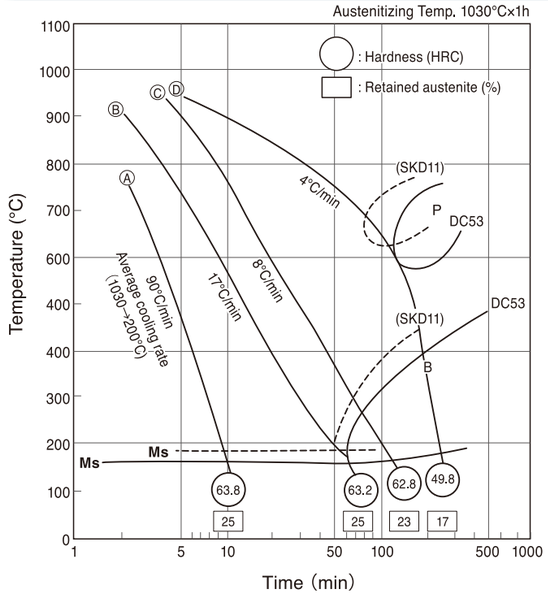
CCT diagram



Physical properties

Quenching:1030°C×1h, Gas cooling
Tempering:520°C×1h, Twice
Hardness:61HRC

◆ **Thermal expansion rate**

Temp.	20~100℃	20~200℃	20~300℃	20~400℃	20~500℃	20~600℃
×10⁻⁶/K	10.8	11.6	12.2	12.8	13.2	13.5

◆ **Thermal conductivity**

Temp.	25℃	100℃	200℃	300℃	400℃	500℃	600℃
W/m·K	17.8	19.3	20.0	22.5	24.3	24.5	26.3

＊Accuracy of repeated measurements is about ±10%.

◆ **Specific heat**

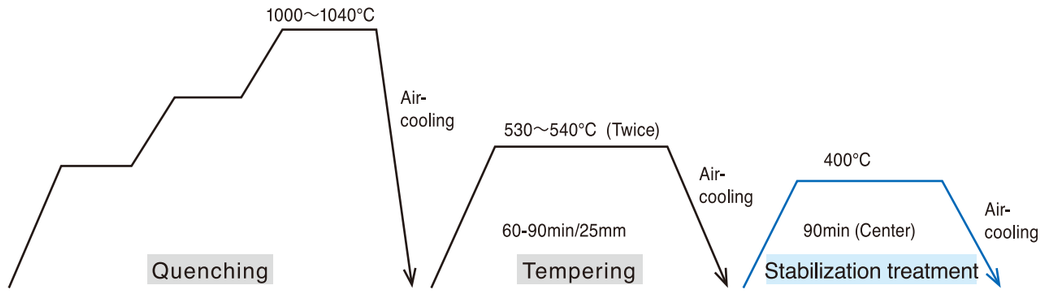
Temp.	25℃	100℃	200℃	300℃	400℃	500℃	600℃
J/kg·K	450	466	476	544	608	646	737

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

Young's modulus	Rigidity modulus	Poisson's ratio
207GPa	79GPa	0.31

Stabilization treatment

◆ SKD11, DC53 and other cold work die steels are prone to slight deformation over time when they are tempered at high temperature due to performance requirements. Therefore, when used in high-precision molds, it is recommended to perform stabilization treatment. If DC53 undergoes the following stabilization treatment, the deformation over time can be reduced to a very low level. (For more detailed information, please ask the agency)



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Daido's Cold Work Die Steel Series

DC53™

High Hardness & Toughness New General-Purpose Cold Work Die Steel

Features

DC53 is a Daido's cold work die steel with superior performance than JIS SKD11 in the field of general and precision dies.

◆ Three Advantages in Basic Properties (DC53)

1. Higher hardness after heat treatment than SKD11
A hardness of 62-63 HRC is secured after tempering at high temperatures (520-530°C). Therefore, DC53 exceeds SKD11 in strength and wear resistance.

2. Double the toughness of SKD11
DC53 has higher toughness than conventional cold die steels. Therefore, tools and dies made of DC53 are free from the problems such as cracking and chipping, which often seriously affect conventional tools and dies, and enjoy greater durability.

3. Smaller primary carbides than SKD11
Primary carbides in DC53 are smaller in size by one-third than those in SKD11. Therefore, the use of DC53 protects the die from chipping and cracking, often the initial cause of die failure.

◆ Five Advantages in Practical Use (DC53)

1. Excellent machinability and grindability
DC53 is superior to SKD11 in machinability and grindability. Therefore, the use of DC53 insures longer tool life and reduces the number of processes in die making.

2. Improved hardenability
Superior hardenability of DC53 makes heat treatment easier and reduces hardness problems due to vacuum heat treatment which uses gas cooling.

3. Less residual stress after wire electro-discharge machining
Residual stress is lessened by means of high-temperature tempering. Therefore, problems such as cracking and distortion prevented during and after wire electro-discharge machining.

