Group	Name	Neptun Code	Date
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Material Selection Report

A. Project

Rotary slitter blade

Dimension : 200 mm diameter, 10 mm thickness

Load & requirement : high wear load, required hardness : 60 HRC

Service parameters : for slitting of metal sheets, sharpening must be possible.

Production : small series.

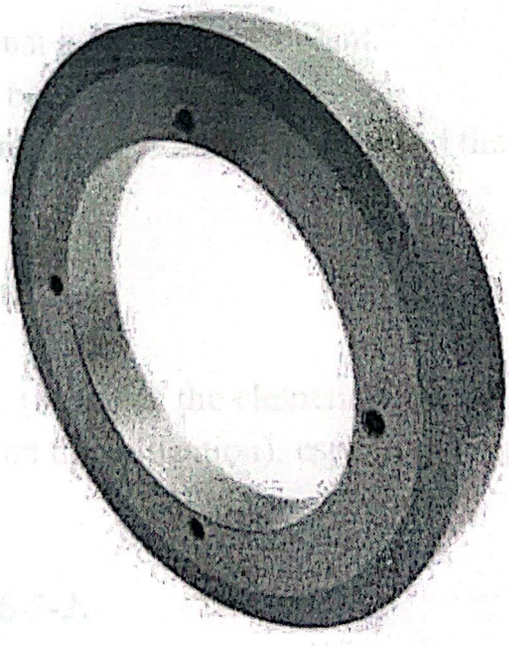


Fig 1. Picture of rotary slitter blade

B. Part/tool

Short description

Rotary slitter blades, also known as circular cutting blades are tools that used for cutting in mechanical manufacturing, usually applied in steel coil slitting line machine. They are types of blades with sharp cutting edges. They usually have low cutting angles and no teeth. As the name suggests, circular slitter blades are mostly used for slitting type cutting operations, such as slitting paper, tape, tape, film, gold, silver, copper, aluminum, alloy foil and other items. These products require the blade to have the least cutting resistance and the most wear resistance. The cutting edge needs to be sharp and durable, and must reach micron-level accuracy due to the requirement of product accuracy. By the recent applied high-tech, the circular blade is treated with ceramic composite and tungsten carbide coating on the surface of the blade, so that the blade is not easy to wear and does not stick to powder when slitting, reducing the friction during slitting other materials. It greatly improves the cutting precision and speed, also extends the service life of the cutter.

Selection Criteria

- The cutting part must be in the exact point.
- The blades should be sharp and stable.
- The blades have the least cutting resistance and the most wear resistance.

C. Selected Material

Type :

High alloyed steels (based on the element content)

Tool steels (based on the utilization), especially high speed steel

Material :

EN	- HS-6-5-2C		
AISI	- M2	JIS	- SKH51
DIN	- 1.3343	ASTM	- A600

Description :

M2 steel (tungsten-molybdenum high-speed steel) with a high strength at elevated temperature, a well-balanced carbon composition and high toughness. This type of high-speed steel are used primarily for the manufacture of cutting tools because of its great hardness and wear resistance. The alloying elements raise the temperature at which tempering occurs, allowing M2 steel to be used at temperatures up to 650°C. Hardness of the surface is about 62 – 67 HRC, makes them suitable for use in high-speed machinery.

Chemical Composition :

(w % of steel HS-6-5-2C (1.3343) : EN 4957 – 2000)

Chemical elements	C	Si	Mn	P	S	Cr	Mo	W	V
w%	0.85	0.45	0.28	0.03	0.03	4.15	5.0	6.4	1.85

- **C** : 0.85% Carbon improves the steel hardness, tensile strength, and improves wear resistance. As the amount of carbon in a steel alloy goes up, the ductility trends downward.
- **Si** : 0.45% Silicon improves the steel strength.
- **Mn** : 0.28% Manganese increases the hardenability and wear resistance.
- **P** : 0.03% Phosphorous improves the machinability, strength, and hardness of M2 steel.
- **S** : 0.03% Sulfur boosts machinability. This element has to be used in small amounts since too much of it can increase impurity level in the steel alloy and affect its strength.
- **Cr** : 4.15% Chromium enhances tensile strength, hardness, and toughness.
- **Mo** : 5.0% Molybdenum increases the hardness, strength, and toughness of this steel.
- **W** : 6.4% adds to hot hardness and wear resistance, causes secondary hardening and enhances resistance to tempering.
- **V** : 1.85% Vanadium boosts the steel toughness while increasing its strength and wear resistance.

D. Processing Technology Steps and Parameters

1) Cutting

The selected material cut into desirable size of the tool and circular shape with 200 mm diameter.

2) Heat threating

a. Hardening :

