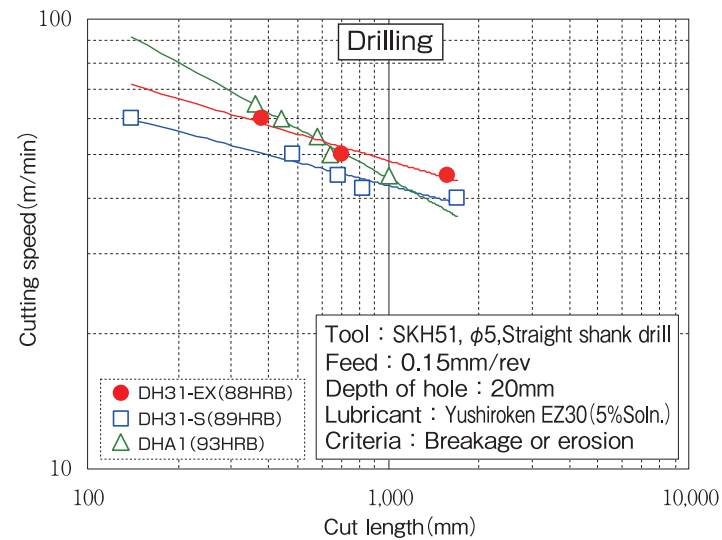
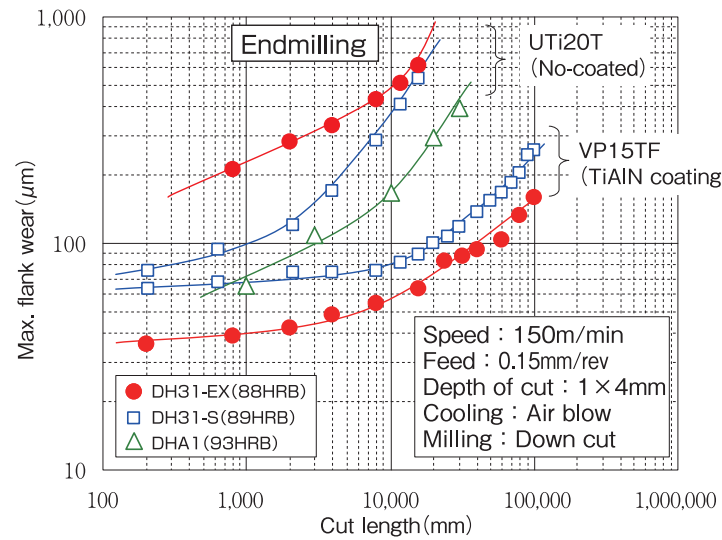


## Machinability



## Main applications

Applications	Hardness(HRC)
Al, Zn, Mg Die casting dies	41~48
Hot extrusion dies	43~50
Hot shear blades	35~45
Hot forging dies	42~50

## Physical properties

Quenching : 1030°C × 1h, Air cooling  
Tempering : 610°C × 1h, Twice  
Hardness : 45HRC

### ◆ Thermal expansion rate

Temp.	20~100°C	20~200°C	20~300°C	20~400°C	20~500°C	20~600°C
× 10 <sup>-6</sup> /K	11.0	11.4	11.7	12.1	12.5	12.7

### ◆ Thermal conductivity

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
W/m·K	27.2	28.4	29.1	29.8	30.1	30.0	29.6

\*Accuracy of repeated measurements is about ± 10%.

### ◆ Specific heat

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
J/kg·K	468	513	557	588	657	712	825

### ◆ Young's modulus / Rigidity modulus / Poisson's ratio(25°C)

Young's modulus	Rigidity modulus	Poisson's ratio
211GPa	81GPa	0.29



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### ■ Document Disclaimer

The product characteristics included in this brochure are the representative values based on the result of our measurements, and do not guarantee the performance in use of the products. Please inquire the latest information to our department in charge as the information of this brochure is updated without previous notice as needed.

