

# DHA-WORLD

## High hardenability and high tough General use Hot Work Die Steel

### Features

- Improved H13 applicable for a wide variety of uses
- High toughness even in large dies due to higher hardenability than that of H13

### Applications and proper hardness

Applications	Hardness (HRC)
Al, Zn, Mg die casting molds	41 ~ 48HRC
Die casting parts (Plunger sleeve, Chip, etc.)	45 ~ 50HRC
Hot extrusion dies	43 ~ 50HRC
Hot shear blades	35 ~ 45HRC
Hot forging dies	42 ~ 50HRC

### Chemistries

Patent pending

### Heat treatment

Forging Temp. : C	Treating temperature : C			Hardness		Transformation point : C	
	Annealing	Quenching	Tempering	Annealed	Quenched & tempered	Ac	Ms
1200 - 900	820 - 870 Slow cooling	1000-1050 Air cooling	550 ~ 650 Air cooling	≤ 229HB	≤ 53HRC	815 ~ 875	300 Austenite temp : 1030 C

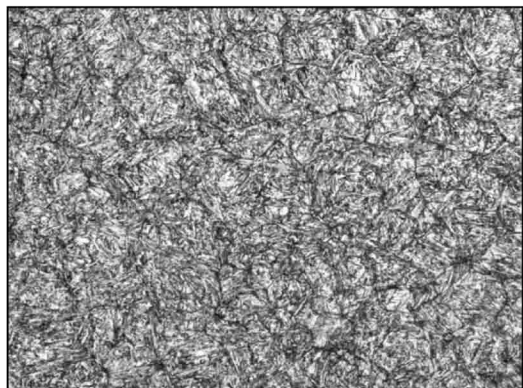
  
INTERNATIONAL MOLD STEEL, INC.

1-800-625-6653  
[www.imsteel.com](http://www.imsteel.com)

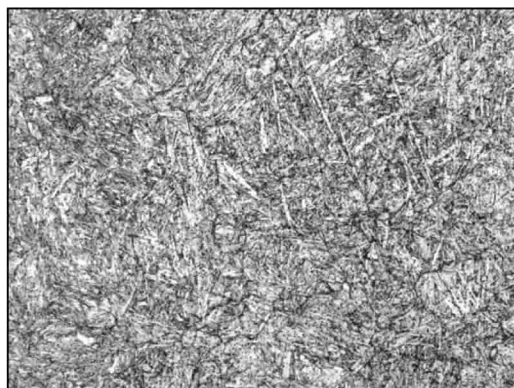
# Microstructure (Quenched and tempered)

Specimen : 200H x 600W x 300L(Center)  
Vacuum quenched and tempered

25  $\mu$  m

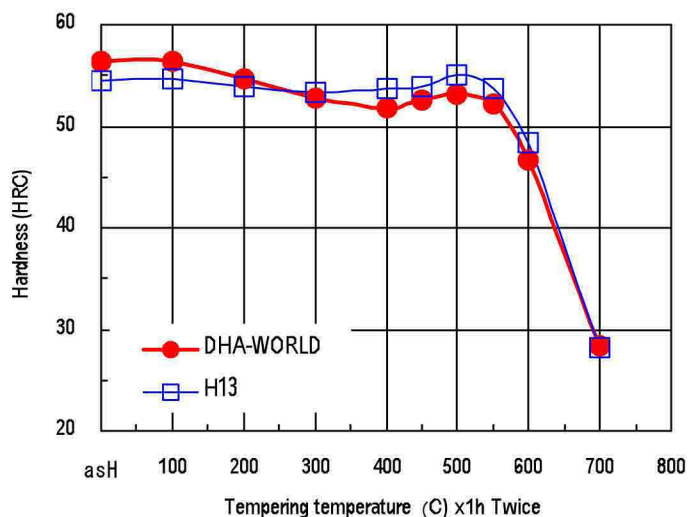


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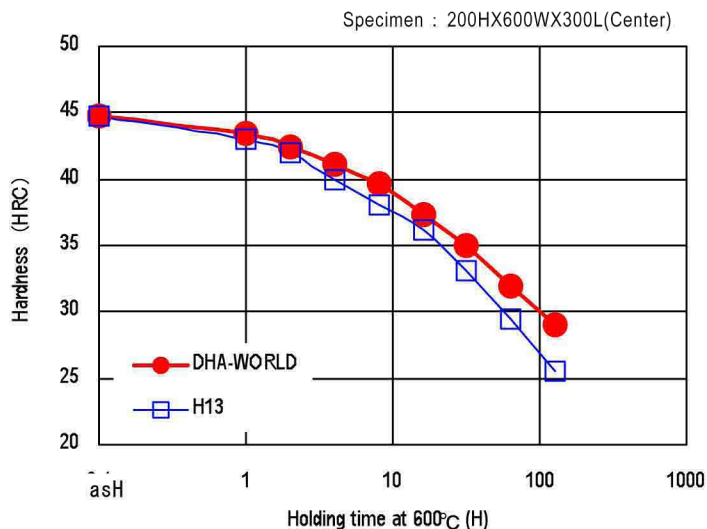