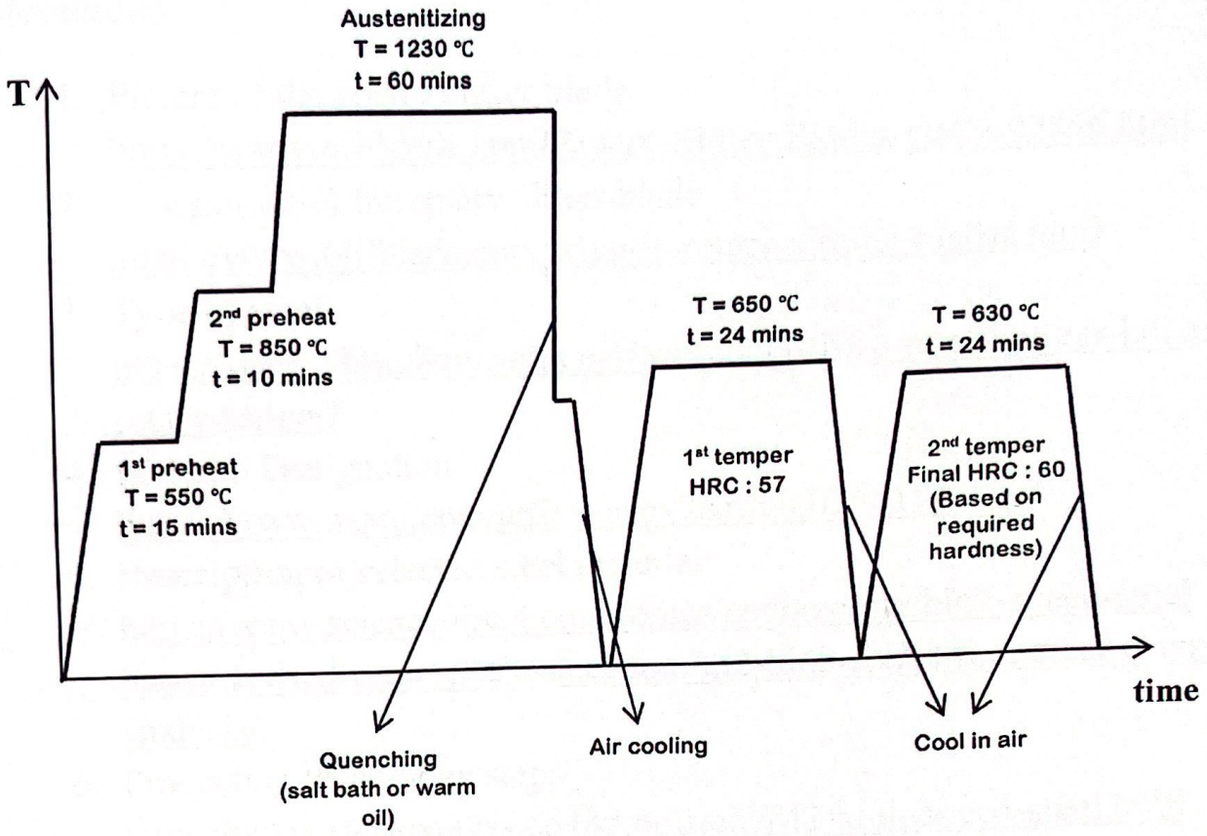
Hardening are done in three steps. First preheat at 550°C. Second preheat at 850°C. Third, austenitizing at 1230°C for one hour. Then, quenching is performed in salt bath or warm oil.

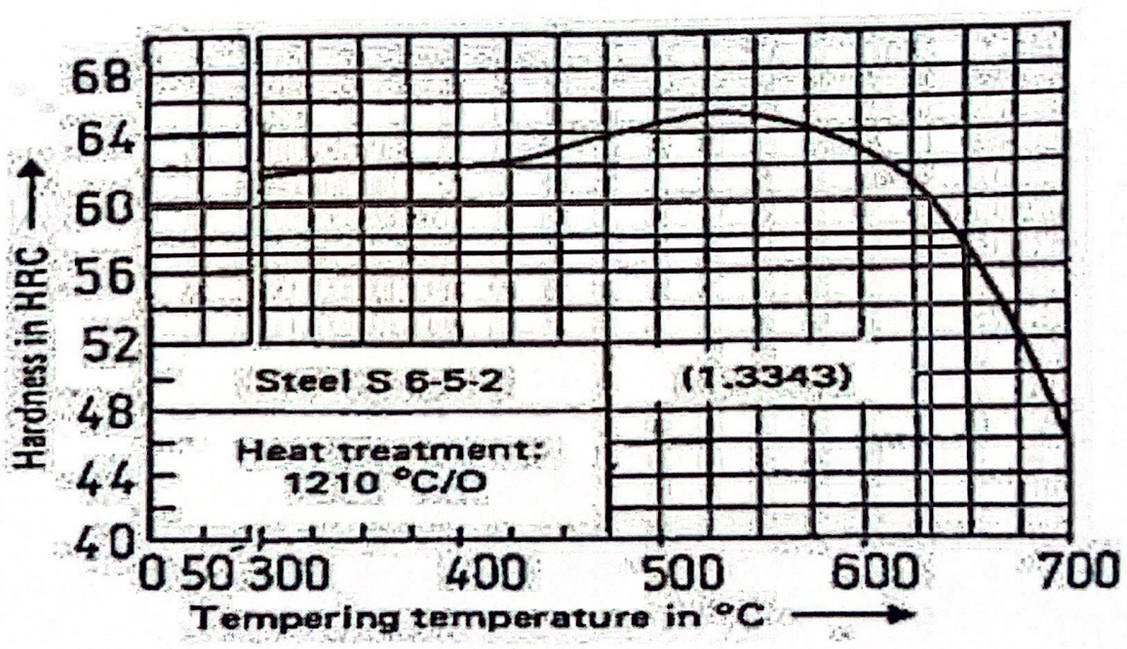
b. *Tempering* :

Slowly heating to tempering temperature at 650°C for 60 HRC, right after hardening. Hold at temperature for at least two hours or one hour per 25 mm of thickness (24 mins for 10 mm of thickness). Air cool to room temperature between tempers. Doule temper is mandatory.

3) Polishing (with water)

The tool were then subjected to water-polished with 220, 360, 400, 600 and 1200 mesh sanding. Later on, they need to be polished with 3 μm alumina felt. After polishing the tools were washed with water and 70° INPM ethyl alcohol, dried with a thermal blower.





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