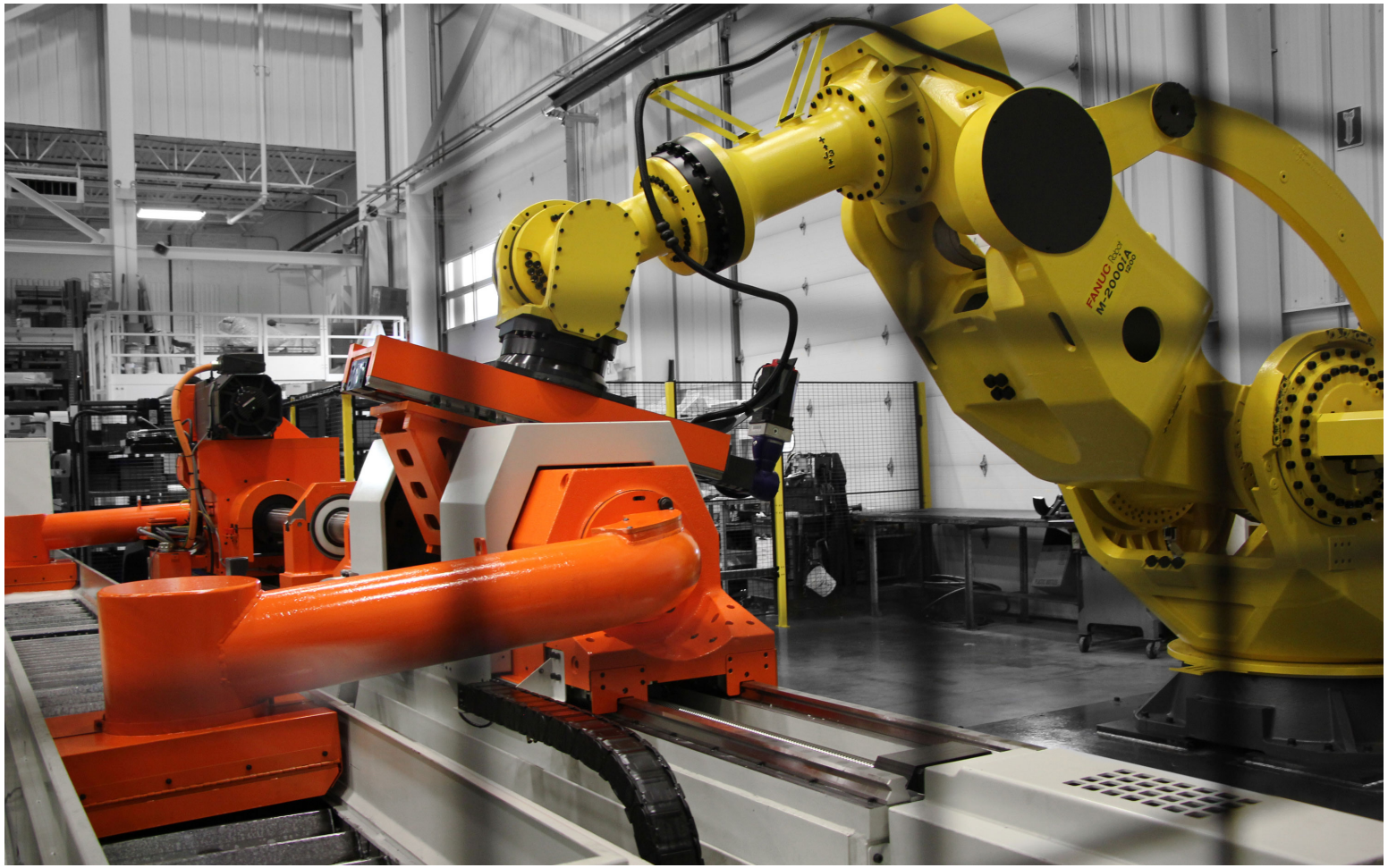


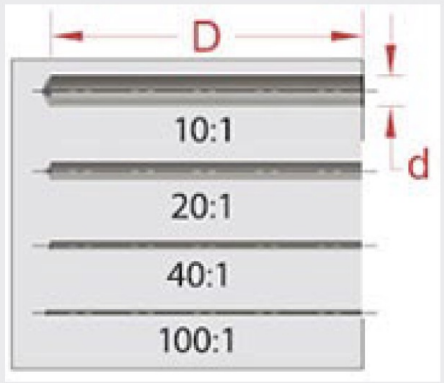
UNISIG
DEEP HOLE DRILLING SYSTEMS

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

Depth to Diameter Ratio

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

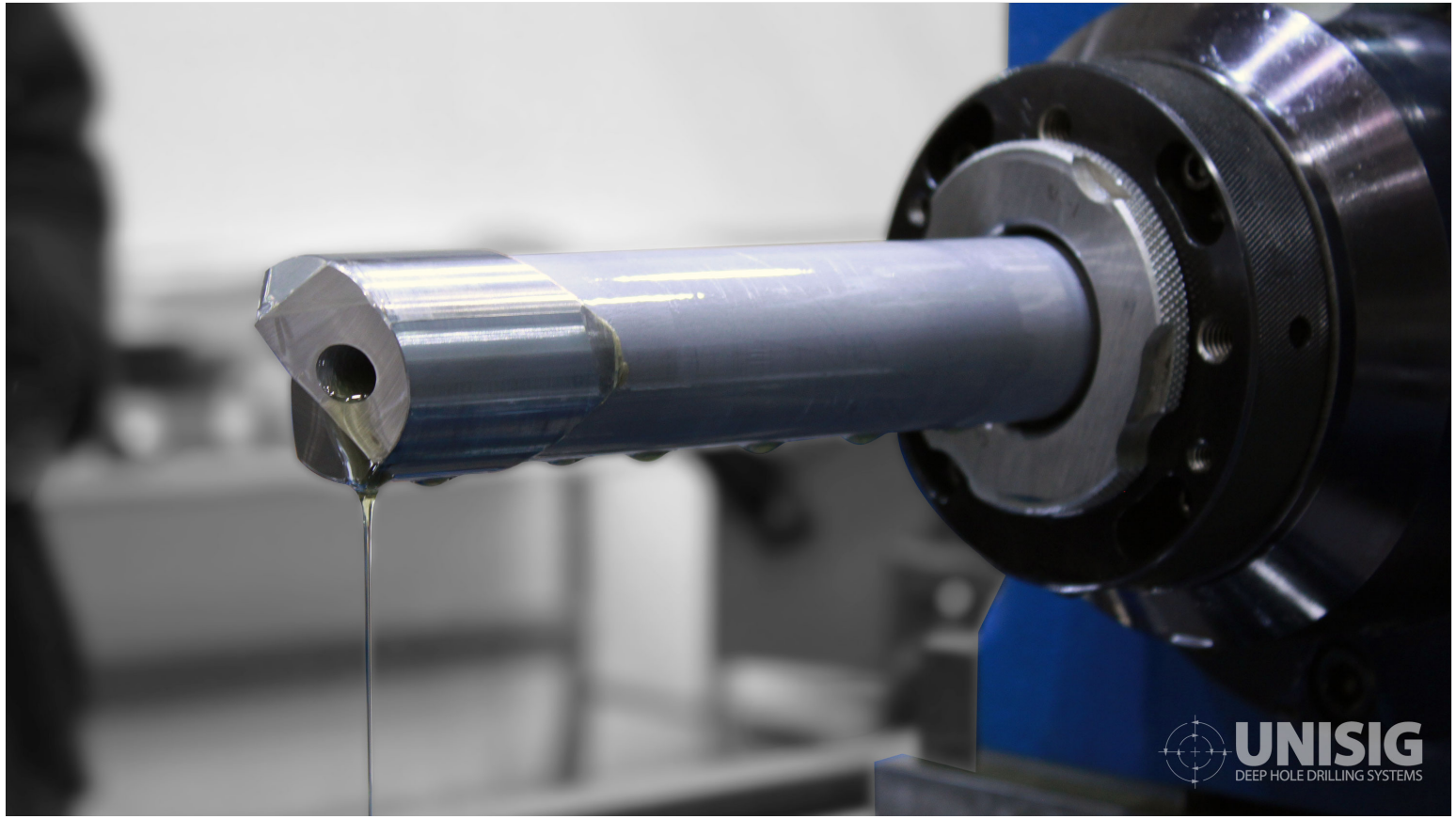
Example:

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]

Gundrilling vs. Deep Hole Drilling