H13

## Tempering hardness

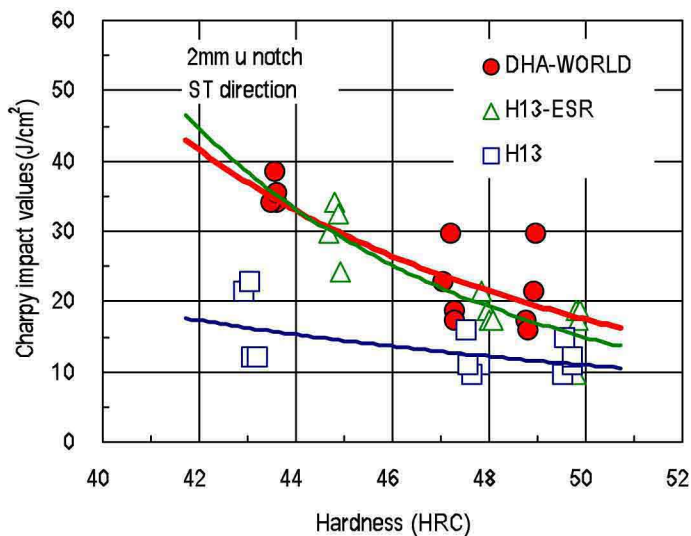


## Softening resistance



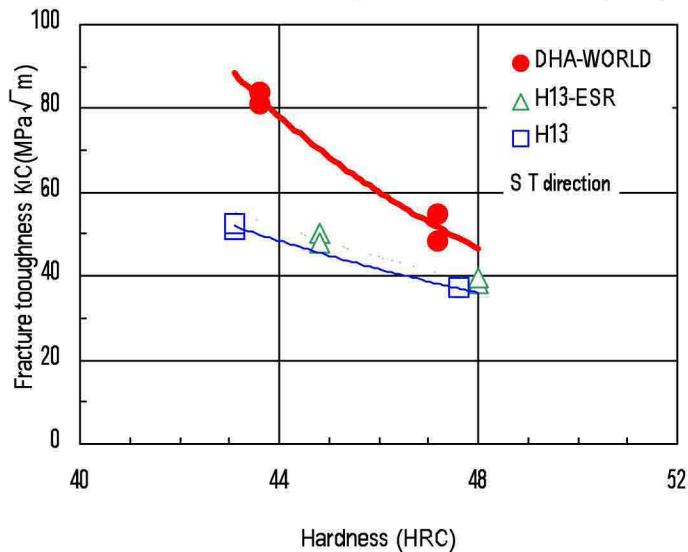
## Toughness

Specimen : 200HX600WX300L(Center)

