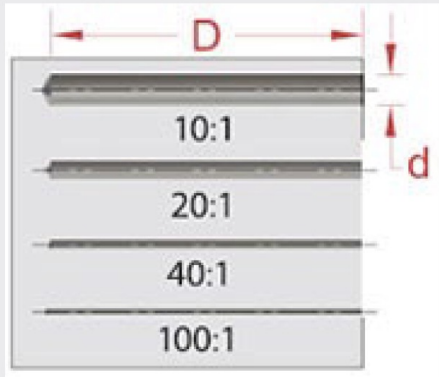


## Deep Hole Drilling

- Machines
- Automation
- Applications

Headquarters in Menomonee Falls, Wisconsin, USA

# Definition of Deep Hole Drilling



Depth to diameter ratio

## HOLE DEPTH : DIAMETER (D:d)

- 5:1 Common twist drills
- 10:1 High performance twist drills with through-tool coolant
- 20:1 Special deep hole drilling tools with through-tool coolant
- 100:1 Deep hole drilling tools on dedicated deep hole drilling machines
- 200:1 Gundrilling tools on high performance gundrilling machines
- 400:1 Extreme drilling range, proprietary processes and equipment required

We use a “Depth to Diameter” ratio to put dimension to deep holes.

Example:

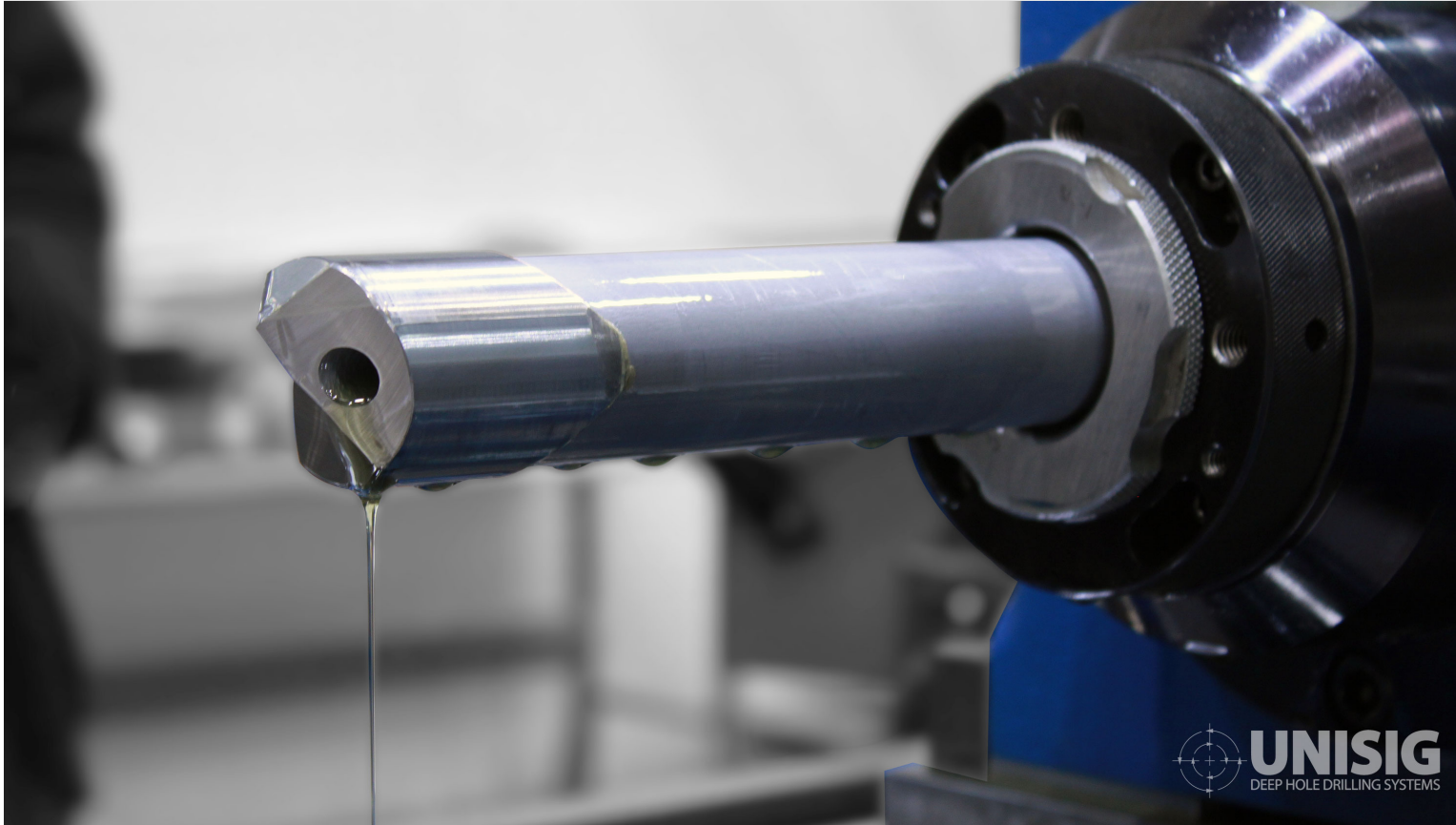
**1.00 inch diameter 4 inches deep  
= 4:1 ratio [not deep]**

