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The Metalworking Innovators

WHITEPAPER

HIGH SPEED SPINDLES

WHAT ARE YOUR BEST OPTIONS?

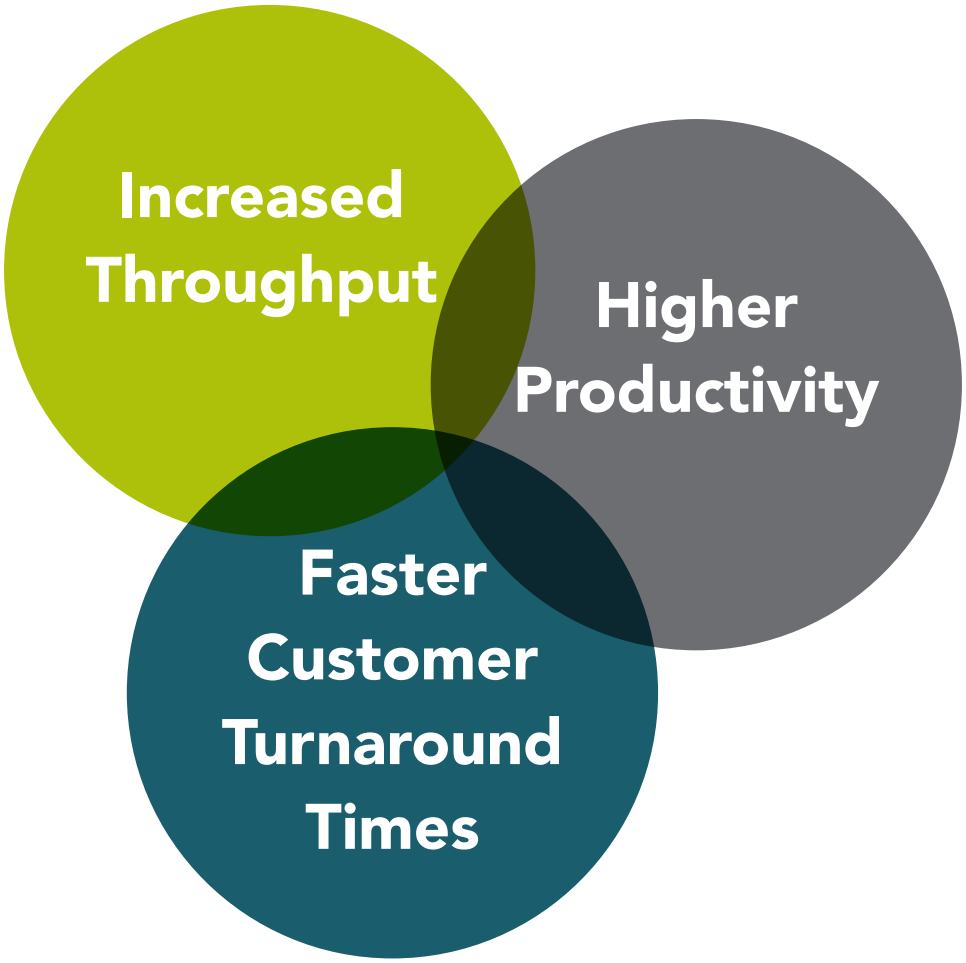
Mechanical Speed Increaser

Coolant Driven Speed Increaser

Electrical Speed Increaser

Air Driven Speed Increaser

Every machining company understands **the value of working at higher speeds.** These benefits include:

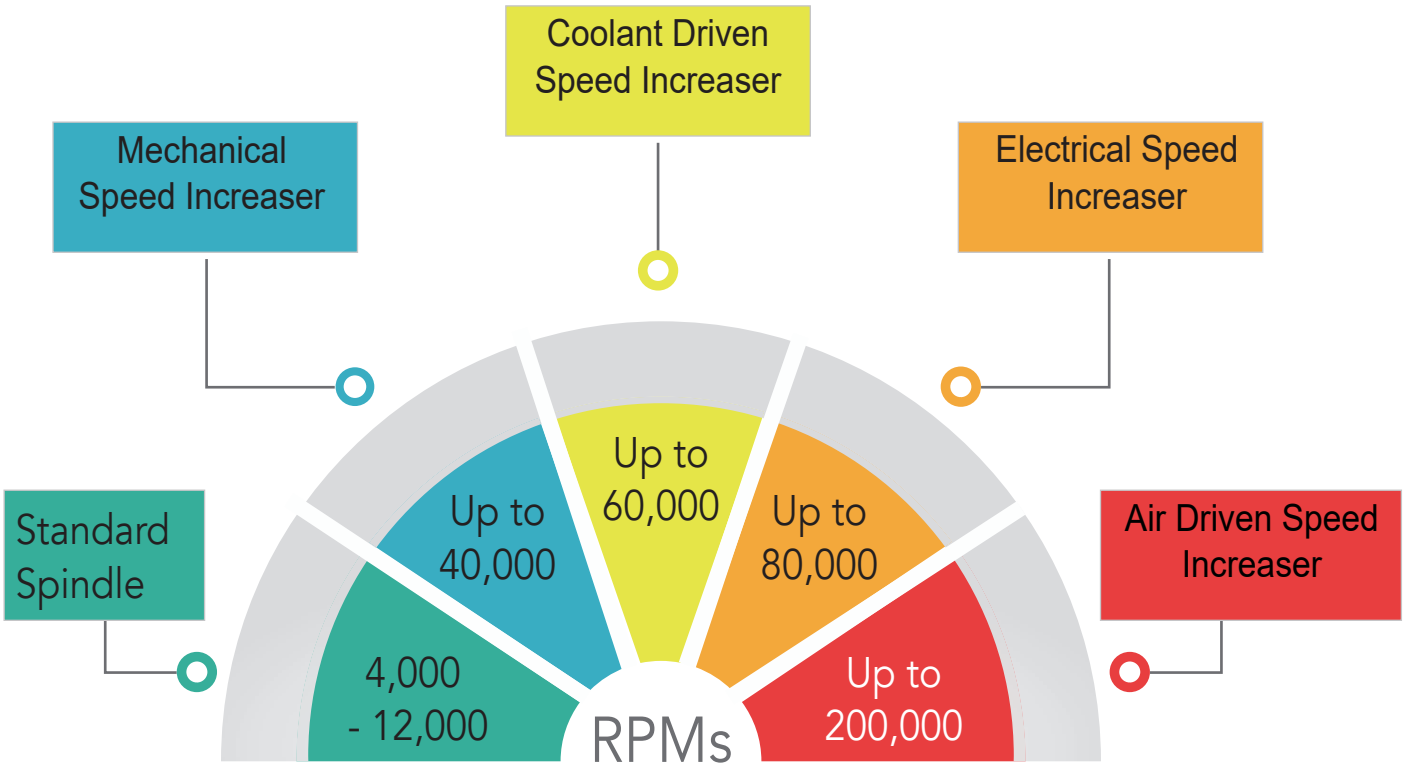


Additionally, it helps operators:

- **Extend machine tool life**
- **Reduce build-up edge**
- **Achieve good chip separation**
- **Create smoother surfaces**

Many companies assume they have to invest in a high speed machine to enjoy these benefits, but they are costly and much of their capacity often goes unused. Speed increasers are a less expensive and more practical alternative.

Today, there are a variety of speed increasers for CNC machines – electrical, mechanical, air driven and coolant driven – and each has its own advantages and disadvantages.



AS YOU EVALUATE YOUR OPTIONS, THERE ARE A FEW KEY QUESTIONS TO ASK YOURSELF IN THE PROCESS:

Can torque be regulated as well or does it just govern RPMs?

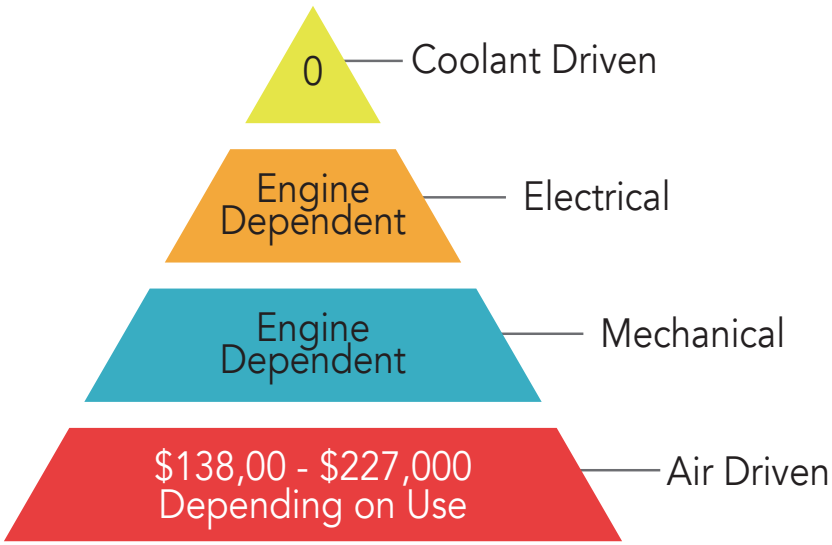
What are the achievable speeds? Will they be fast enough to meet manufacturer specifications to maximize tool life?