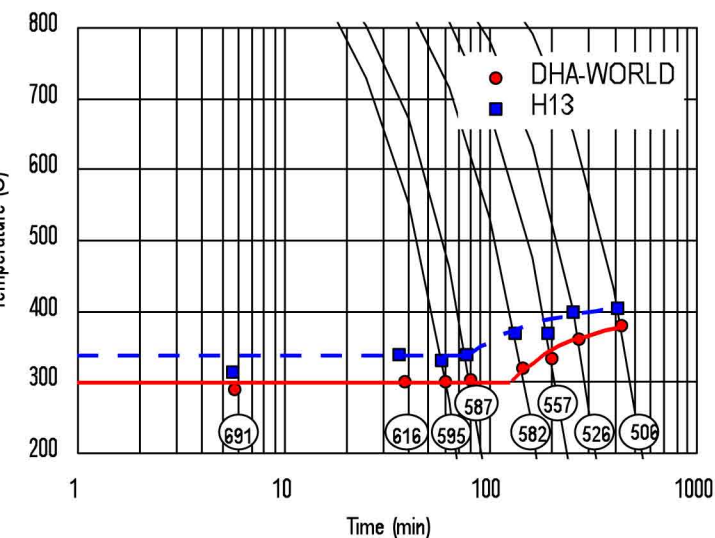


## Fracture toughness

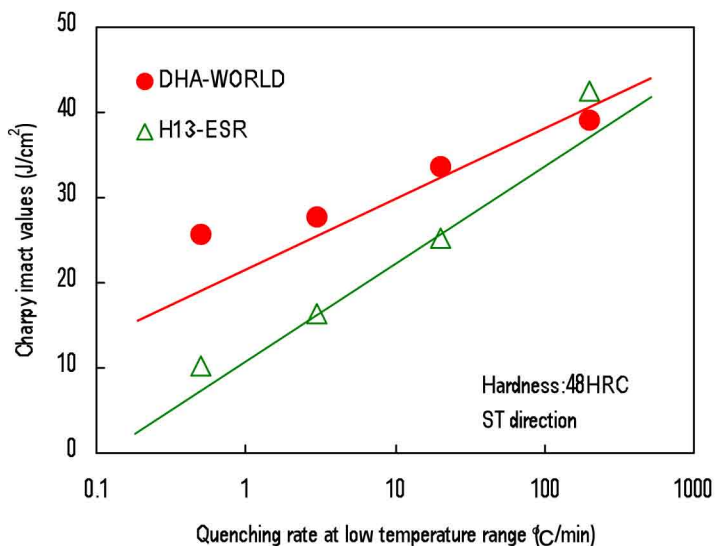
Specimen : 200HX600WX300L(1/4 H)



## CCT curves

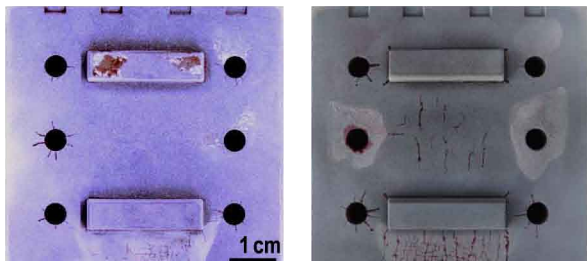


## Quenching rate vs. Toughness



## Heat checking resistance

135t Die casting test machine

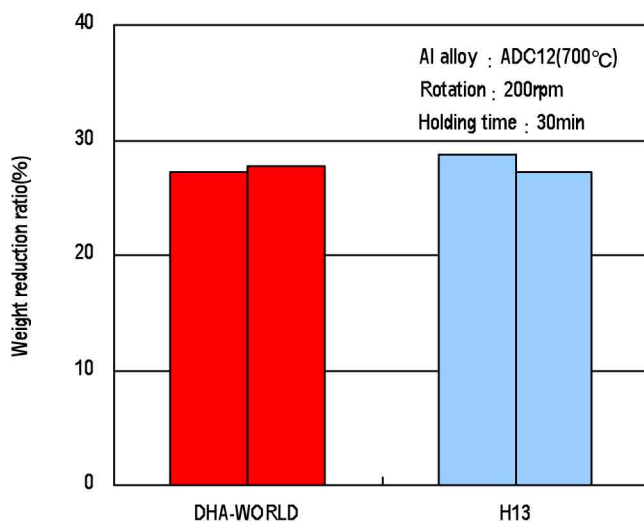


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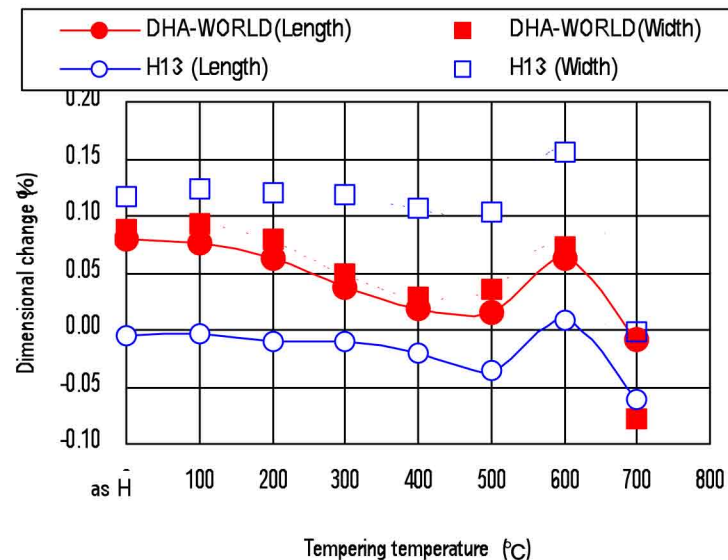
H13

Hardness: 43HRC  
Number of run: 10,000  
Al alloy: ADC12(700°C)  
Cycle time: 30sec

