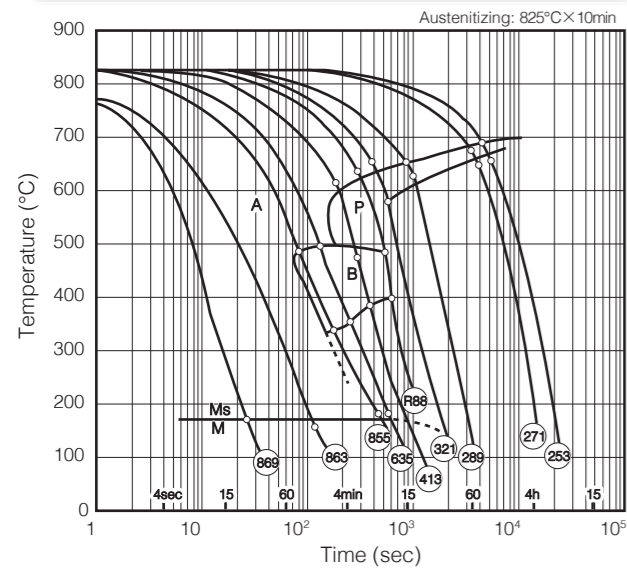


## CCT diagram



## Physical properties

### ◆ 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	11.7	13.0	13.0	10.6	10.8	11.5

### ◆ Thermal conductivity

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
W/m · K	29.9	30.8	31.9	35.0	35.1	33.6	32.0

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

### ◆ Specific heat

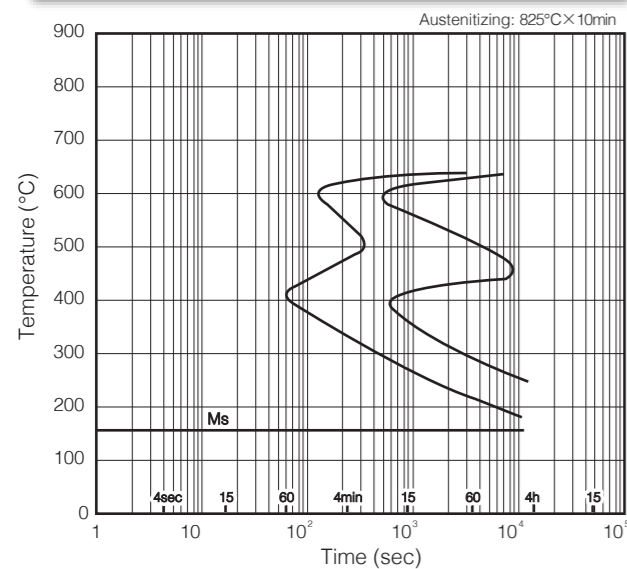
Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
J/kg · K	517	537	566	588	626	666	728

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

Young's modulus	Rigidity modulus	Poisson's ratio
200GPa	77GPa	0.29

Quenching: 830°C×1h, Gas cooling  
Tempering: 180°C×1h, Twice  
Hardness: 63HRC

## TTT diagram



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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.

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## Daido's Cold Work Die Steel Series

# GOA™



## Excellent Hardenability and Wear Resistance Special Tool Steel

### Features

- ◆ High cleanliness by vacuum degassing in refining process.
- ◆ High hardness attained even with products of relatively large size because of better hardenability compared with JIS SKS3.
- ◆ Excellent wear resistance by uniformly distributed fine tungsten and chrome carbides.
- ◆ Excellent machinability resulting from completely spheroidized microstructure.