How is it powered? How expensive will it be to run on a daily basis?

Does the speed increaser fit the operations and applications that you typically run?

Can it fit seamlessly with ATCs and tool magazines to keep processes automated?

What modifications need to be made to the CNC machine itself to accommodate the speed increaser?



Annual Incremental Operating Costs

REAL-TIME SPEED DISPLAYS

✓ **Coolant Driven Speed Increaser**

✓ **Electrical Speed Increaser**

X Air Driven Speed Increaser

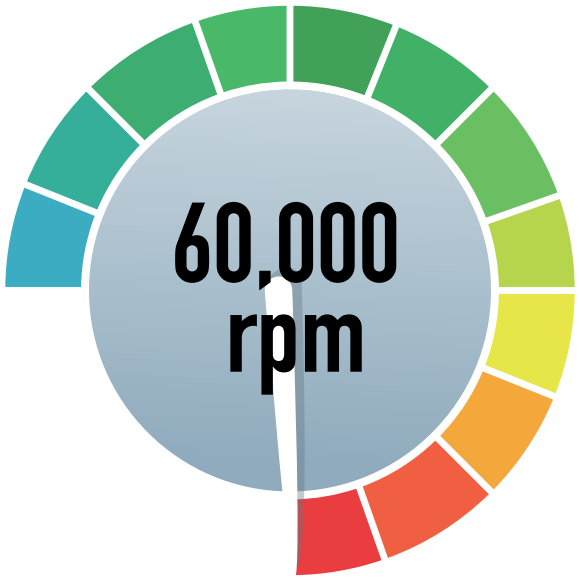
X Mechanical Speed Increaser

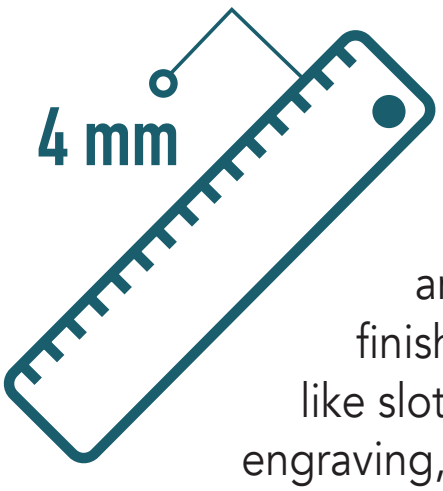
X Standard Spindle

In the following section we'll take a look at the pros and cons of each type of speed increaser. Keep these questions in mind as you review individual solutions to help clarify the decision-making process and ensure that you end up with the solution that best suits your machine environment, job requirements and budget.

COOLANT DRIVEN SPEED INCREASERS

This technique is one of the newest advancements in the HS market and uses the CNC machine's coolant to power the spindle to speeds up to 60,000 RPMs.

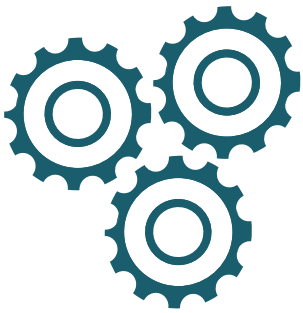




Coolant driven speed increasers support all small tool applications (under 4 mm) and are particularly useful in semi-finishing and finishing applications like slot milling, profile milling, engraving, internal threading, etc.

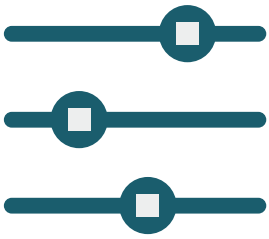
Because they use the machine's existing resources, these speed increasers have an extremely compact design.

