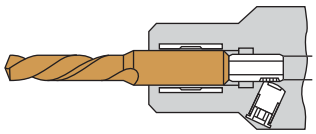
Solid Carbide Drills — General Application Instructions for SE Drills

Toolholding Systems

As with any drilling system, components of the entire system contribute to the quality of the machined hole, not just the drill itself. For maximum efficiency and accuracy, the following toolholding systems would be your best choices:

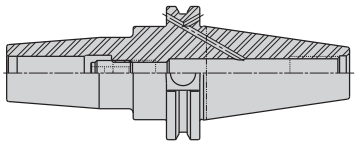
First Choice

Hydraulic chucks



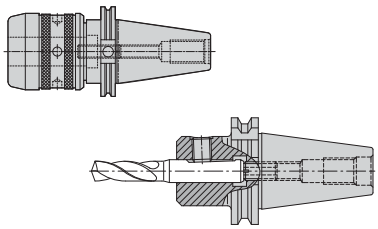
Second Choice

Shrink Fit

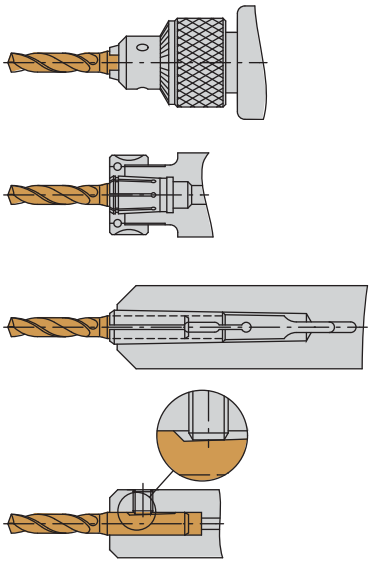


Third Choice

Powergrip milling chucks with collets



Not Recommended

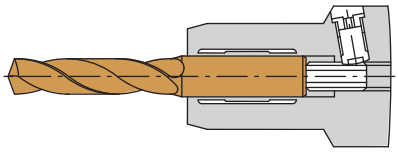


Clamping Chuck

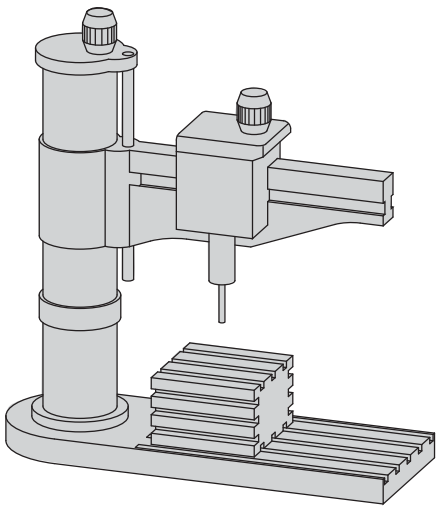
Use of all-purpose drilling chuck collets, clamping sleeves, and Weldon clamping chucks should be avoided because they do not absorb cutting forces reliably or provide insufficient precision of concentricity.

Hydraulic chucks ensure a secure torque transmission with excellent concentricity.

Highly Recommended



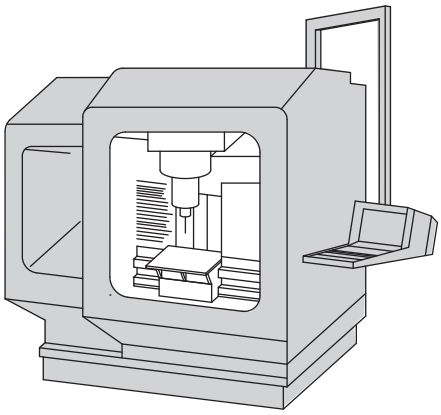
Not Recommended



Machine

Dynapoint solid carbide drills have a rigidity 5 times higher than conventional high-speed steel drills. This enables the machining of close-tolerance holes with a position accuracy of ± .001. However, it also means that Dynapoint drills require rigid machine tools with good spindles.

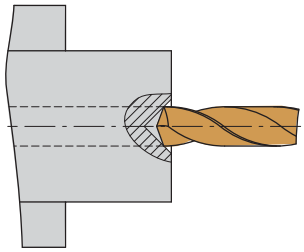
Rigid Machine Tool Recommended



Toolholding Systems

As with any drilling system, components of the entire system contribute to the quality of the machined hole, not just the drill itself. For maximum efficiency and accuracy, the following toolholding systems would be your best choices:

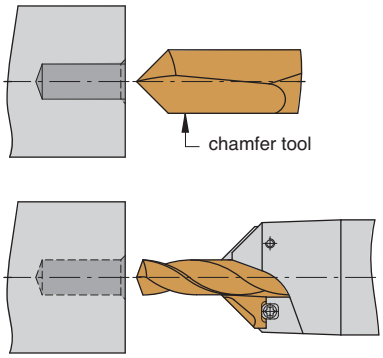
Wrong



Drilling and Chamfering

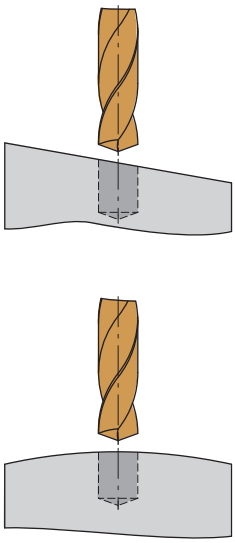
Drill into the solid first, then chamfer.