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No.SC1302d 24.10.03 (DDD)

## Daido's Hot Work Die Steel Series

# DH31-EX<sup>TM</sup>

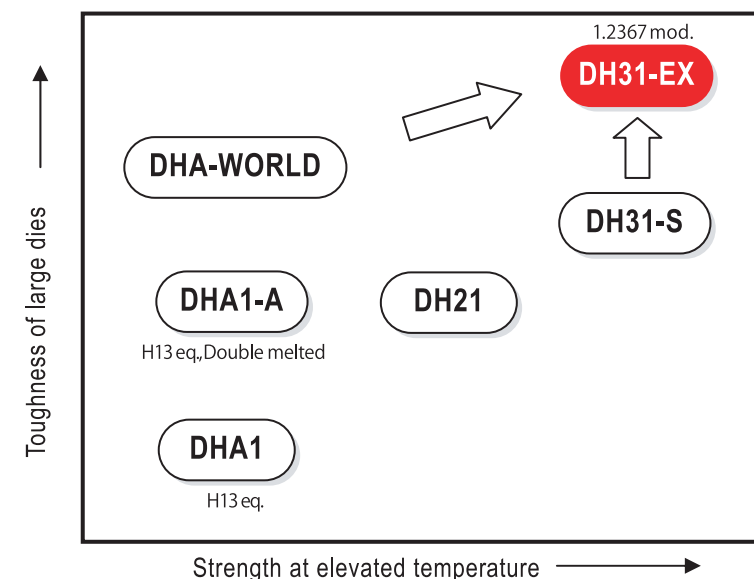


## High Performance Hot Work Die Steel

### Features

High toughness throughout large Die Casting Dies and Forging Dies contributes to prevent from the risk of gross cracking in service

- ◆ High hardenability : High toughness even in large sized dies
- ◆ High hot strength : Great heat checking and wear resistance
- ◆ Double melted : Homogeneous and almost isotropic properties throughout dies



## Heat treatment

Re-forging Temperature (°C)	Heat treatment(°C)			Hardness		Transformation Temp.(°C)	
	Annealing	Quenching	Tempering	Annealed	Quenched & Tempered	Ac	Ms
900~1200	820~870 Slow cooling	1000~1050 Air cooling	550~650 Air cooling	≤ 235HBW	35~53HRC	805~885	300 (Austenitized at 1030°C)

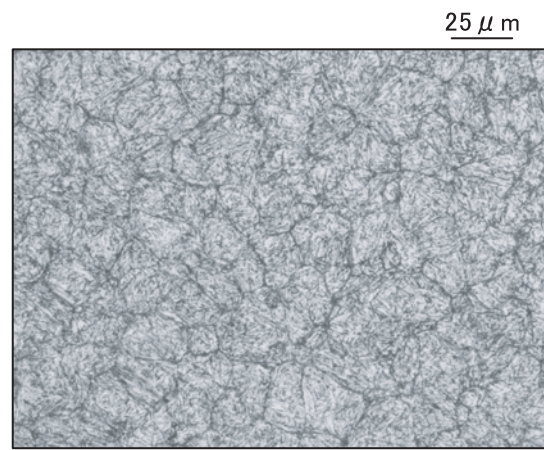


# Properties

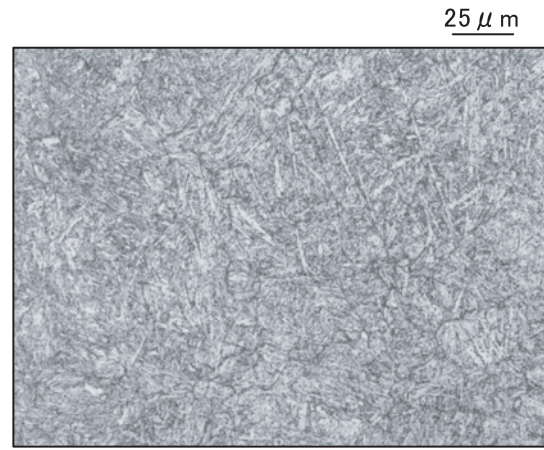
Material size : 200mm H × 800mm W

## Microstructure (Quenched and Tempered)

Specimen : 200mmH × 600mmW × 300mmL(Center)  
Quenching : 1030°C, Gas quenching with 6-9 bar in vacuum furnace