### Main applications

Application		Hardness
Cold press	Trimming dies, Forming dies, Punch	58~62HRC
Coining dies		58~62HRC
Shear blade	Sheets (less than 6 mm)	58~62HRC
	Plates (6~8 mm)	55~60HRC
Gauges		60~64HRC

### Chemical composition

DAIDO Brand	Chemical composition (%)										
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	W	Special elements
GOA	0.9	0.3	1.2	≤0.030	≤0.030	≤0.25	≤0.25	0.5	0.1	0.5	Added

### Heat treatment

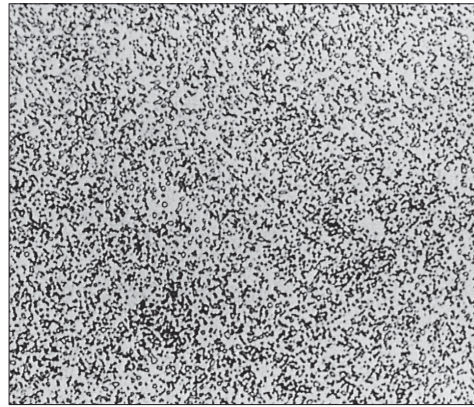
Re-forging Temp. (°C)	Heat treatment (°C)			Hardness		Transformation Temp. (°C)		
	Annealing	Quenching	Tempering	Annealed (HBW)	Quenched & Tempered (HRC)	Ac	Ar	Ms
850~1100	750~800 Slow cooling	800~850 Oil quenching	150~200 Air cooling	≤ 217	≥ 61	708~726	—	160 (Austenitized at 825)



# Properties

Material size:  $\Phi 36$   
(Except for Dimensional changes)

## Microstructure

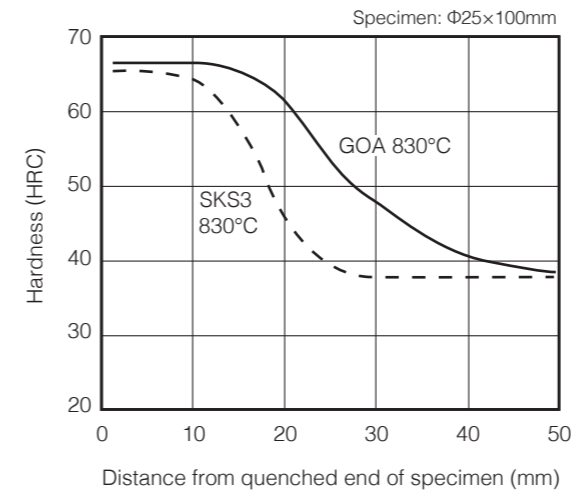


Spheroidized annealing  
(x 400)

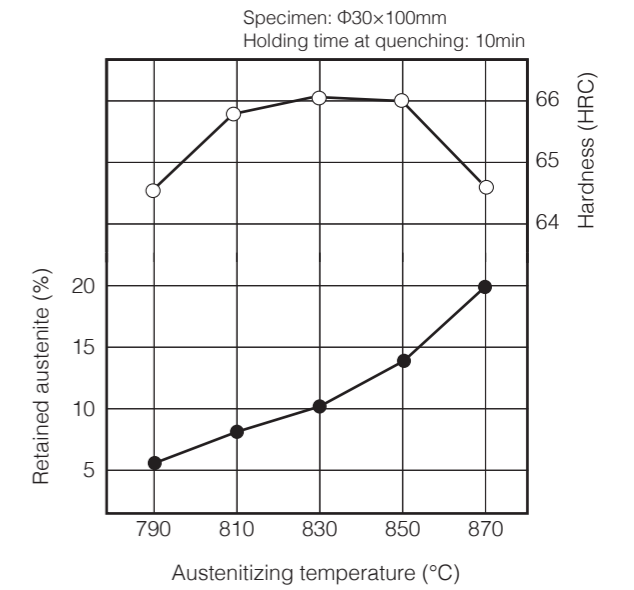


After quenching tempering  
(x 400)

## Hardenability (End-quench test)



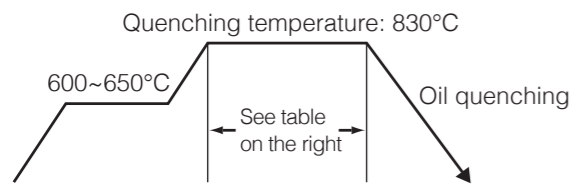
## Quenched hardness & Retained austenite