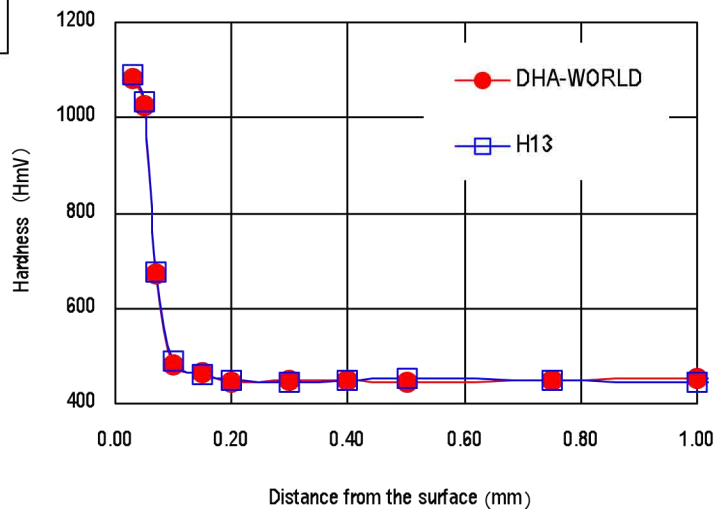
## Al erosion resistance



## Dimensional change

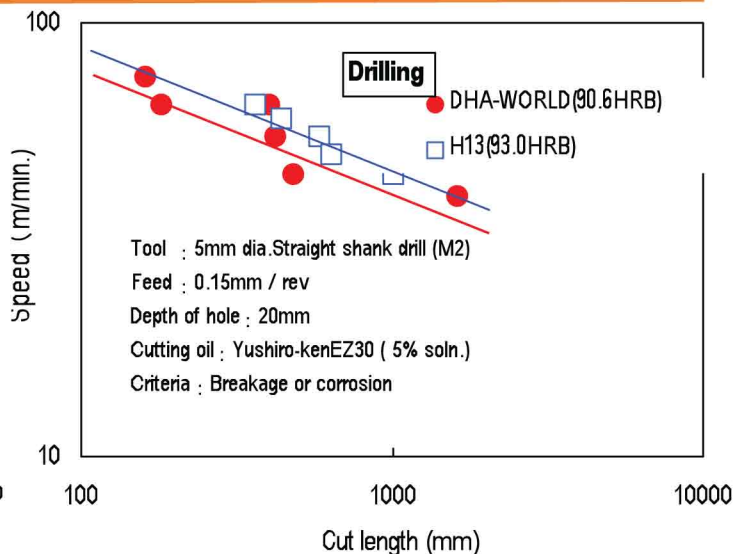
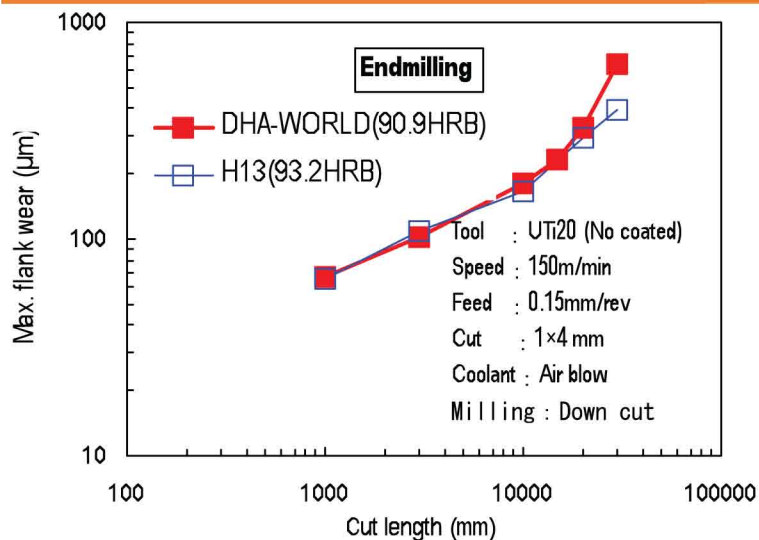


## Nitriding characteristics





## Machinability



## Thermal expansion rate

Temperature	20~100°C	20~200°C	20~300°C	20~400°C	20~500°C	20~600°C	20~700°C
$\times 10^{-6}/\text{K}$	11.3	11.7	12.1	12.5	12.8	13.1	13.2

## Thermal conductivity

Temperature	100°C	200°C	300°C	400°C	500°C	600°C	700°C
W/m·K	25.2	26.6	27.9	28.5	28.7	28.3	27.6

## Specific heat

Temperature	100°C	200°C	300°C	400°C	500°C	600°C	700°C
J/kg·K	473	509	558	604	667	760	934
[cal/g·°C]	[0.113]	[0.122]	[0.133]	[0.144]	[0.159]	[0.182]	[0.223]

## Specific weight

Temperature	20°C
kg/m <sup>3</sup>	7800.0
[g/cm <sup>3</sup> ]	[7.80]



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