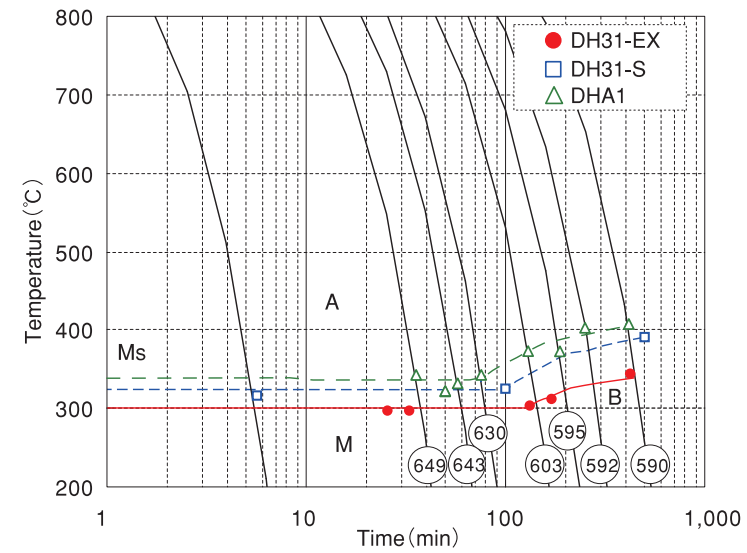
DH31-EX



DHA1

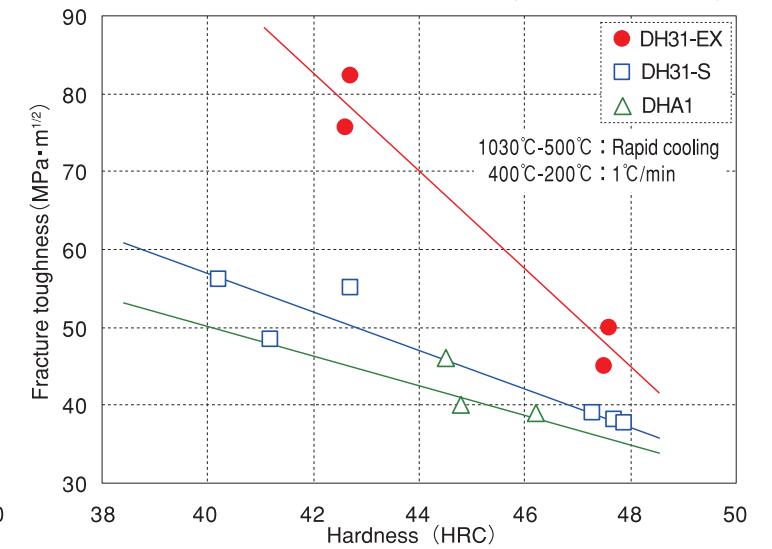
## CCT diagram

Austenitizing : 1030°C × 15min



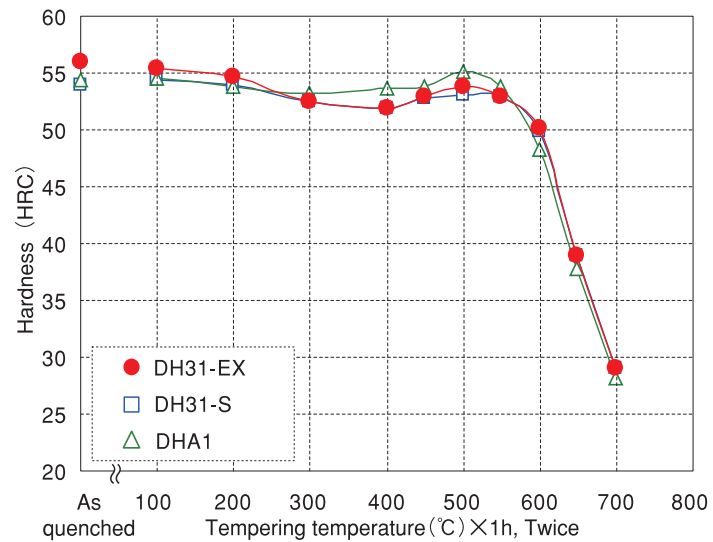
## Fracture toughness

Specimen : 12.5mm × 61mm × 64mm  
Quenching : 1030°C, Gas cooling