## Tempering hardness

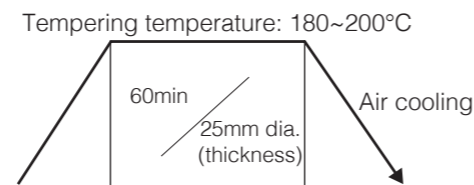
### ◆ Quenching

Ordinary quenching

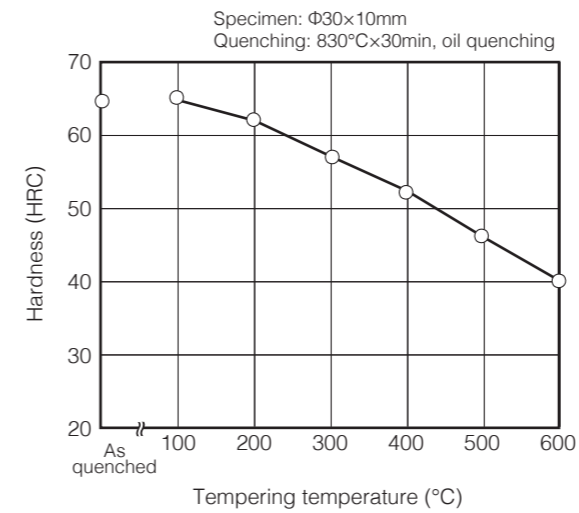


### ◆ Tempering

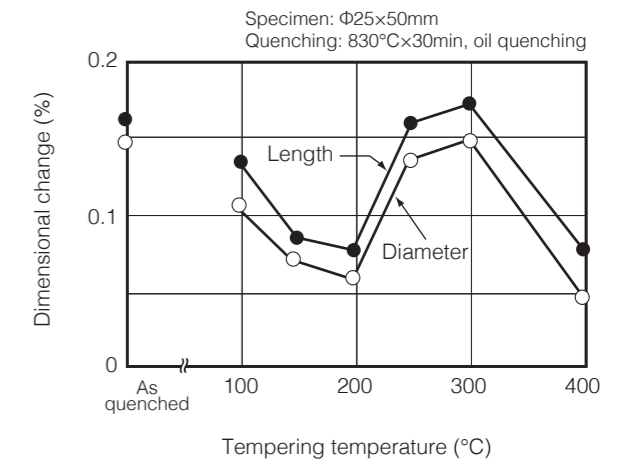
Tempered more than twice in case of wire cutting.



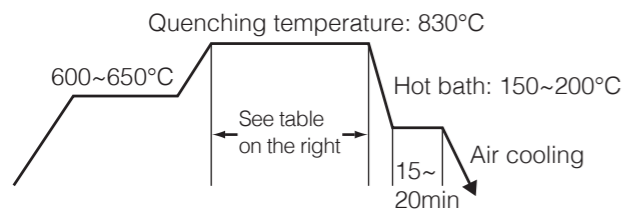
## Tempering hardness



## Dimensional change

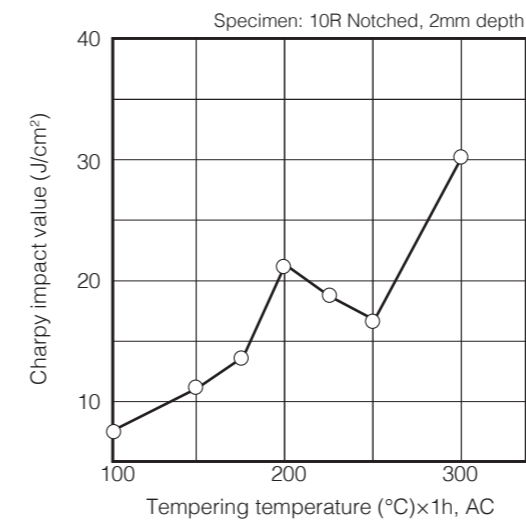


### ◆ Martempering (Hot bath quenching)



Salt bath		Electric furnace Gaseous atmosphere furnace		Packaged heating
Dimension Dia./ Thickness (mm)	Immersion time (min)	Dimension Dia./ Thickness (mm)	Time (min)	Soaking time
10	5~8	25	30	20~45min. Box wall thickness: 25mm
20	8~10	100	80	
30	10~15	125	100	
50	20~25	200	120	
100	30~40	500	200	

## Toughness



## Wear resistance

