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 This catalog is pro-bid as of May 200

SěAH css

Cold



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Maximum durability SeAH CSS's Cold Work Tool Steel



Durability

The DuMAC Series is an exclusive brand developed by SeAH CSS for the best performance in harsh working environments requiring much stronger materials and more complicated shapes. Designed with different chemical compositions according to its uses, the products have been produced with advanced techniques, providing superior quality.

SeAH CSS contributes to the development of cold working technology and the extension of mould lifespan through development and production of next-generation mould materials.

DuMAC Series Features

Excellent mechanical properties and wear resistance

Toughness, hardness, hardenability, and wear resistance of the DuMAC series have been highly improved.

Various product lineups tailored to your needs

A wide range of products are available from advanced-high strength steel for moulding to Matrix HSS type mould materials. Thus we provide the best choices for our customers.

Applications of the DuMAC Series Matrix HSS

① Cold presses, drawing moulds, warm forging dies	3 In
② High-performance thread rolling dies, forming rolls	@C



Cold Work Tool Steel

Superior cleanliness and equivalent internal quality

Stable quality, performance, and excellent product life.

South Korea's only special steel producer with the largest distribution network in country

Supplying the products clients want in various shapes and precise dimensions in a timely manner.

dustrial shears/slitter knives

Cold trimming moulds, TBM cutters, blanking moulds, etc.

DuMAC series is a cold work tool steel brand that excels in strengthening materials and producing complex shapes. The chemical compositions of the products have been optimized according to its different uses, thus provide superior quality. SeAH CSS is the leading manufacturer in the domestic tool steel market, and is always endeavoring to satisfy customer demands.

DuMAC Series Cold Work Tool Steel

Pro	ducts		Mechanical Property Comparisons		sons									Hordnooo		
SeAH CSS	KS /JIS	AISI /DIN	Wear Resistance	Tough- ness	Hard- ness	Machina- bility	Harden- ability	Major Characteristics	Usages	С	Si	Mn	Cr	Мо	V	(HRC)
DuMAC MAX ESR	8Cr	-	A++	S	A++	А	A+	Suitable for advanced high-strength steel moulds by enhancing heat treatment hardness and chipping suppression capability to the limit	Advanced high-strength steel specialized in trimming and fine blanking	0.90 1.10	0.90 1.20	0.30 0.60	7.70 8.50	Special e	element	60~63
DuMAC PRO	8Cr	_	A+	А	A+	A++	A+	Low deformation from heat treatment and improved machinability reduce production costs and increase product lifespan.	Cold forming of advanced high-strength steel	0.90 1.10	0.95 1.10	0.50 0.80	7.80 8.20	Special e	element	58~62
DuMAC 11	STD 11 SKD 11	D2 WNR 1.2379	B+	B+	B+	В	А	Cold work tool steel with stable wear resistance	General mould	1.40 1.60	0.40	0.60	11.0 13.0	0.80 1.20	0.20 0.50	57~63
DuMAC WF ESR [Specialized Grade]	Matrix HSS	-	В	S	B+	A+	B+	ESR applied materials Matrix HSS with high toughness	Cold/warm punching	0.61 0.67	1.30 1.80	0.40 0.50	4.30 4.90	Special e	element	58~61
DuMAC RD [Specialized Grade]	7Cr	-	A+	А	A++	В	A+	Steel grade specifically designed for high hardness and high toughness of 64 HRC	Thread rolling dies	0.90 1.10	0.80 1.10	0.30 0.60	6.80 7.50	Special e	element	60~64
DuMAC DK [Specialized Grade]	8Cr	-	B+	A++	A+	A	A+	A specifically designed chipping resistant steel grade with high toughness	Industrial knives	0.65 0.80	0.90 1.20	0.30 0.60	7.00 8.00	Special e	element	58~62

◆ RD: Rolling dies ◆ DK: Dies & knives ◆ WF: Warm forging

DuMAC Series Product Positioning





ESR applied material undergoes rapid coagulation and inclusion removal using slag. This process effectively lengthens mould lifespan by curbing segregations in high alloy steels.