With no external cables or pipes, the head can be stored in the turret magazine and changed out by the ATC to be used like any standard machine tool.



No additional power is needed to run the high speed spindle which eliminates auxiliary operating expenses for each job.

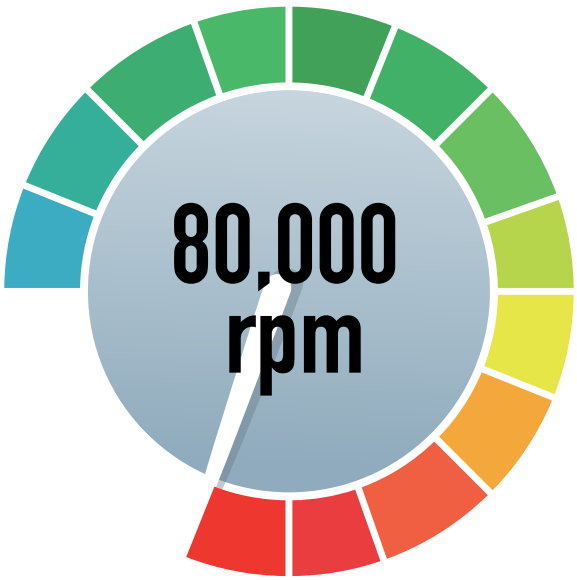
Because there is no way to adjust torque as RPMs increase, you will need to make adjustments in cutting applications and instead use more light cuts to complete the process.

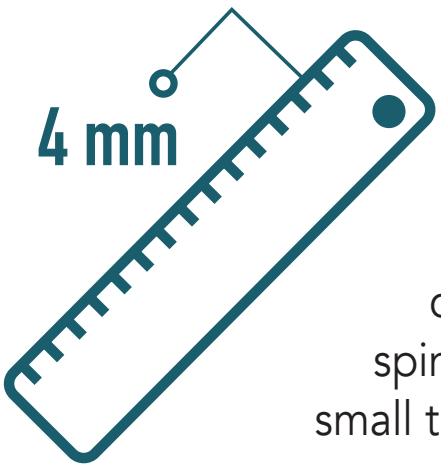


ELECTRIC SPEED INCREASERS

Electric speed increasers have a motor that is an integral part of the spindle shaft and housing assembly. Typically, the spindle shaft is kept positioned with a set of ball bearings.

Today, there is a wide range of engines with different horsepower options and speeds up to 80,000 RPMs.

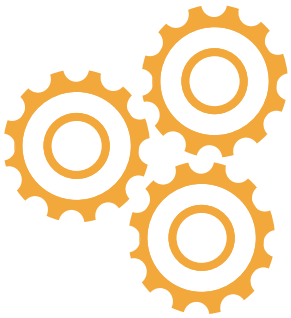




In this case, an electrical motor with a separate controller is attached to the spindle to increase speeds for small tool applications (under 4 mm).

Electric speed increasers must be manually installed prior to use and they do not integrate with ATCs and tool magazines.

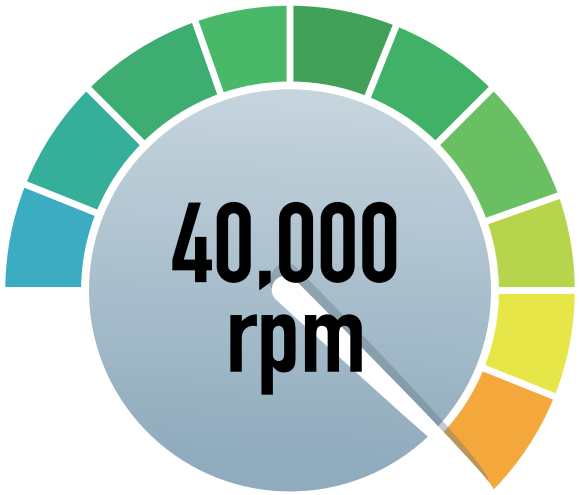
Although the power draw is not as large as the CNC machine's itself, companies will see an incremental increase in utility bills with this type of speed increaser.