Correct



SEFAS – the optimum solution

Wrong



Drilling on Inclined Surfaces

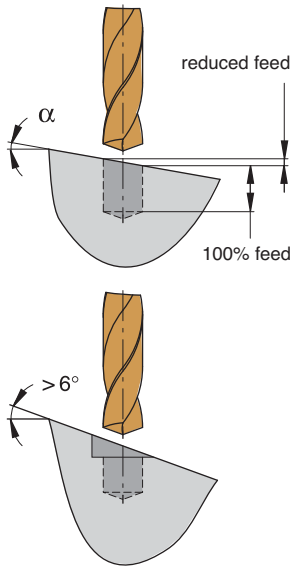
When drilling on inclined or curved surfaces, use a lower feed than the standard value. The reduction of feed required is dependent on the inclination angle of the workpiece surface and the drill type (see table).

reduced feed (% of standard value)

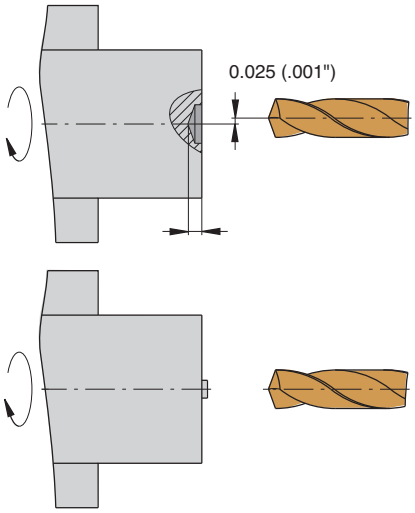
inclination α	SE210HP, SE224, SE261	TF105 SE211HP, SE212HP, SE225, SE226
1°	100%	80%
2°	80%-50%	80%-50%
3°	65%	50%
4°	50%	—
6°	30%	—

More inclined surfaces must be premachined with a mill.

Correct



Wrong



Drilling on Turning Machines

When drilling on turning machines, the drill must be on center. The tolerance range of the center position should not exceed ±.001.

On bar-turning lathes, do not drill into center pips or test drill holes. Cutoff tools must be mounted precisely.

Hole Depths Greater than 3xD

Hole depths that are deeper than three times the drill diameter may require a speed reduction. A 15% lower speed is suggested. Refer to the applicable KENNA PERFECT Workpiece Materials Group chart (page G126) for recommended operating parameters.

Solid Carbide Drills — General Application Instructions

Coolant

Kennametal drills are high-performance, solid carbide tools. To optimize their performance, they must be adequately cooled. With the proper coolant flow, tool life and higher maximum effective cutting speeds can be reached.

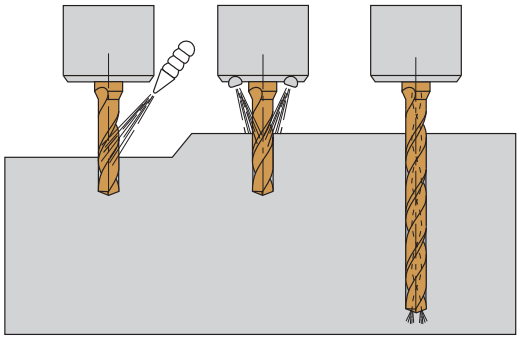
If not properly cooled, the drill will heat up rapidly. This causes the drill diameter to expand, which in turn may cause the drill to seize inside the hole.

Kennametal drills, with internal coolant channels, require deeper drilling depths to be effective. The higher the coolant pressure, the better the drilling results. Drill life and hole quality improve with ample coolant flow.

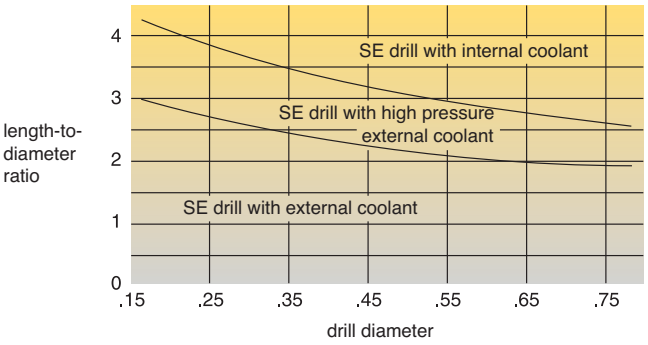
When using drills without internal coolant flow, try to get at least one coolant jet as parallel to the drill as possible.

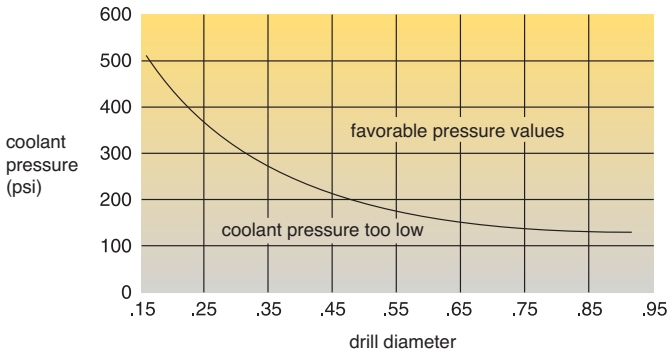
For short-hole applications, drills without internal coolant often may provide better tool life. The tool is more solid, and it does not suffer from thermal shock at the cutting edge. Typically, drills without internal coolant cost less.

