm)	Machine Tool	Drill Lubricant	Drill Diameter (mm)	Drill Speed (min ⁻¹)	Rotation Speed (min ⁻¹)	Feed Rate (mm/rev)	Plated Through Hole	Length of Cut (mm)
ABREX 500	Powder High Speed Steel	25	Standing radial boor bank drilling machine	aqueous drill lubricant at 15x dilution	φ10	5.2	165	0.15	31	775
					φ20	4.7	75	0.25	53	1325
					φ30	4.7	50	0.25	20	500
ABREX 400	Powder High Speed Steel	25	Standing radial boor bank drilling machine	aqueous drill lubricant at 15x dilution	φ10	6.3	200	0.15	78	1950
					φ20	6.9	110	0.25	136	3400
					φ30	7.1	75	0.25	42	1050
	Cobalt High Speed Steel	25	Standing radial boor bank drilling machine	aqueous drill lubricant at 15x dilution	φ10	5.2	165	0.15	123	3075
					φ20	4.7	75	0.25	52	1300
					φ30	4.7	50	0.25	34	850

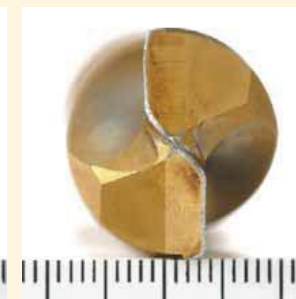
Close-up Photos of Drill Bits (All 3 have a diameter of 20mm)



ABREX 500 Powder High Speed Steel
4.7m/min 0.25mm/rev
Plated Through Hole: 53



ABREX 400 Powder High Speed Steel
4.7m/min 0.25mm/rev
Plated Through Hole: 136



ABREX 400 Cobalt High Speed Steel
4.7m/min 0.15mm/rev
Plated Through Hole: 52

Examples of the Product in Use



Bulldozer



Crusher



Dump Truck



Excavator

Primer

ABREX will be shipped with primer paint upon order.

Designation	Normal Color
ABREX 400, ABREX 400LT	Brown
ABREX 450, ABREX 450LT	Green
ABREX 500, ABREX 500LT	Gray
ABREX 600	Blue

Reference

NSSMC Specifications; Comparison with Former Specifications

Former NSC Product Name	Former Sumitomo Metals Product Name	New NSSMC Name
—	SUMIHARD-K340	—
WEL-HARD400 WEL-TEN AR360E	SUMIHARD-K400	ABREX 400
WEL-TEN AR400E	SUMIHARD-K450	ABREX 450
WEL-HARD500 WEL-TEN AR500E	SUMIHARD-K500	ABREX 500
—	—	ABREX 600
—	—	ABREX 400LT
—	—	ABREX 450LT
—	—	ABREX 500LT

* With regard to products that have been discontinued or where the product name no longer exists, NSSMC can continue to manufacture said products in line with any existing agreement and specifications.

* With regard to special specification products not included in the above table, please contact us about these specific products.

Hardness Conversion Table

Vickers Hardness	Brinell Hardness 10mm sphere; 29400N Load	Rockwell Hardness		Shore Hardness	Tensile Strength (N/mm ²) (approximate values)
	Tungsten Carbide Sphere	B Scale 980N Load Sphere 1/16in Diameter	C Scale 1470N Load Sphere 1/16in Diameter Brale Indenter		
600	564	—	55.2	74	—
590	554	—	54.7	—	2055
580	545	—	54.1	72	2020
570	535	—	53.6	—	1985
560	525	—	53.0	71	1950
550	517	—	52.3	—	1905
540	507	—	51.7	69	1860
530	497	—	51.1	—	1825
520	488	—	50.5	67	1795
510	479	—	49.8	—	1750
500	471	—	49.1	66	1705
490	460	—	48.4	—	1660
480	452	—	47.7	64	1620
470	442	—	46.9	—	1570
460	433	—	46.1	62	1530
450	425	—	45.3	—	1495
440	415	—	44.5	59	1460
430	405	—	43.6	—	1410
420	397	—	42.7	57	1370
410	388	—	41.8	—	1330
400	379	—	40.8	55	1290
390	369	—	39.8	—	1240
380	360	(110.0)	38.8	52	1205
370	350	—	37.7	—	1170
360	341	(109.0)	36.5	50	1130
350	331	—	35.5	—	1095
340	322	(108.0)	34.4	47	1070
330	312	—	33.3	—	1035
320	303	(107.0)	32.2	45	1005
310	294	—	31.0	—	980
300	284	(105.5)	29.8	42	950
290	275	(104.5)	28.5	41	915
280	266	(103.5)	27.1	40	890
270	256	(102.0)	25.6	38	855
260	248	(101.0)	24.0	37	825