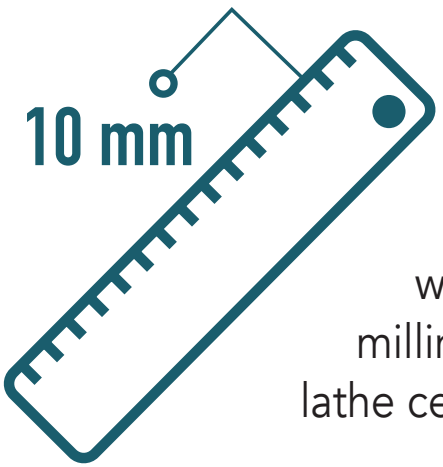


When using electric speed increasers, keep the ball bearings fully lubricated to ensure optimal functioning.

MECHANICAL SPEED INCREASERS

Mechanical speed increasers use gears or belts attached to a separately located engine to boost spindle speeds to a maximum of 40,000 RPMs.





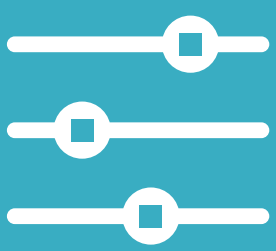
This solution supports large solid carbine cutting tools (10 mm and above) and works well with transfer machines, milling machines, drilling machines, lathe centers and grinding machines.

Because the engine remains separate from the CNC machine itself and doesn't have to fit inside the existing bore, operators can use an engine big enough to supply the torque required for the job at hand.

If there are any issues with the existing CNC machine spindle, it will impact the mechanical speed increaser. Existing runout will be transferred to the new solution and the excess vibration will put undue stress on the bearings and gears inside.

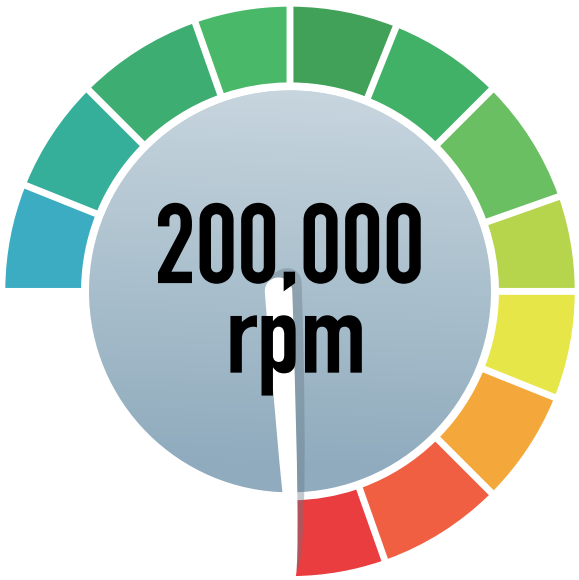
While mechanical speed increasers are not difficult to install, they will require operator involvement to run jobs. Because they are external to the spindle itself, mechanical speed increasers don't interrupt ATC and tool magazine functionality.

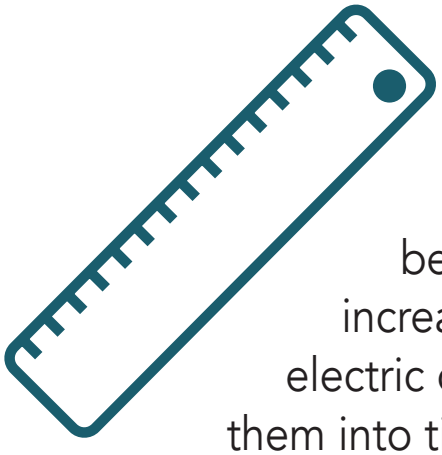
Ongoing operating costs vary based on the type of motor being used to power the solution; however, the initial investment tends to be lower than with other types of speed increasers.



AIR DRIVEN SPEED INCREASERS

With this method, the speed increaser uses compressed air to spin the tool inside the turbine drive to speeds up to 200,000 RPMs – although most typically they are operated at speeds under 60,000 RMPs.

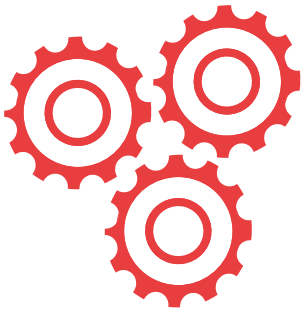




This approach supports most small tool applications except lathe applications. However, because many air driven speed increasers are physically longer than electric options, it may be difficult to fit them into tight spaces like screw machines.