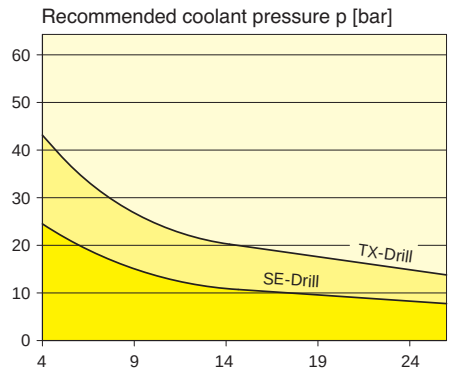
- Provide generous "volume" of coolant when drilling steels and when applying HTS drills in a vertical application to improve chip evacuation and increase tool life.
- It is important to use high coolant concentration to provide lubricity, which will aid in tool life, chip evacuation, and finer surface finishes.

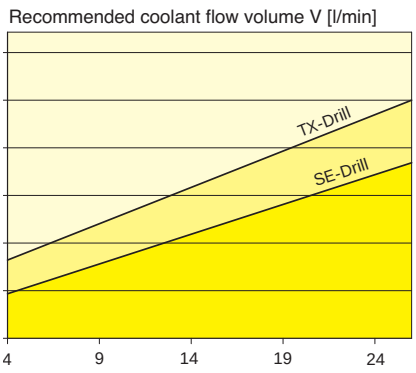


- High-pressure coolant, either through the tool or through a line adjacent and parallel to the tool, should always be considered for increased tool life and production.
- Do not use multi-coolant lines. Use one line with 100% of the flow capacity to evacuate the chips from the hole.



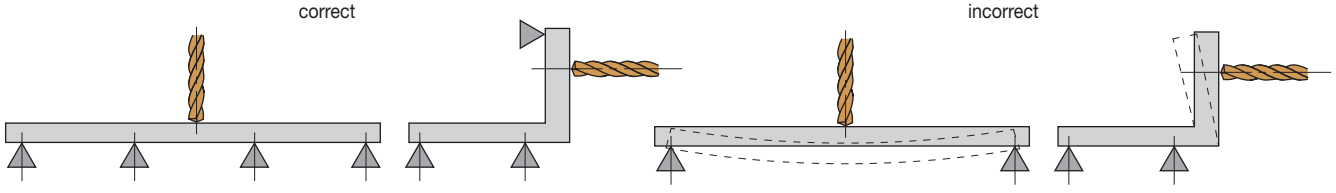


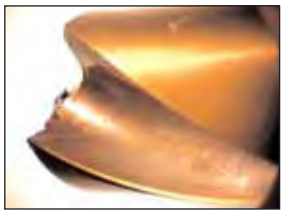




Workpiece Rigidity

Because solid carbide drills have much higher penetration rates, it is important that the workpiece has adequate support.

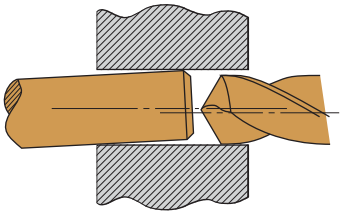
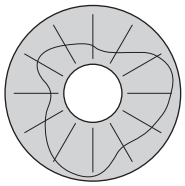
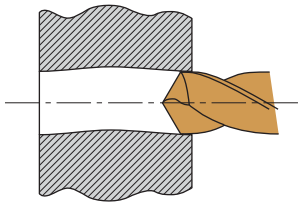


problem	*source*	*solution*
heavy wear on the cutting corners 	insufficient coolant	• Check cooling lubricant. In the case of internal coolant supply, increase coolant pressure. In the case of external coolant supply, adjust positioning of coolant jet. Cool from both sides.
	cutting conditions	• Reduce cutting speed, increase feed.
splintering on the chisel edge 	clamping chuck	• Check clamping accuracy. Use hydraulic clamping chuck or high-precision chucking system.
	cutting conditions	• Increase feed.
built-up edge 	insufficient coolant	• Check cooling lubricant. In the case of internal coolant supply, increase coolant pressure. In the case of external coolant supply, adjust positioning of coolant jet. Cool from both sides.
	cutting conditions	• Increase speed 20-30%.
splintering on the cutting edges 	clamping chuck	• Check clamping accuracy and torque transmission. Use hydraulic clamping chuck or high-precision chucking system.
	cutting conditions caused by built-up edge	• Check cutting values and, possibly increase cutting speed. • Examine regularly for built-up edge.
thermal checking/comb cracking 	cutting conditions	• Inconsistent/insufficient coolant supply.

(continued on next page)

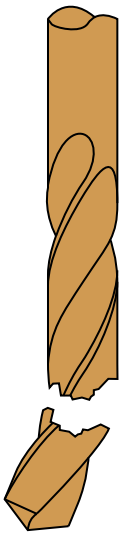
Solid Carbide Drills — Troubleshooting Guide

(continued from previous page)

problem	source	solution
heavy wear on the cutting corners 	workpiece movement	• Stabilize workpiece chucking and check stability of machine tool.
	insufficient coolant	• Check cooling lubricant. In the case of internal coolant supply, increase coolant pressure. In the case of external coolant supply, adjust positioning of coolant jet. Cool from both sides.
	wrong drill	• Check drill type, drilling depth, cooling system, and workpiece material.
	cutting conditions	• Check cutting parameters at exit. Reduce feed 15-20% prior to breakout.
hole too big 	cutting conditions	• Check cutting values, increase cutting speed, or reduce feed.
	clamping chuck	• Check clamping accuracy and torque transmission. Use hydraulic clamping chuck or high-precision chucking system.
	wrong drill	• Check drill diameter. Please notice that drills are ground to a positive tolerance. Check concentric running.
hole too small 	insufficient coolant	• Check cooling lubricant. In the case of internal coolant supply, increase coolant pressure. In the case of external coolant supply, adjusting positioning of coolant jet. Cool from both sides.
	cutting conditions	• Reduce cutting speed; increase feed.
	wrong drill	• Check cutting-edge diameter.
hole not cylindrical 	clamping chuck	• Check clamping accuracy and torque transmission. Use hydraulic clamping chuck or high-precision chucking system.
	workpiece movement	• Stabilize workpiece chucking and check stability of machine tool.
	wrong drill	• Check drill type and drilling depth. Use longer drills.
	cutting conditions	• Reduce feed at entry.