**0.20 inch diameter 4 inches deep  
= 20:1 ratio [deep hole]**

**0.04 inch diameter 4 inches deep  
= 100:1 ratio [very deep hole]**

Depth to Diameter Ratio

## Gundrilling vs. Deep Hole Drilling

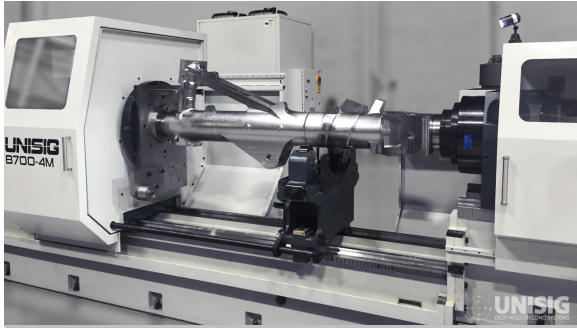


**Gundrilling** is often used as a catch-all term for deep hole drilling. It is incorrectly applied in many cases.

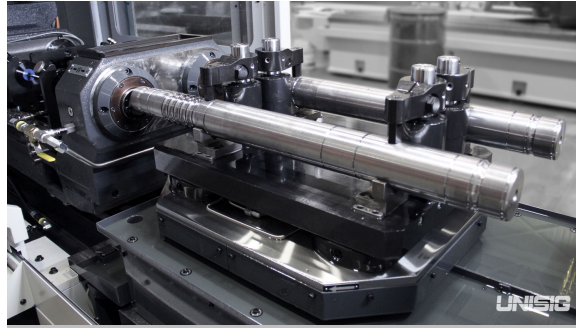
The word “gundrill” actually refers to one specific type of tool used to drill deep holes.

**Deep Hole Drilling** refers to any process that creates holes with a depth to diameter ratio not normally possible with conventional tools.

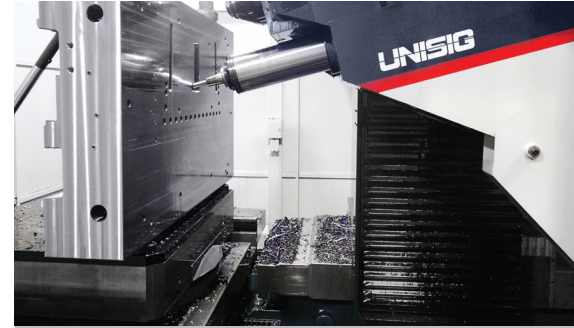
# Industry Applications for Deep Hole Drilling