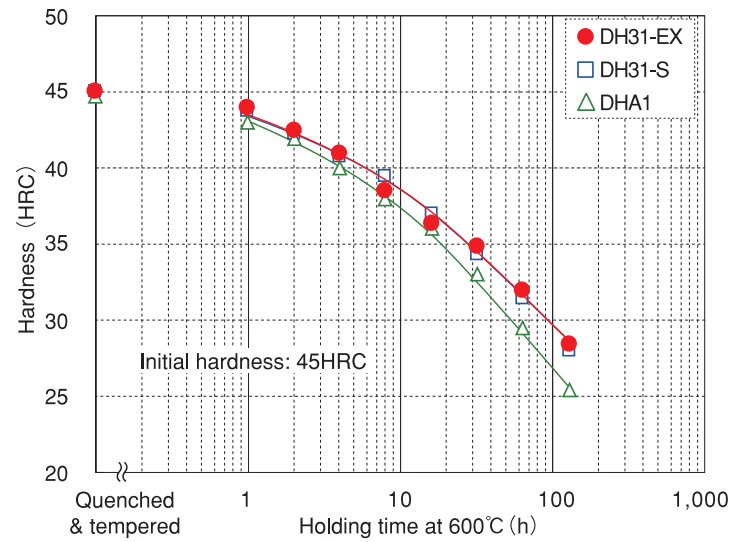
## Tempered hardness

Specimen : 10mm × 15mm × 20mm  
Quenching : 1030°C × 15min, AC



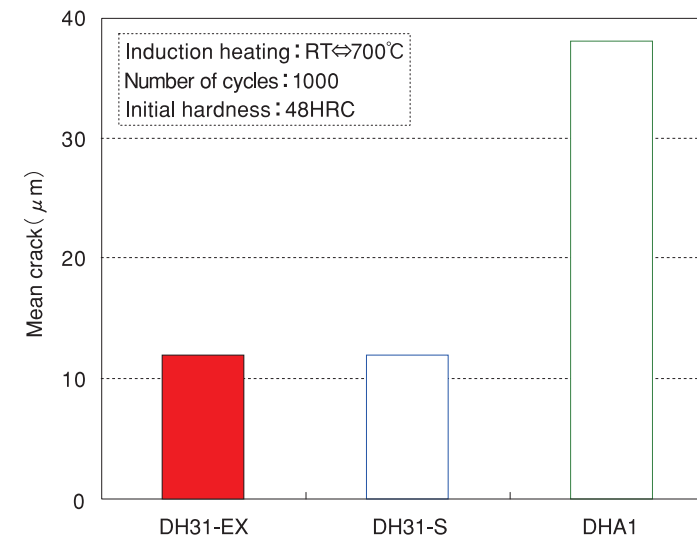
## Softening resistance

Specimen : 200mmH × 600mmW × 300mmL (Center)  
Quenching : 1030°C, Gas quenching with 6-9bar