(continued on next page)

(continued from previous page)

problem	source	solution
drill breakage 	clamping chuck	• Check clamping accuracy and torque transmission. Use hydraulic clamping chuck or high-precision chucking system.
	workpiece movement	• Stabilize workpiece chucking and check stability of machine tool.
	wrong drill	• Check drill type, drilling depth, ooling system, and workpiece material.
	insufficient coolant	• Check cooling lubricant. In the case of internal coolant supply, increase coolant pressure. In the case of external coolant supply, adjust positioning of coolant jet. Cool from both sides.
	cutting conditions	• Check cutting values, and possibly reduce feed.
splintering on the cutting corners 	clamping chuck	• Check torque transmission. Use hydraulic clamping chuck or high-precision chucking system.
	workpiece movement	• Stabilize workpiece chucking and check stability of machine tool.
	wrong drill	• Check drill type, drilling depth, cooling system, and workpiece material. Possibly, use longer drill.
	insufficient coolant	• Check cooling lubricant. In the case of internal coolant supply, increase coolant pressure. In the case of external coolant supply, adjust positioning of coolant jet. Cool from both sides.
	cutting conditions	• Check cutting values and possibly reduce feed.

Solid Carbide Drill — TX Drill Applications

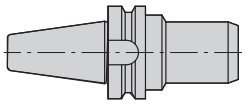
Fast, Tough, and Economical

TX drills are high-performance tools whose capacity can be fully utilized with the help of appropriate clamping fixtures. Kennametal hydraulic chucks are an ideal solution. They increase the productivity of the TX drill to the maximum level. Optimal concentricity and safe transmission of torque result in excellent repeatability and longer drill life. The simple handling of the adapters enables an easy length adjustment, even in the machine. Tool presetting costs are minimized. For more information about chucks, refer to the Systems Section of this catalog.

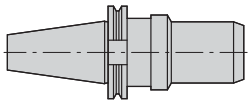
SEFAS Chamfering Rings

SEFAS chamfering rings can be mounted directly on Kennametal hydraulic chucks. High-precision drilled holes can be provided with a chamfer in the same operating cycle. The SEFAS compact tool also is compatible with TX drills. This tool style is particularly slim, enabling work in very narrow applications.

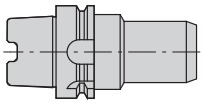
Hydraulic Chucks



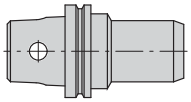
BT



CV

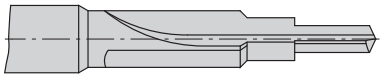


HSK

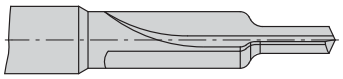


KM

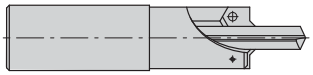
TX Drills



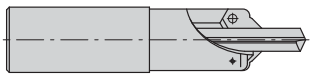
multi-stage drill (special)



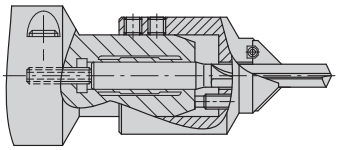
profile drilling tools (special)



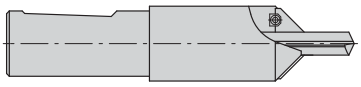
BF tool for drilling, chamfering, and spot facing



BF tool for drilling and profile countersinking

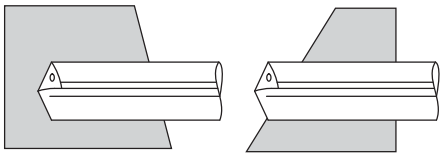


SEFAS chamfering ring for drilling and chamfering

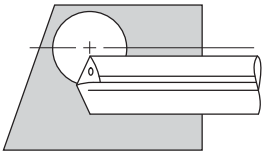


SEFAS drilling and chamfering

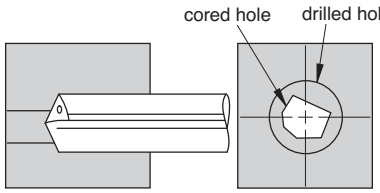
The excellent stability of the TX drill enables it to be used for drilling through inclined planes, intersecting holes, and cored holes.



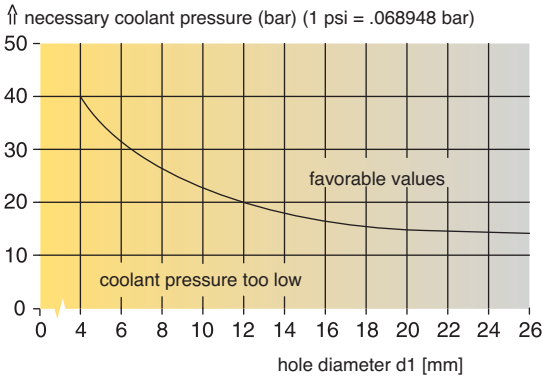
inclined planes



intersecting holes



cored holes

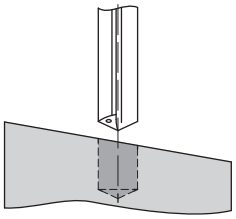


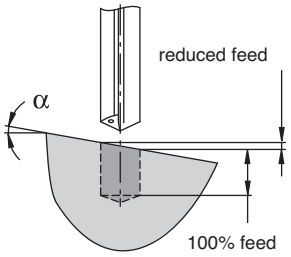
Coolant Pressure

The diagram at left shows the coolant pressure as a function of the hole diameter. The higher the coolant pressure, the better the drilling result. Tool life and hole quality improve with increasing coolant flow.