**Aerospace**



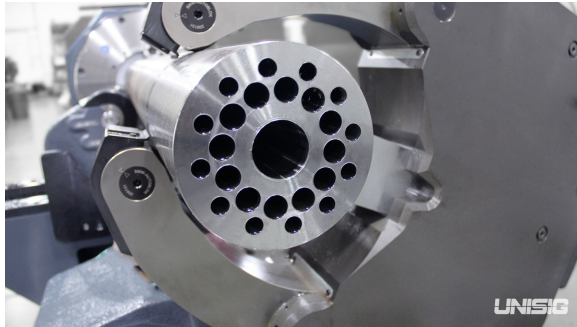
**Automotive**



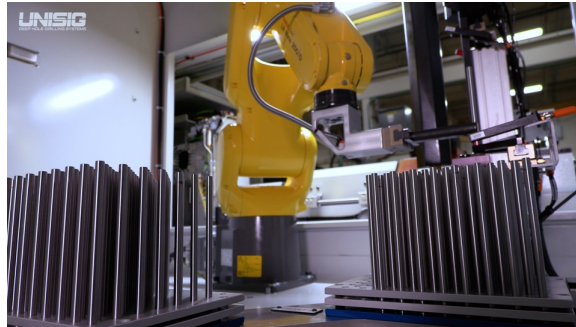
**Mold**



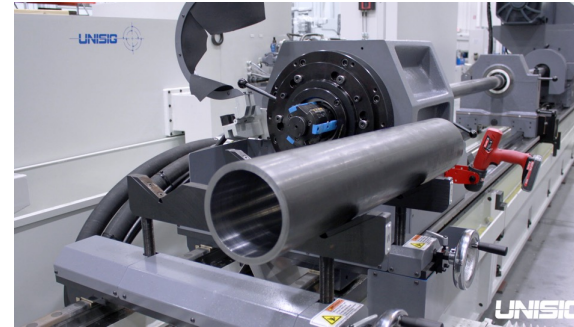
**Defense/Firearms**



**Oil and Gas**



**Medical**

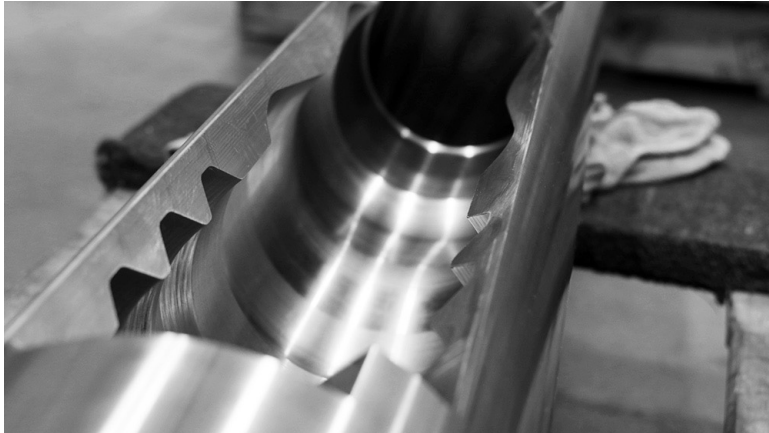


**Agriculture/Construction**

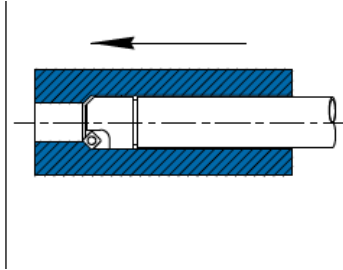


**Job Shop**

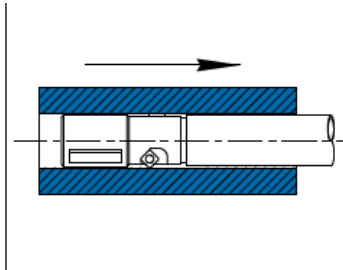
# Deep Hole Machining (not just drilling)



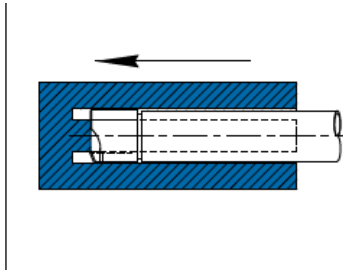
**PUSH-COUNTER BORING/ REAMING**  
20 - 630 mm  
[0.79 - 24.8 in]  
*External coolant*



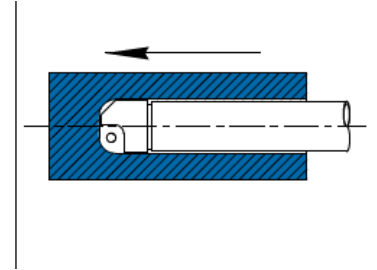
**PULL BORING**  
20 - 630 mm  
[0.79 - 24.8 in]  
*External coolant*