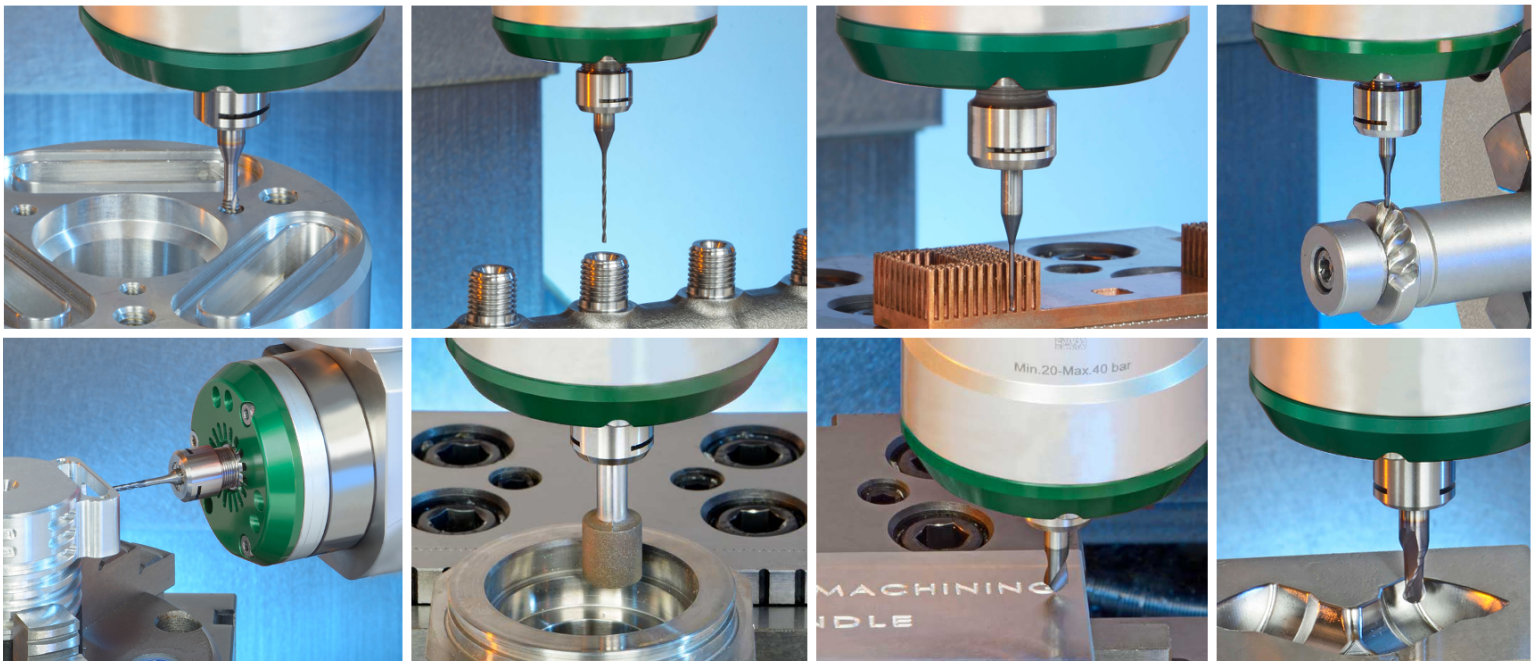
In many ways, air driven solutions are the most difficult to install. Because 95% of modern CNC machines don't have a built in air supply, choosing an air driven speed increaser requires operators to install a dedicated system or an additional hose with an earmarked regulator to manually control air flow and spindle speed.

Operator intervention is required with this option because air driven speed increasers don't work with ATCs or the common turret model of milling machines.



Because they rely on clean, compressed air for power, they can be expensive to operate on a daily basis – averaging between $138,000 and $227,000 annually.

Companies that use air driven spindles to run at extremely high speeds need to understand that there are torque tradeoffs – these solutions can't take on heavy cutting operations. Operators should be aware that this option works best with finer applications.