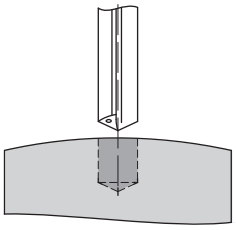
Drilling on Inclined Surfaces

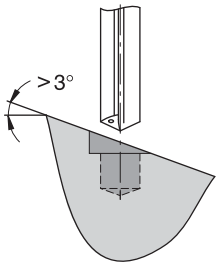
When drilling on inclined or curved surfaces, use a lower feed than the standard value. The feed reduction necessary depends on the angle of inclination of the workpiece surface. After the drill margins are fully engaged in the workpiece, increase the feed to the standard value (100%).





inclination α	reduced feed (% of standard value) TX411
1°	80%
2°	50%
3°	30%





Surfaces with a greater inclination need a spot-face (for example with a milling cutter).

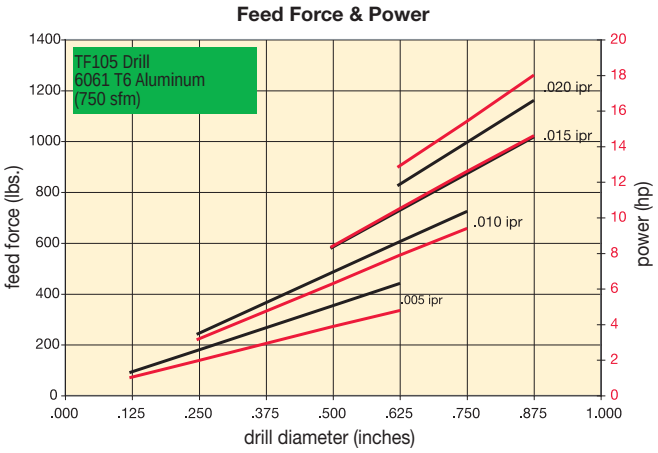
Solid Carbide Drills — Horsepower, Torque, and Thrust Values

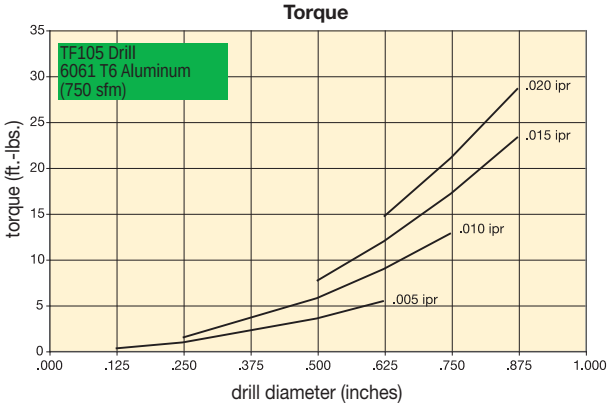
Graph Illustrations

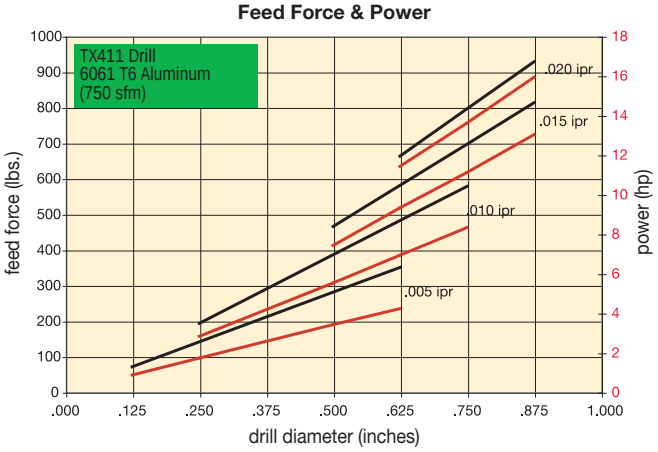
The following graphs represent actual drill values taken in an ideal machining environment under ideal operating conditions. This analysis was conducted in a machine lab with various scientific capabilities. Actual values may not be duplicated in a true manufacturing operation. In-plant results may be higher or lower, depending on a number of conditions or variables. Each graph is intended to be used as reference only. Horsepower and feed force are charted together since thrust is the largest component of overall horsepower consumed. Speeds and feeds used for the horsepower calculations are recommended starting speeds and feeds. Internal or external coolant was used during this evaluation, where applicable.

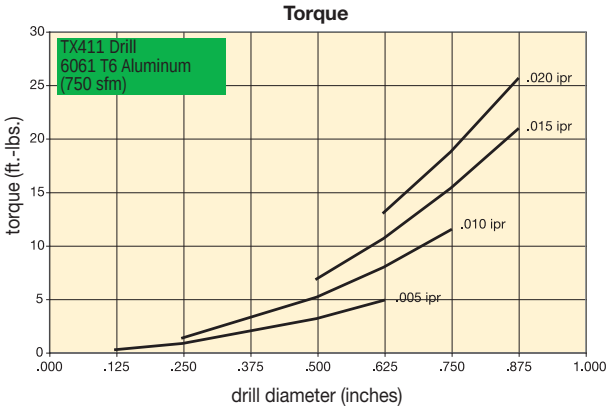
- Horsepower is calculated at the cut (HPc).