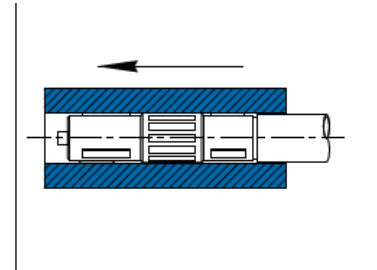
**TREPPANNING**  
20 - 500 mm  
[0.79 - 20.0 in]  
*External coolant*



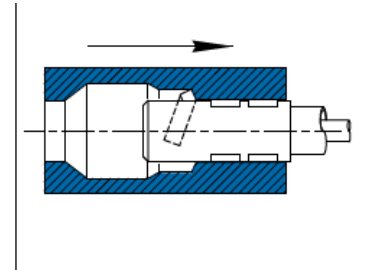
**BOTTOM FORMING**  
20 - 500 mm  
[0.79 - 20.0 in]  
*External coolant*



**SKIVING AND ROLLER BURNISHING**  
20 - 500 mm  
[0.79 - 20.0 in]  
*External coolant*



**BOTTLE BORING**  
Special application  
*External coolant*



## Can you drill deep holes on a CNC machining center?



Gundrilling on a machining center at UNISIG.

Yes, CNC machining centers can drill deep holes, in certain applications.

- Very productive in certain cases where holes aren't extremely deep and tolerances are forgiving.
- Limitations with very deep holes requiring close tolerances and high process reliability.
- Large diameter holes exceed the power, torque, thrust, coolant flow and chip removal and dimensions of machining centers.

# How deep can you drill with a deep hole drilling machine?



A UNISIG B-Series machine capable of drilling 40 feet [12 meters] deep

Hole depths are mainly limited by the tooling and equipment available, not the process itself.

- 40ft and longer is possible in larger diameters.
- Depth to diameter ratio is the determining factor.

## What kind of tools are used for deep hole drilling?



Common tools for drilling deep holes from solid.

There is not one universal tool used in deep hole drilling.

There is a wide range of tooling available, each designed for a specific area of application need.

Common examples:

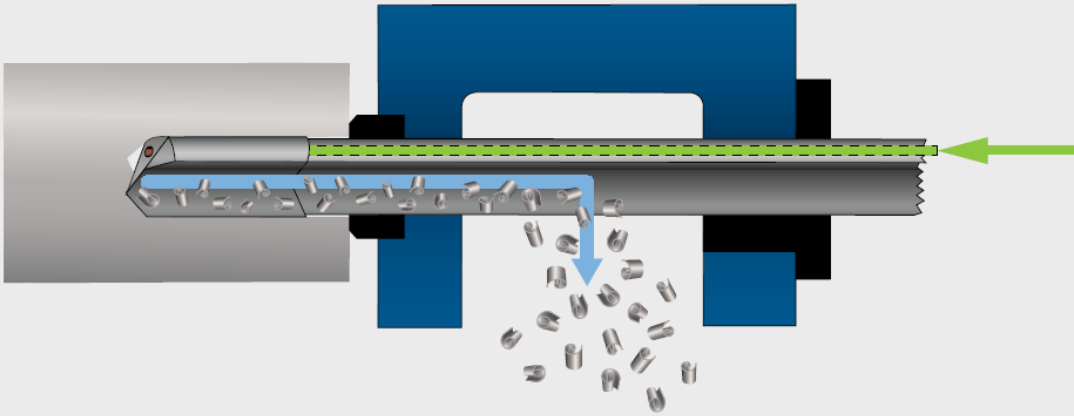
- Solid carbide gundrills
- Brazed gundrills
- Indexable gundrills
- Brazed BTA drills
- Indexable BTA drills