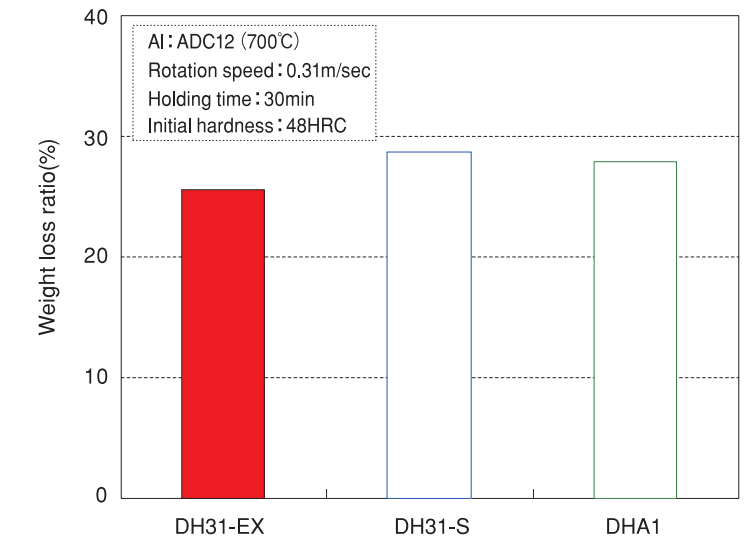
## Heat checking resistance

Specimen : φ 15 × 5mm  
Quenching : 1030°C, Gas cooling



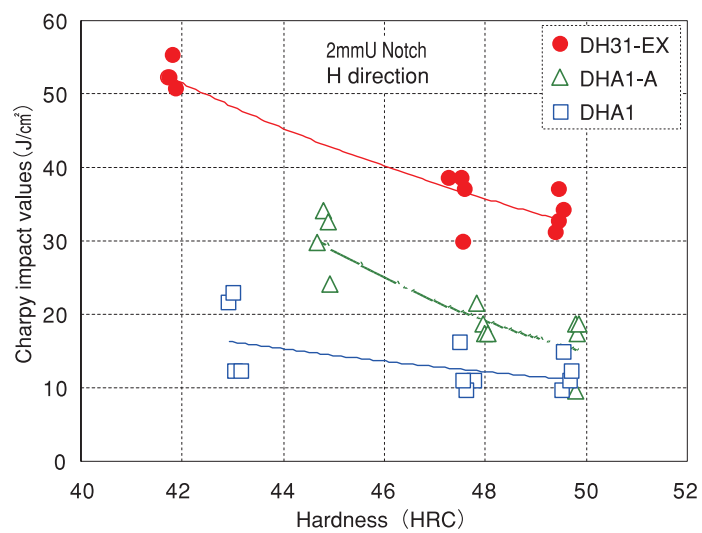
## Al erosion resistance

Specimen : φ 10 × 30mm  
Quenching : 1030°C, Gas cooling

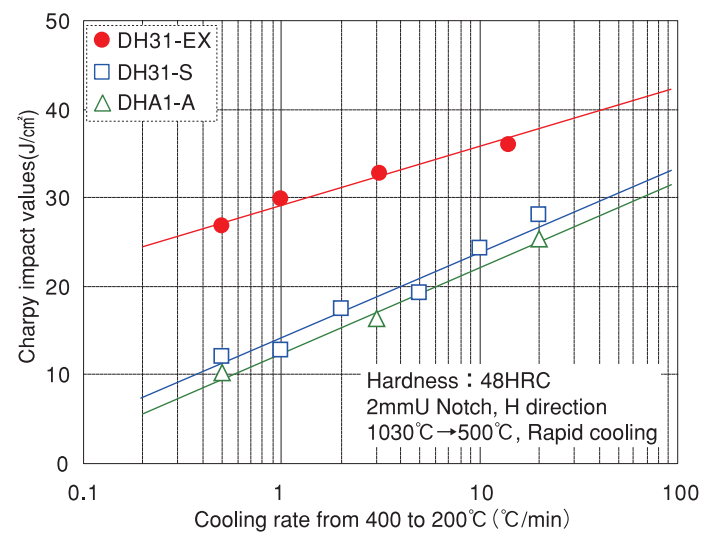


## Toughness

Specimen : 200mmH × 600mmW × 300mmL (center)  
Quenching : 1030°C, Gas quenching with 6-9bar

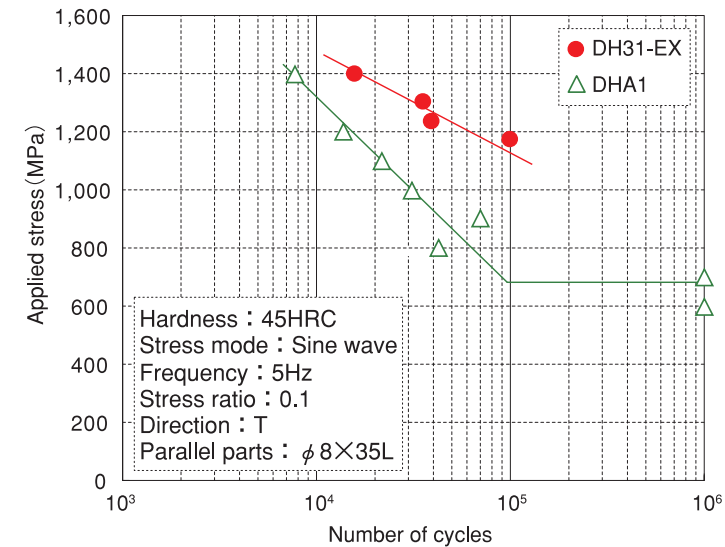


Specimen : 10 × 10 × 55mm  
Quenching : 1030°C × 1h, Gas cooling



## Fatigue properties

Specimen : φ 26 × 180mm  
Quenching : 1030°C, Gas cooling



## Nitriding characteristics

Nitriding : PS treatment  
Initial hardness : 45HRC

