

GENERAL MILLING FORMULAS (English)

TO FIND	USING		FORMULA
SFM Surface Feet per Minute	RPM – Revolutions per Minute Dia – Diameter of End Mill		$SFM = RPM \div 3.82 \times Dia$
RPM Revolutions per Minute	SFM – Surface Feet per Minute Dia – Diameter of End Mill		$RPM = SFM \times 3.82 \div Dia$
IPM Inches per Minute	RPM – Revolutions per Minute IPT – Inch per Tooth, Chipload # FL – # of Flutes		$IPM = RPM \times IPT \times \#FL$
IPT Inch per Tooth, Chipload	IPM – Inches per Minute RPM – Revolutions per Minute # FL – # of Flutes		$IPT = IPM \div RPM \div \#FL$
IPR/FR Inch (Feed) per Revolution	IPM – Inches per Minute RPM – Revolutions per Minute		$IPR (FR) = IPM \div RPM$
MR Metal Removal Cubic Inches per Minute	ADC – Axil Depth of Cut RDC – Radial Depth of Cut IPM – Inches per Minute	ADC = ap RDC = ae	$MR = ADC \times RDC \times IPM$
HP Horsepower Required	IPM – Inches per Minute RDC – Radial Depth of Cut ADC – Axil Depth of Cut PC – Power Constants	RDC = ae ADC = ap	$HP = IPM \times RDC \times ADC \times PC$

GENERAL MILLING FORMULAS (Metric)

TO FIND	USING	Unit of Measure	FORMULA
m/min meters per minute	RPM – Revolutions per Minute Dia – Diameter of End Mill	Dia. in mm	$m/min = RPM \times .00314 \times \text{Tool Diameter}$
RPM Revolutions per Minute	m/min = surface meters per minute Dia – Diameter of End Mill	Dia. in mm	$RPM = \frac{m/min \times 318.057}{\text{Tool Diameter}}$
mm/min Milimeters per Minute Feed Rate	RPM – Revolutions per Minute MMPT – Milimeters per Tooth, Chipload # FL – # of Flutes	MMPT in mm	$mm/min = RPM \times MMPT \times \#FL$
MMPT Milimeters per Tooth, Chipload	mm/min - Milimeters per Minute RPM – Revolutions per Minute # FL – # of Flutes		$MMPT = \frac{mm/min}{RPM \times \#FL}$
MMPR/FR Milimeters (Feed) per Revolution	mm/min - Milimeters per Minute RPM – Revolutions per Minute		$MMPR (FR) = mm/min \div RPM$
MR Metal Removal Cubic Meters per Minute	ADC – Axil Depth of Cut RDC – Radial Depth of Cut mm/min - Milimeters per Minute	ADC = ap in mm RDC = ae in mm	$MR (cm^3/min) = \frac{ADC (mm) \times RDC (mm) \times mm/min}{1000}$
HP Horsepower Required	mm/min - Milimeters per Minute RDC – Radial Depth of Cut ADC – Axil Depth of Cut PC – Power Constants	RDC = ae in mm ADC = ap in mm	$HP = mm/min \times RDC(mm) \times ADC(mm) \times .001 \times PC$
kW			$kW = .7457 \times \text{Horsepower}$

Conversions

TO FIND	USING		FORMULA
m/min	SFM - Surface Feet per Minute		$SFM \times .3048 = m/min$
mm/min	IPM - Inches per Minute		$IPM \times 25.4 = mm/min$
SFM	m/min - meters per minute		$m/min \div .3048 = SFM$
IPM	mm/min - milimeters per minute		$mm/min \div 25.4 = IPM$
HP (metric)	Hp (english)		$Hp (metric) = Hp(English) \times 16.3871$

Revolutions per Minute	rpm	$rpm = Vc \times 12 / \pi \times Dm$
Feed rate, mm/min	Fm	$Fm = Ft \times n \times rpm$
Cutting Time, min	t	$t = L / Fm$
Rate of metal removal, cm ³ /min	Q	$Q = w \times d \times Fm$
Power required at spindle	kWs	$HPs = Q \times P$
Horsepower required at motor	kWm	$HPm = (Q \times P) / E$
Torque at spindle	Ts	$Ts = (63030 \times HPs) / rpm$
Vc from RPM if necessary	Vc	$Vc = (\pi \times rpm \times D) / 12$

Class Vocabulary**Term**

[chip load](#)

[CNC machine](#)

[column-and-knee mill](#)

[constant surface speed](#)

[depth of cut](#)

[engine lathe](#)

[feed](#)

[feed per revolution](#)

[feed per tooth](#)

[hardness](#)

[horsepower](#)

[inch per revolution](#)

[inches per minute](#)

[live tooling](#)

[millimeter per revolution](#)

[millimeters per minute](#)

[part program](#)

[pi](#)

[revolutions per minute](#)

[roughing](#)

[speed](#)

[surface feet per minute](#)

[surface meters per minute](#)

Definition

Another term for feed per tooth that refers to the thickness of chip material removed by the cutting edge of a tool.

A sophisticated machine tool run by a computer that can perform multiple machining operations in the same setup with a variety of tools. CNC

The original and most basic type of mill that is used to machine flat or rectangular workpieces.

A mode on a CNC lathe that adjusts the spindle rpm as the tool travels toward and away from the spindle's axis.

The thickness of material removed by one pass of the cutting tool.

The original and most basic type of manual lathe that is used to make cylindrical workpieces.

The rate that either the workpiece or cutting tool changes in position during the length of the cut. Feed typically defines a linear or contour movement.

The linear distance that a tool advances during one rotation of the workpiece or cutting tool. On the mill, feed per revolution (fpr) may be used.

The thickness of chip material that each cutting edge of a tool removes with one pass.

The ability of a material to resist scratching, indentation, or penetration. Workpiece materials with increased hardness generate more heat and wear.

A unit of power used to describe machine strength. A machine with increased horsepower has a spindle that can exert a greater amount of force.

The distance in inches that the tool advances during one complete revolution of the workpiece. Inch per revolution (ipr) is an English measurement.

The distance in inches that the entire tool or workpiece advances in one minute. Inches per minute (ipm) is an English measurement for feed.

Rotating power-driven cutting tools, such as end mills and drills, that are held in the turret of a lathe. Live tools can perform machining operations.

The distance in millimeters that the tool advances during one complete revolution of the workpiece. Millimeter per revolution (mm/rev) is a metric measurement.

The distance in millimeters that the entire tool or workpiece advances in one minute. Millimeters per minute (mm/min) is a metric measurement for feed.

A series of numerical instructions used by a CNC machine to perform the necessary sequence of operations to machine a specific workpiece.

A special constant value that relates the diameter of a circle to its circumference. Pi is roughly 3.14 and is used to find the circumference and area of a circle.

The number of revolutions that a spindle or cutting tool completes in one minute. Revolutions per minute (rpm) is a measurement of speed in rotation.

A cutting pass that emphasizes high material removal rates at the possible sacrifice of surface finish or accuracy.

The rate that the workpiece surface and cutting tool pass each other at the point of contact. Speed typically defines a rotational movement.

The distance in feet that the workpiece surface or cutting edge travels in one minute. Surface feet per minute (sfm) is an English measurement for speed.

The distance in meters that the workpiece surface or cutting edge travels in one minute. Surface meters per minute (smm) is a metric measurement for speed.