# Primary Deep Hole Drilling Tool Systems

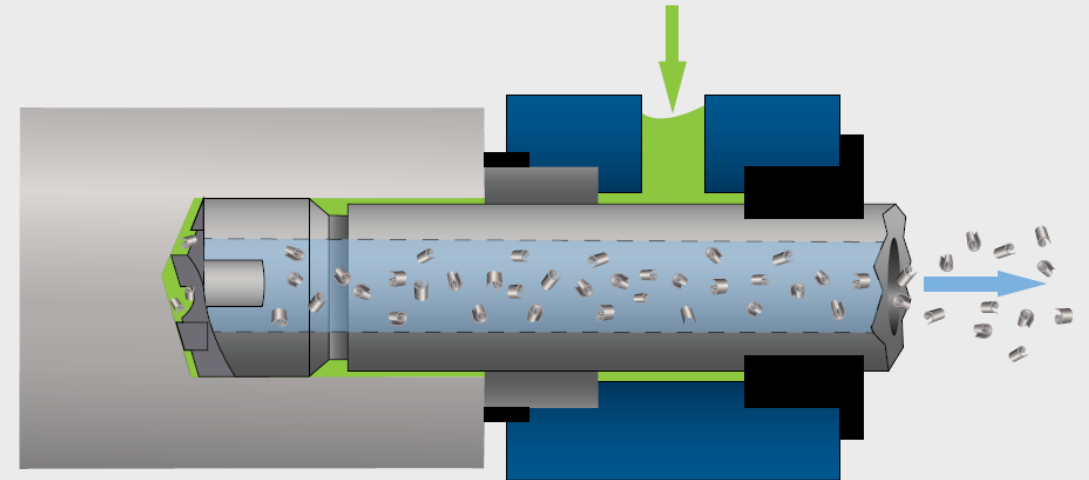
## GUNDRILL

Internal Coolant Delivery  
External Chip Exhaust



## BTA

External Coolant Delivery  
Internal Chip Exhaust



# Gundrill



Gundrilling tools

## Gundrill

Single flute, self-piloting tool used to drill deep holes.

Coolant is introduced through the tool. Chips are exhausted outside the tool.

Typical hole size range 0.8 - 50 mm  
[0.03 – 2.0 inch]

## BTA Drill



BTA tools – Boring and Trepanning Association

### **BTA Drill**

Self-piloting tool for deep hole drilling and machining.

BTA stands for “**Boring and Trepanning Association.**”

Many tool manufactures produce tools using this concept.

Coolant is introduced around the tool. Chips are exhausted through the center of the tool.

Typical hole size range  
13mm – 300mm [0.50 – 12.00 inch]

# Hole quality?

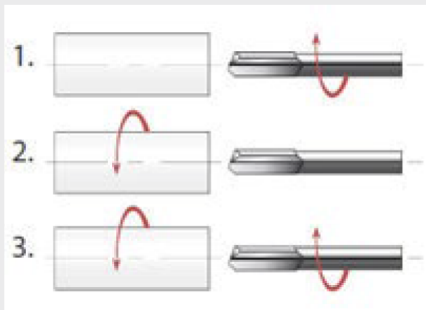
PROCESS	CONFIGURATION	HOLE SIZE	HOLE STRAIGHTNESS		SURFACE FINISH	
			(inch/foot)	(mm/meter)	μ-inch Ra	μ-m Ra
Gundrilling	Tool rotate- Work rotate	IT6-IT11 (heavily influenced by work material)	0.001-0.004	0.08-0.33	8-248	0.2-6.3
	Tool stationary- Work rotate		0.002-0.006	0.16-0.5		
	Tool rotate- Work stationary		0.012	1.00		
BTA • Solid drilling • Trepanning • Counter-boring	Tool rotate – Work rotate	IT8-IT10	0.001-0.003	0.08-0.25	60-125	1.5-3.2
	Tool stationary – Work rotate		0.003-0.005	0.25-0.42		
	Tool rotate – Work stationary		0.012	1.00		
Pull boring	Tool rotate- Work rotate	IT7-IT9	0.001	0.08	32-125	1.5-3.2
Skive-burnishing	Tool rotate- Work stationary	IT8-IT9	as received	as received	< 8.0	< 0.2

Each application is different, but in general deep hole drilling tools can be applied in close tolerance applications.

Deep Hole Drilling tools by design produce high quality holes.

- Self-piloting tools burnish the hole as they drill, so roundness, finish and diameter tolerance is very well controlled.
- Hole straightness is superior to other methods, particularly as the hole gets deeper.
- Specialized tooling is available for improving finish and tolerances, such as skiving and roller burnishing.