SeAH CSS uses its superior production technology to keep P, S and other impurities at levels lower than required by SKD 11/STD 11 standards.

Heat Treatment



Preheating for guench hardening is performed in two stages: the first in the 500-600°C section, the second in the 750-800°C section. Salt bath heat treatment is recommended for high-speed tool steel.

It is essential to prevent material decarburization and oxidation during quenching.

Tempering





◆ For details on heat treatment conditions, refer to the standard heat treatment conditions for each steel grade.

Tempering conditions are for high temperature tempering.

Tempering is recommended at least twice, but three times for high-speed tool steel.

~35	36~64	65~84	85~124	125~174	175~249	250~349	350~499
.5	2	3	4	5	6	7	8

The best solution for advanced high-strength steel ESR

DuMAC MAX is a premium cold work tool steel grade specially developed to meet the needs for ultra-high strength mould materials. With ESR (electroslag remelting) and advanced manufacturing methods, chipping and cracking have been reduced while hardness and wear resistance greatly improved, increasing mould lifespan.

* Inclusions are removed from the substance used in the ESR process, while that substance undergoes rapid solidification using the slag to curb the forming of segregation in the high-alloy steel, thereby effectively increasing mould lifespan.



Applications

Optimized for cold working (trimming, cutting, and stamping) of advanced high-strength steel

Chemical Composition

• To ensure both high hardness and impact toughness, ESR is used in the manufacturing process.

Steel	Grade	Chemical Composition (wt%)						
SeAH CSS	KS	С	Si	Mn	Cr	Мо	V	Other
DuMAC MAX	STD 11 Modified	0.90 1.10	0.90 1.20	0.30 0.60	7.70 8.50	Special Element		

Microstructure Comparison

• Due to the ESR process, DuMAC MAX has a homogenous and finer distribution of eutectic carbide and provides superior mechanical properties than DuMAC 11.





DuMAC 11 (non-ESR)

Mechanical Properties

- Due to the ESR process and optimization of elements, it is possible to obtain higher hardness and improved fatique strength after high temperature tempering.
- By reducing chipping and cracking, mould lifespan and performance can be improved.



• DuMAC Max has longer mould lifespan than 8Cr ESR steel due to its increased toughness and wear resistance.



Cases of Increased Mould Lifespan



DuMAC MAX (ESR)

Physical Properties

Thermal Expansion	Specific Gravity	Thermal Conductivity	Young's Modulus
Coefficient (x 10 ⁻⁶ /℃)	(g/cm³)	(W/m·K)	(GPa)
11.8(25~200°C)	7.68	17.8	220

Heat Treatment Conditions

• The heat treatment conditions (1030~1050°C) suggested by SeAH CSS are essential to maximize product life.







DuMA PRO

A premium solution for giga steel moulding

DuMAC PRO is a cold work tool steel with improved impact toughness, hardness, and wear resistance. Not only that, it is being recognized as a high-quality, cost-effective product with its improved machinability and reduced heat deformation.



Application

For cold forming moulds using high-strength steel and other high-strength materials



Drawing Moulds

Chemical Composition

· Optimized composition of elements to improve productivity of mould production (improved machine processability and dimensional stability during heat treatment)

								1	
Steel	Grade			Chemic	al Compositio	n (wt%)			
SeAH CSS	KS	С	Si	Mn	Cr	Мо	V	Other	
DuMAC	STD 11	0.90	0.95	0.50	7.80	Special Element			
PRO	Modified	1.10	1.10	0.80	8.20	·	opecial Element		
Physical P	Properties								
Thermal Expansion Coefficient (x 10 ⁻⁶ /°C)		Sp	ecific Gravity (g/cm ³)	TI	nermal Conduc (W/m·K)	ctivity	Young's Modulus (GPa)		
12.2(25~200℃)		7.70			16.7				