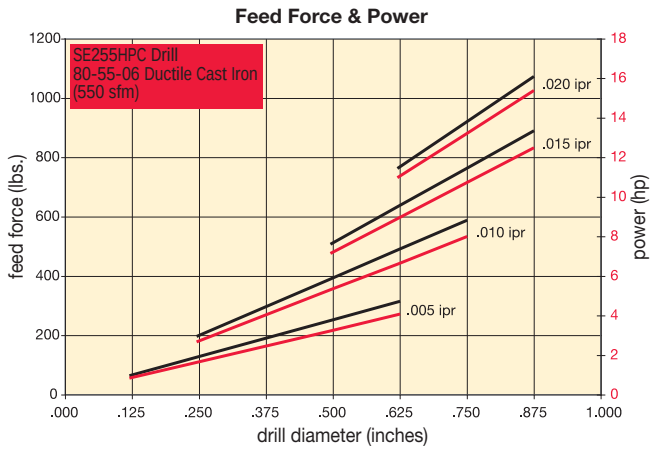
Horsepower Calculations — Aluminum

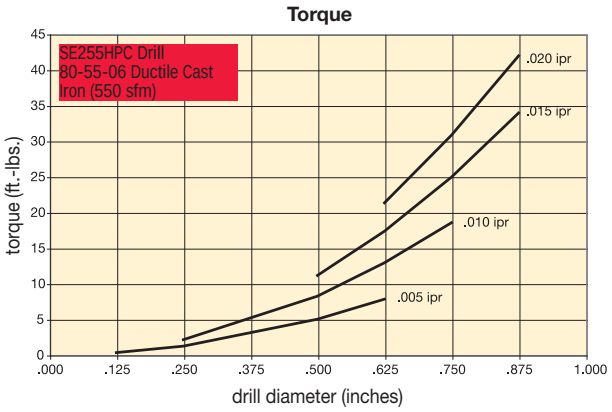


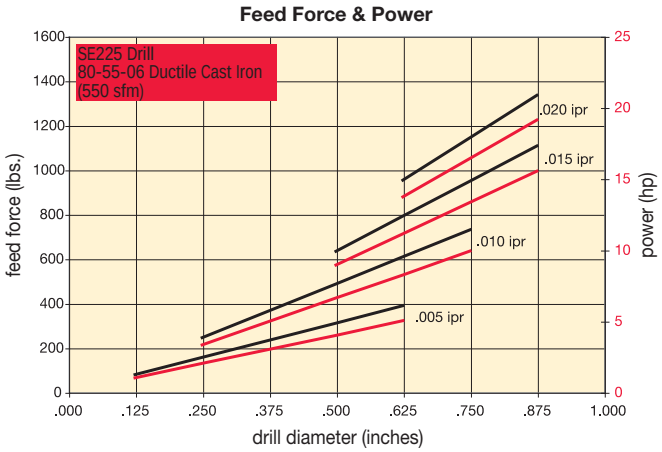


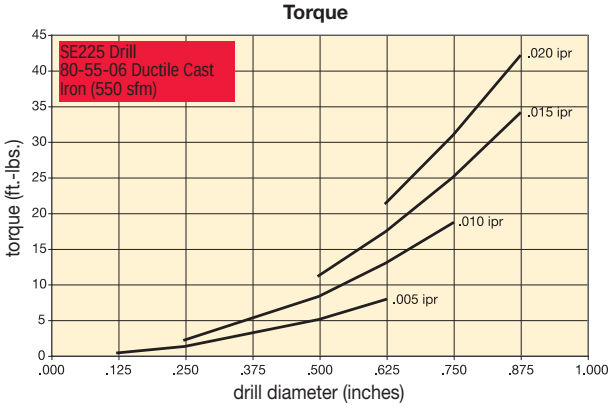





Feed Force & Power
SE255HPC Drill
80-55-06 Ductile Cast Iron
(550 sfm)
.020 ipr
.015 ipr
.010 ipr
.005 ipr
feed force (lbs.)
power (hp)
drill diameter (inches)
0
200
400
600
800
1000
1200
2
4
6
8
10
12
14
16
18
.000
.125
.250
.375
.500
.625
.750
.875
1.000

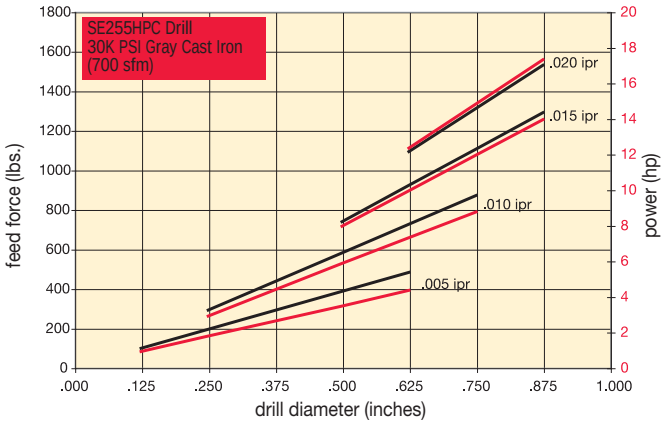

Torque
SE255HPC Drill
80-55-06 Ductile Cast
Iron (550 sfm)
.020 ipr
.015 ipr
.010 ipr
.005 ipr
torque (ft.-lbs.)
drill diameter (inches)
0
5
10
15
20
25
30
35
40
45
.000
.125
.250
.375
.500
.625
.750
.875
1.000