4. High hardness after surface hardening
The hardness of DC53 after surface hardening remains higher than that of SKD11, insuring better die performance.

5. Easy welding
DC53 does not require temperature as high as those required by SKD11 for pre- and post-heating. This makes welding simpler.

Main applications

- Blanking dies
- Cold forging dies
- Fine blanking dies
- Progressing dies
- Drawing dies
- Plastic molds
- Rolling dies
- Rolls
- Trimming dies
- Bending dies
- Punches
- Shear blades

Heat treatment

Re-forging Temp. (°C)	Heat treatment (°C)				Hardness		
	Annealing	Quenching	Tempering	Stabilization	Annealed	Quenched	Tempered
900~1100	830~880 Slow cooling	1020~1040 Air cooling	Low:180~200 High:500~550 Air cooling ≧Twice	400°C×>1h	≦255HBW	≧62HRC	57~63HRC

DAIDO STEEL

Properties

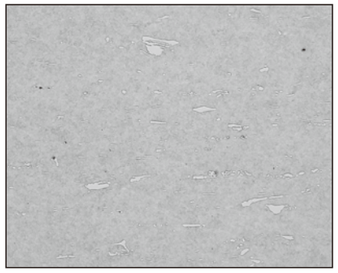
Material size: Φ36mm (Except for Dimensional changes)

Microstructure (As annealed)

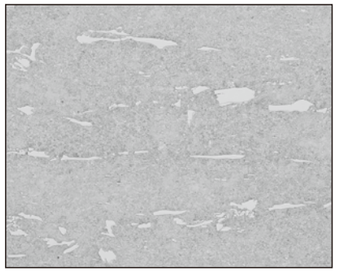
◆ Compared with SKD11, DC53 has less coarse carbides.

Specimen: Taken from 1/4 width × 1/2 thickness of the material with a thickness of 130-150 mm

200 μm



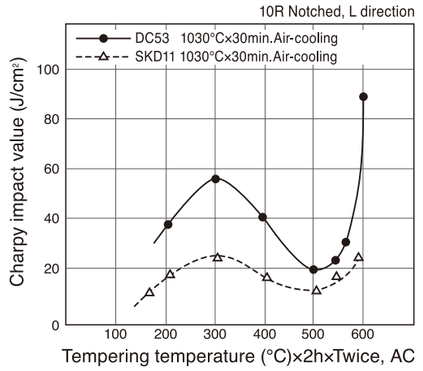
DC53

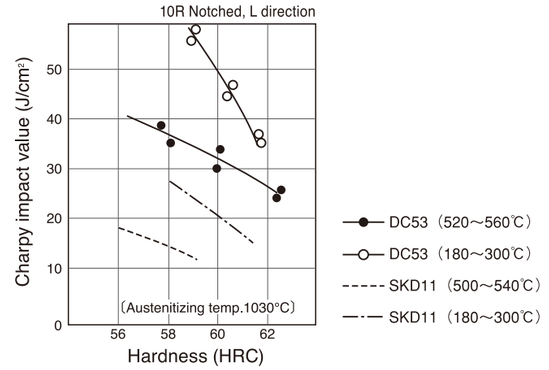


DC11(JIS SKD11)

Toughness

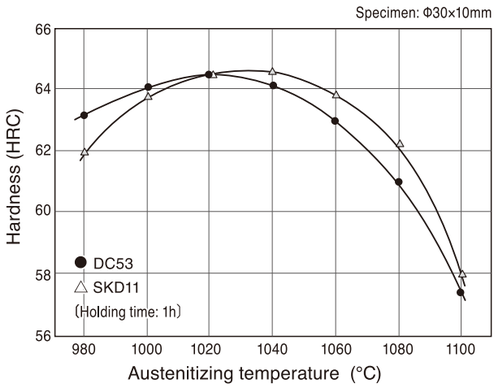
◆ Compared with SKD11, higher toughness can be obtained.





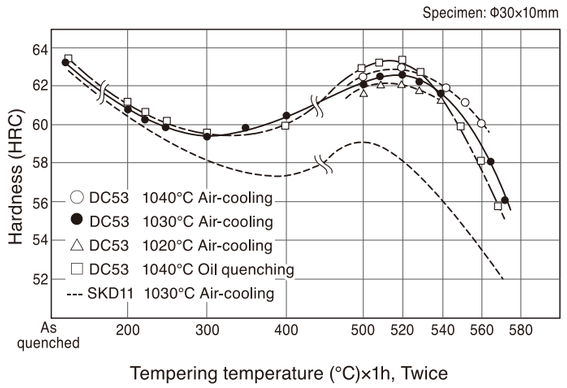
Quenched hardness

◆ The quenching temperature is the same as SKD11, which is 1030°C.