Steel	Grade			Chemic	al Compositio	n (wt%)			
SeAH CSS	KS	С	Si	Mn	Cr	Мо	V	Other	
DuMAC	STD 11	0.90	0.95	0.50	7.80		Spacial Elamo	at	
PRO	Modified	1.10	1.10	0.80	8.20		Special Element		
Physical F	Properties								
Thermal Expansion Coefficient (x 10 ⁻⁶ /°c)		Specific Gravity (g/cm³)		TI	Thermal Conductivity (W/m⋅K)			Young's Modulus (GPa)	
12.2(25~200℃)			7.70		16.7			220	



Trimming Moulds

Mechanical Properties

• DuMAC PRO is an advanced, hot-tempered high strength steel moulding that has undergone CVD and PVD coating processes and nitriding.



· Improved wear resistance and fatigue strength extends mould lifespan. Especially effective for chipping and other causes of mould damage.





• Lower volume change rate during heat treatment compared to STD 11. This lowers total production costs by decreasing processing frequency.



200

300

Tempering Temperature (℃)

400

500

600



Heat Treatment Conditions

• QT heat treatment can be applied under the same conditions as STD 11 while incurring no additional cost.



Welding Conditions and Materials

Welding C	onditions	
Diameter (Ø)	Current (A)	
3.2	85~110	- Preheat: Up to 350℃ (maintain 25
4.0	120~160	 Maintain 350°C at mould center Preheat after welding: Increase p
5.0	150~200	(to prevent cracking during fast c

♦ Welding rod: SeAH ESAB's coated arc welding rod for cold work tool steel (SH 61) is recommended.

Lengthened Mould Lifespan Cases

• The products are being used for the moulds of domestic and international automobile-parts manufacturers, and have displayed longer lifespan than that of STD 11.

Туре	Applications Evaluation Results (vs. STD 11)	Evaluated Companies (Mould)	Hardness / Heat Treatment (Coating)
Drawing Mould (Center Pillar)	▲ 35% Up	S***** DP 980: 1.6t	58~61 HRC High temperature tempering+PVD
Drawing Mould (Center Pillar)	▲ 65% Up	K***** HR580: 3.8t	58~61 HRC High temperature tempering+TD
Drawing Mould (Door Hinge)	▲ 12% Up	C***** HR340LA: 4.0t	58~61 HRC High temperature tempering+PVD
Trimming Mould (Side Sill)	▲ 75% Up	S***** CP1180: 1.2t	58~60 HRC Low temperature tempering

-0.10%

-0.20%

0

100

Welding Methods

50°C mould temperature during welding)

preheating temperature by 50°C and cool off slowly cooling)

DuMAC 11

An all-in-one solution with comparative advantage

SeAH CSS's DuMAC 11 introduces a new set of standards in cold work tool steel. With SeAh CSS's empirical data and technology, DuMAC 11 is an all-purpose product that show an even better performance than the standard steel grade, STD 11. Wear resistance has been improved by adding C-Cr and damage rate has been reduced by improving impact toughness. These improvements have satisfied our customers and enabled us to become a leader in the domestic market.



Usage

Cold press moulds, forming rolls, industrial shears/slitter knives, cold trimming moulds, TBM cutters, blanking moulds





Shear knives

Plates for press dies

Chemical Composition

Steel Grade				Chemic	al Compositic	on (wt%)		
SeAH CSS	KS/JIS	С	Si	Mn	Cr	Мо	V	Other
DuMAC 11	STD 11 SKD 11	1.40 1.60	0.40	0.60	11.0 13.0	0.80 1.20	0.20 0.50	-

Physical Properties

Thermal Expansion	Specific Gravity	Thermal Conductivity	Young's Modulus
Coefficient (x 10 ⁻⁶ /℃)	(g/cm ³)	(W/m⋅K)	(GPa)
11.2(25~200°C)	7.73	20.6	225

Microstructure

· Improved machinability and wear resistance through uniform spheroidization / eutectic carbide distribution

Spheroidizing Annealing





Heat Treatment Conditions



Mechanical Properties

- Hardness of 63 ~ 64 HRC can be secured with low temperature tempering while 58 ~ 60 HRC can be secured with high temperature tempering.
- Minimal dimensional changes after QT heat treatment through improved anisotropy*. (*The property of substances to exhibit variations in physical properties along different directions)



- Material wear: Greater wear resistance than low-alloy tool steel (SKS3)
- Impact toughness: High impact toughness under the same hardness conditions when compared to cold work tool steel STD 11.