Feed Force & Power
SE225 Drill
80-55-06 Ductile Cast Iron
(550 sfm)
.020 ipr
.015 ipr
.010 ipr
.005 ipr
feed force (lbs.)
power (hp)
drill diameter (inches)
0
200
400
600
800
1000
1200
1400
1600
5
10
15
20
25
.000
.125
.250
.375
.500
.625
.750
.875
1.000

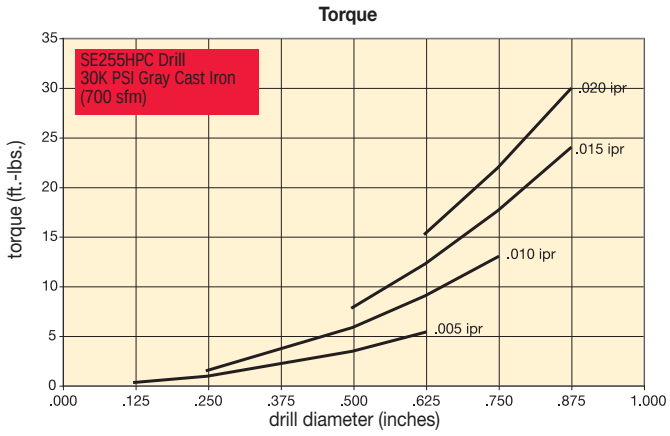

Torque
SE225 Drill
80-55-06 Ductile Cast
Iron (550 sfm)
.020 ipr
.015 ipr
.010 ipr
.005 ipr
torque (ft.-lbs.)
drill diameter (inches)
0
5
10
15
20
25
30
35
40
45
.000
.125
.250
.375
.500
.625
.750
.875
1.000