Applications

Coolant Driven Speed Increaser	All Small Tool Applications (up to 4 mm)
Electrical Speed Increaser	All Small Tool Applications (up to 4 mm)
Mechanical Speed Increaser	Large Tools (10 mm and up) Solid Carbine Cutting Tools
Air Driven Speed Increaser	Small Tool Applications with the Exception of Lathe, Certain Models have Additional Exceptions

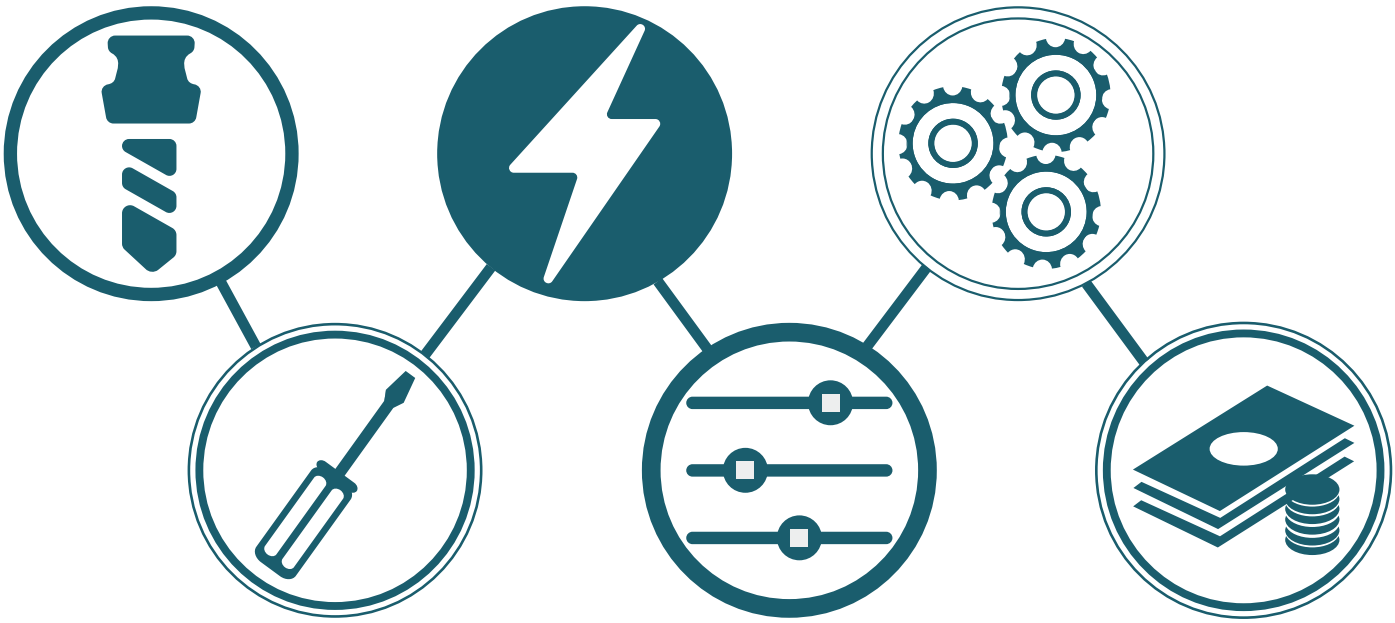
	Standard Spindle	Coolant Driven	Air Driven	Electrical	Mechanical
Torque Adjustment		X	X	✓	✓
ATC/Tool Magazine Integration	✓	✓	X	✓	X
CNC Machine Alterations	X	X	✓	X	X
Operator Intervention Prior to Use	X	X	✓	✓	✓

When choosing a speed increaser, start by finding one that meets your speed and application requirements. Once you have narrowed that down, it's important to find the least disruptive solution available. If you're going for speed, you don't want a solution that continuously requires operator intervention. Not only will it delay the job, manual interference can impact the quality of the finished product.

Of course, there are financial implications to consider as well.

Beyond purchase price, you need to be sure that the additional revenue generated from increased throughput covers any incremental costs generated from running at higher speeds.

While you may be in a hurry to purchase a speed increaser for a CNC machine spindle, it's important to take your time during the decision making phase to ensure that you're investing in the solution that works best for your company, your customers and your bottom line.



WANT TO HEAR MORE ABOUT COLIBRI SPINDLE SPEED INCREASERS

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