DuMACWF Specialized Grade

The best choice for cold and warm forging **ESR**

DuMAC WF is a newly developed special-purpose cold tool steel from SeAH CSS, designed for unparalleled performance in both cold and warm forging. With optimized chemical compositions, DuMAC WF has high wear resistance and toughness, characteristics of both the cold work tool steel and hot work tool steel. Furthermore, it ensures material cleanliness and homogeneous performance through ESR process.

* Inclusions are removed from the substance used in the ESR process, while that substance undergoes rapid solidification using the slag to curb the forming of segregation in the high-alloy steel, thereby effectively increasing mould lifespan.



Usage

Recommended for cold and warm punching moulds that require high toughness and stable wear resistance

Chemical Composition

Steel	Grade		Chemical Composition (wt%)					
SeAH CSS	KS	С	Si	Mn	Cr	Мо	V	Other
DuMAC	Matrix	0.61	1.30	0.40	4.30	Special Element		
WF	HSS	0.67	1.80	0.50	4.90			

Mechanical Properties

· Higher hardness compared to STD 11





Similar wear resistance as high-speed tool steel

Material Wear (Wear Resistance)



 Maintaining high hardness even exposed in long term in high temperatures

Softening Resistance (600°C)



Superior impact toughness compared to STD 11



DuMAC WF

STD 11

DUMAC RD Specialized Grade

A byword for cold work tool steel for rolling dies

DuMAC RD is a special purpose cold work tool steel developed for diverse usage and environments especially for rolling dies. This product maintains excellent hardness at 64 HRC after QT heat treatment by finely dispersing eutectic carbide (M7C3), rendering greater predictability to mould lifespan.



Usage

Suitable for roll dies that require high hardness

Chemical Composition

Optimal composition of alloy elements to improve mould lifespan

Steel Grade		Chemical Composition (wt%)						
SeAH CSS	KS	С	Si	Mn	Cr	Мо	V	Other
DuMAC	STD 11	0.90	0.80	0.30	6.80	Special Element		at
RD	Modified	1.10	1.10	0.60	7.50	Special Element		

Mechanical Properties

- Higher hardness after heat treatment than STD 11 (64 HRC)
- · Residual austenite decomposition during heat treatment shows similar properties as STD 11.

Heat Treatment Hardness











DUMAC DK Specialized Grade

The best solution for industrial knives

DuMAC DK is a special-purpose cold work tool steel developed by SeAH CSS for dies and industrial knives, where impact toughness is especially important. C-Cr composition is lower, Mo and special alloys have been added, and eutectic carbides are refined to provide unrivaled toughness even at high hardness to reduce damage to the cutting area.



Application

Suitable for slitter knives, cold presses, and blanking mould applications which require cold working of high-strength materials





Slitter Knife

Press Mould Plate

Chemical Composition

Steel Grade		Chemical Composition (wt%)							
SeAH CSS	KS	С	Si	Mn	Cr	Мо	V	Other	
DuMAC	STD 11	0.65	0.90	0.30	7.00		Special Element		
DK	Modified	0.80	1.20	0.60	8.00		Special Liement		

Physical Properties

Thermal Expansion	Specific Gravity	Thermal Conductivity	Young's Modulus
Coefficient (x 10⁻⁰/℃)	(g/cm³)	(W/m⋅K)	(GPa)
12.2(25~200℃)	7.75	17.7	220

Heat Treatment Conditions

• QT heat treatment can be applied under the same conditions as STD 11 while incurring no additional cost.





Mechanical Properties

- Better than STD 11 in moulding high strength materials due to greater hardness in high temperature tempering.
- Creation of chippings can be minimized by refining eutectic carbides which secures high impact toughness even in high hardness levels.





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