LINDQUIST STEELS, INC.
TOOL STEEL SPECIALISTS

Machining Pre-hardened Mold and Tool Steels for PX5 and NAK55

In a recent independent tool study, it was determined that PX5 and NAK 55 can be machined up to twice as fast as conventional 30 R.C. P-20 material and still show equal or less cutting tool wear.

The machine used was a heavy-duty vertical milling machine equipped with #50 taper tool holders.

The cutting tool was a 4-inch in diameter and 8-octagon shaped T.I.N. coated carbide inserts at a positive rake. Cutting depth was .150 inches. At 400 surface feet per minute we were able to cut up to .025 inches per insert or .200 inches per revolution of cutter. Even at this rate we were getting 22 to 25 minutes of 'tool life' before the insert had to be indexed.

Material Removal Rates

Consider this: material removal rate during this time span in approximately 300 pounds of steel. It showed that we could remove a lot of steel with moderate surface feet but a heavy chip load. Once again, the clean make-up of the material made this possible.

To Calculate Surface Feed

Surface speed is usually given in feet per minute. It is the distance (in feet) that the outermost cutting edge of a rotating tool (circumference) covers in the span of 1-minute.

To understand how this translates into spindle speed, or revolutions per minute (rpm) that the cutting tool is revolving, review this example:

Example:

Surface feet 400 feet per minute Diameter of cutting tool is 4 inches. Revolutions per minute (rpm) if cutting tool is _____

Equation:

C = Surface feet per minute (feet) D = Diameter of cutting tool (inches)
R = Revolutions per minute of cutting tool (rpm)

$$R = \frac{(C \times 12)}{(D \times Pi)} = \frac{(400 \times 12)}{(4 \text{ in.} \times 3.14)} = \frac{4800}{12.56} = 382 \text{ rpm}$$

If you need to know surface feet per minute and the cutter diameter and spindle speed is known, you will have this equation:

$$C = \frac{Pi \times D \times R}{12} = \frac{3.14 \times 4 \times 382}{12} = 400 \text{ sf.}$$

To Calculate Chip Load

Chip load is the amount of materials (in .001 inches) that each cutting flute or cutting insert of a rotating tool removes.

Chip load is calculated by dividing the distance of the table travel or feed per minute in inches by the spindle speed of the machine. This will give you the distance the cutter traveled in one revolution. This number is then divided by the number of cutting flutes or inserts.

Example:

Spindle speed is 450 rpm. Table travel or feed rate is 60 inches per minute. Number of flutes or cutting inserts is 6.

Equation:

R = Spindle speed (rpm)
I = Number of cutting flutes or inserts
S = Distance of feed rate or table travel in inches.
C = Chip load

$$C = \frac{\left(\frac{S}{R}\right)\left(\frac{60}{450}\right)}{I} = \frac{.13333}{6} = .0222$$

To Calculate Feed Rate

S = C x I x R =

S = .0222 x 6 x 450

To find rpm of spindle or R with chip load and feed rate known:

$$R = \frac{S}{I \times C} = \frac{60}{6 \times .0222} = 450 \text{ rpm}$$

For more information please log on to www.lindquiststeels.com to find the Lindquist Service Center nearest your location. Or call 1.800.243.9637.