# Improving Concentricity



Tool and workpiece rotation

**1. ROTATING TOOL** - Typically used for non-symmetrical components, or off-center hole requirements

**2. ROTATING WORKPIECE** - Used for round parts with a deep on-center hole, and allows for a reduction in drill drift.

**3. COUNTER-ROTATING TOOL AND WORKPIECE** - Used for round parts with a deep on-center hole, provides the best hole straightness and concentricity.

The drilling process type will improve drill drift in concentric holes:

Rotating tool only  
= poor concentricity

Rotating work only  
= better concentricity

Counter-rotating tool and work  
= best concentricity

Three drilling process types

# Can deep hole drilling be automated?



UNISIG Deep Hole Drilling Automation

Automation in deep hole drilling is very common.

- Increases spindle utilization
- Improves workpiece quality
- Reduces setup and changeover time
- Reduces costs

# More questions?

English • Careers • Contact Us • Request A Quote

Machine Finder   Products   Industries   Information & Resources   Parts & Service   Blog   About UNISIG

## Knowledge Center



**Deep Hole Drilling Videos**  
Find videos of machines, processes, automation, and more.

Watch Videos >



**What is Deep Hole Drilling?**  
Learn what deep hole drilling is, when it's used, and capabilities across applications.

Read more >



**Case Studies**  
Read about proven applications and benefits of UNISIG machines.

Read Studies >



**Downloads**  
Find technical reference information and deep hole drilling downloads.

Read more >

## Search Resources

Type of Resource  Process Type

Industry  Machine Type



UNISIG to Focus on Engineered Automation for Gundrilling at EASTEC

During EASTEC 2023, visitors to UNISIG booth 1117 will learn how automation takes deep hole drilling machine efficiency and productivity to new levels. Company experts will be on hand to discuss how engineered automation is routinely included in deep hole drilling machine cells and can be machine mounted or used to



Hybrid Milling/Drilling Machine Reduces Total Mold Machining Time

As appeared in [MoldMakingTechnology.com](#)

MSI Mold Builders (MSI) of Cedar Rapids, Iowa, and Greenville, South Carolina, specializes in designing and building large-tonnage prototype and production molds for use in the



2022 UNISIG Main Product Catalog

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[Read More](#)

with various machines is primarily determined by the fluid delivery and chip exhaust systems. The two most common deep hole drilling systems are gundrilling and BTA.

Innovations by tooling manufacturers have caused machines to require an array of specialized options to support various fluid delivery and discharge strategies.

UNISIG will provide application advice after reviewing part drawings, tolerance requirements and production volume. Feed and speed recommendations are made by UNISIG based on reputable tooling manufacturer's technical data and our experience drilling many varieties of standard and exotic materials.



Ejector 20-200 mm [0.79 - 7.87 in]

Internal and external coolant

High-pressure coolant is introduced through the space between the inner and outer tubes

Chips are discharged through the inside diameter of the inner tube and exhausted through an adapter mounted to the front of the machining spindle

Typically used to retrofit lathes or machining centers for deep hole drilling

Chip evacuation is not as efficient as a BTA system, due to smaller area for chips and fluid discharge

Limited depth to diameter ratio compared to BTA system

## Drilling Methods

Internal and external coolant

Internal and external coolant

Internal and external coolant

Internal and external coolant

Internal and external coolant

Internal and external coolant

Internal and external coolant

Internal and external coolant

Internal and external coolant

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Internal and external coolant

Internal and external coolant

## ADDITIONAL TOOLS FOR USE ON BTA MACHINES

**PUSH-COUNTER BORING/REAMING**  
20 - 630 mm [0.79 - 24.8 in]  
External coolant

Internal and external coolant

Internal and external coolant

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## Applications and Tolerances

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## BTA Drill Tube Size and Solid Drill Diameter Standards

Internal and external coolant

Internal and external coolant

Internal and external coolant

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The tolerances provided are estimates, commonly quoted by tool manufacturers by applications with depth to diameter ratio up to 100:1 and under optimal conditions. As with any machining process, achieved tolerances depend on several factors: process parameters, workpiece condition or dimensions, tool geometry, demand from chip formation, production and tool life, cutting fluid, etc. Individual results may vary.