Solid Carbide Drills — Horsepower Calculations — Gray Cast Iron

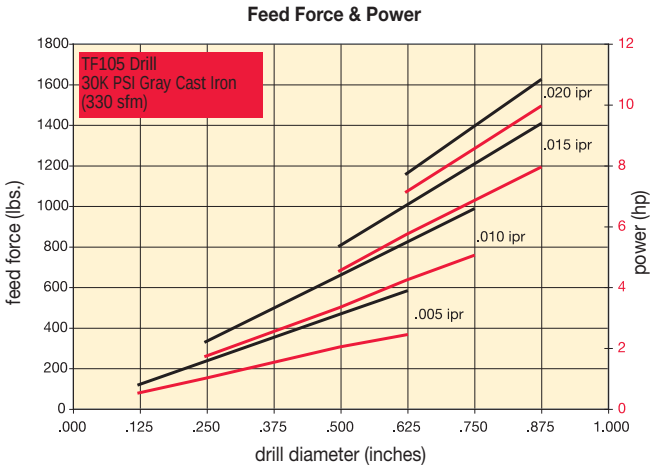
Feed Force & Power



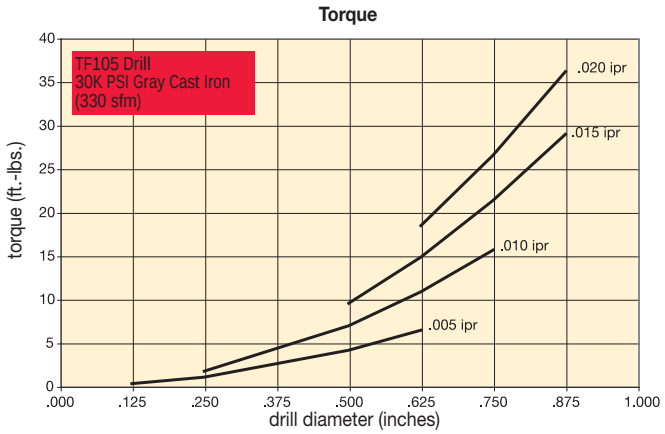
Torque



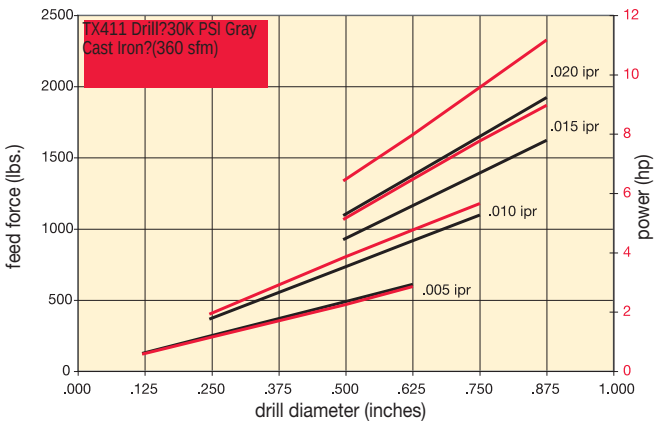
Feed Force & Power



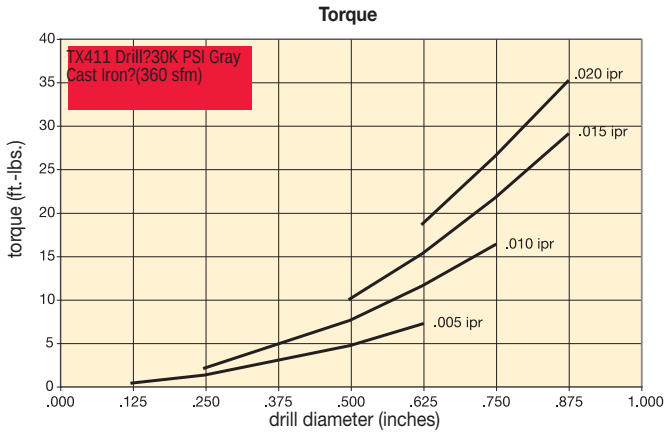
Torque



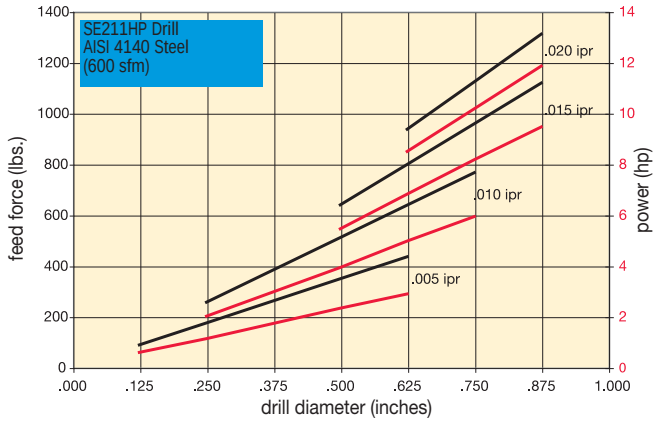
Feed Force & Power



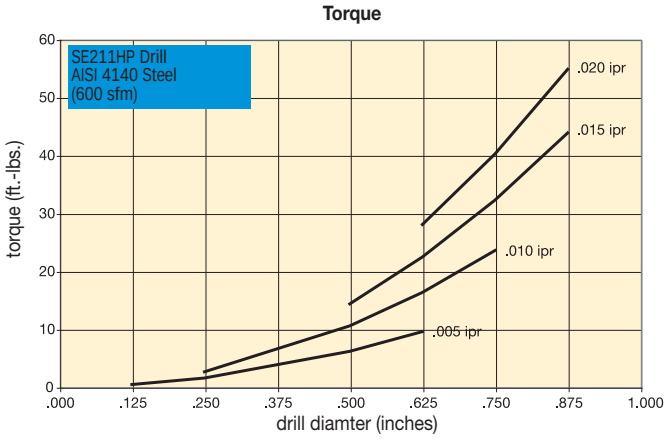
Torque



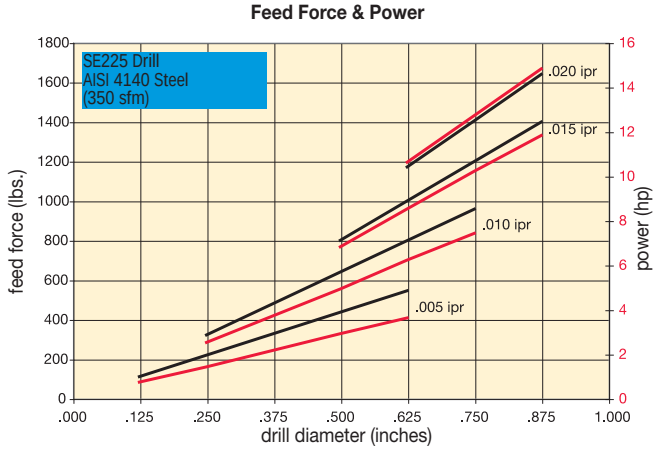
Feed Force & Power



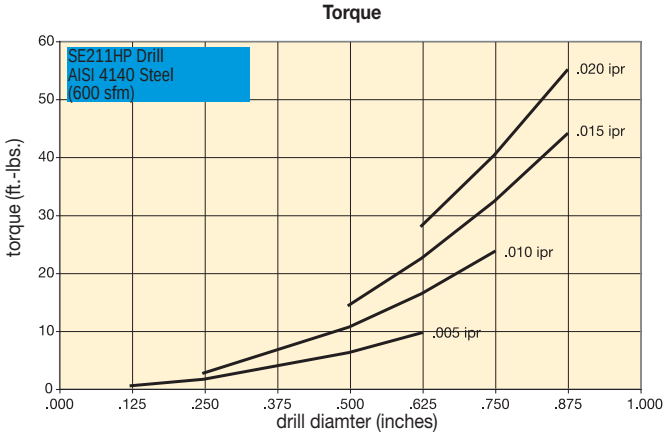
Torque



Feed Force & Power

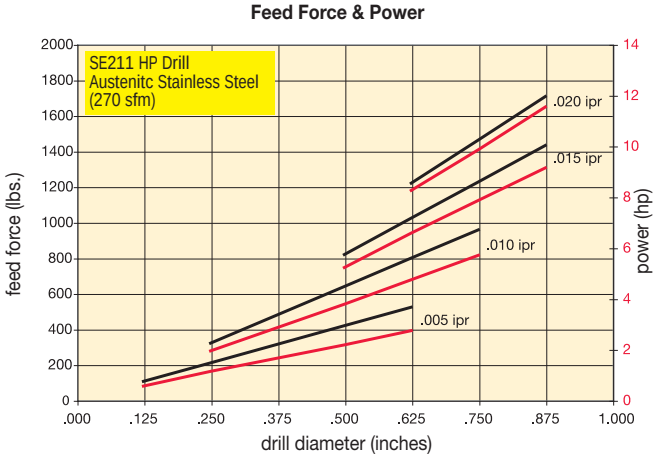


Torque



Horsepower Calculations — Stainless Steel

Feed Force & Power



Torque