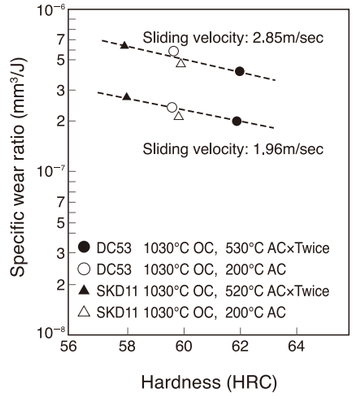
Tempered hardness

◆ It has hardness equivalent to SKD11 in low temperature tempering, and higher hardness than SKD11 in high temperature tempering.



Wear resistance

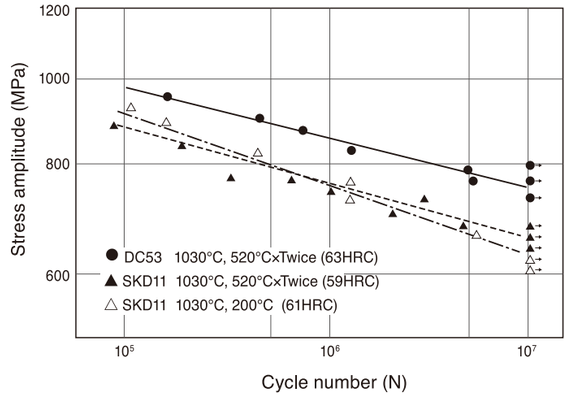
◆ High temperature tempering can obtain high hardness and excellent wear resistance.



Test conditions
- Test method : Ogoshi-type wear test
- Load : 67.7N
- Sliding distance : 200m
- Lubricant : none
- Rotation disc : SCM415 (163HBW)

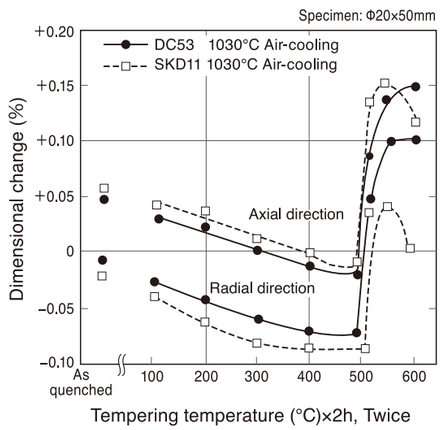
Fatigue strength

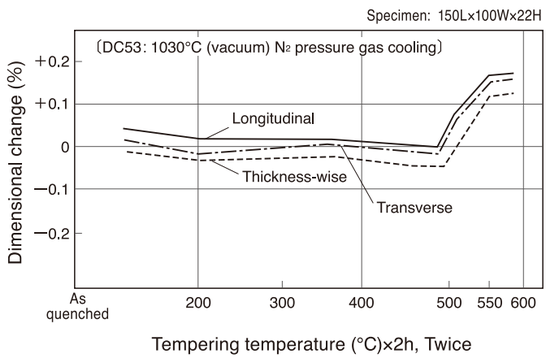
◆ Compared with SKD11, higher fatigue strength can be obtained.



Dimensional change

◆ The dimensional change rate of heat treatment is smaller than that of SKD11.

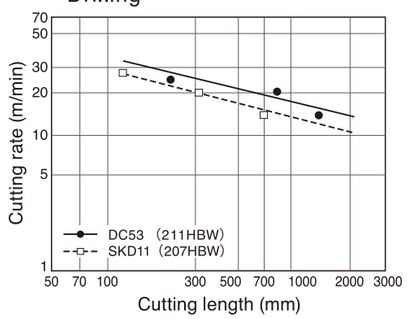




Machinability (As annealed)

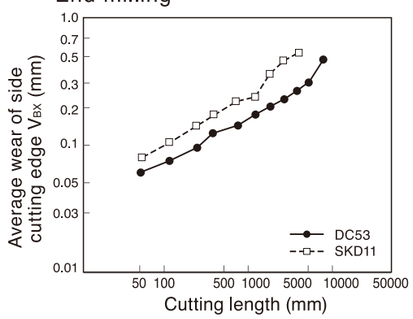
◆ Compared with SKD11, it has better machinability.

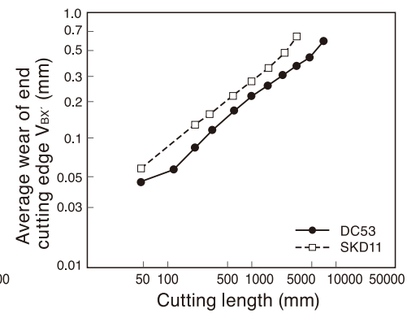
● Drilling



Test conditions
- Tool : SKH51 Φ10 Taper shank drill, α=118
- Feed : 0.15mm/rev Hole depth : 30mm (Blind hole)
- Cutting fluid : none Durability criterion: tool failure

● End milling





Test conditions
- Cutter : TDG4406R (φ160)
- Chip : SDCN42ZTN (UX30)
- Number of chip : 1
- Feed : 27mm/min (0.1255mm/blade)
- Cut depth : 2mm
- Rotating speed : 215rpm (108m/min)
- Method of machining : center cut
- Cutting fluid : none (dry process)