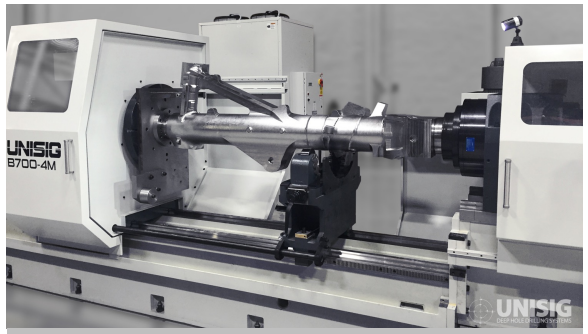


Gundrilling is often used as a catch-all term for deep hole drilling. It is incorrectly applied in many cases.

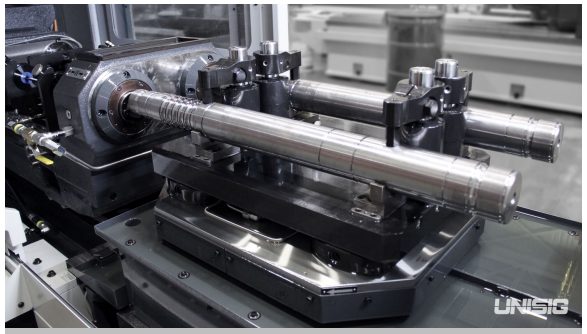
The word “gundrill” actually refers to one specific type of tool used to drill deep holes.

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



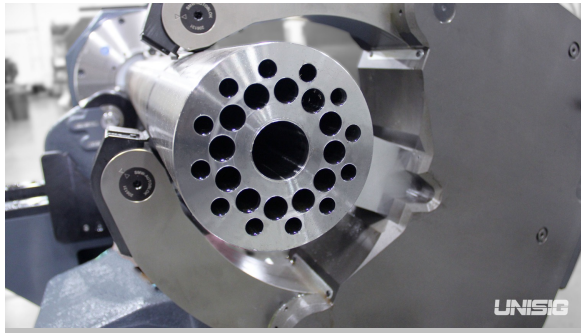
Aerospace



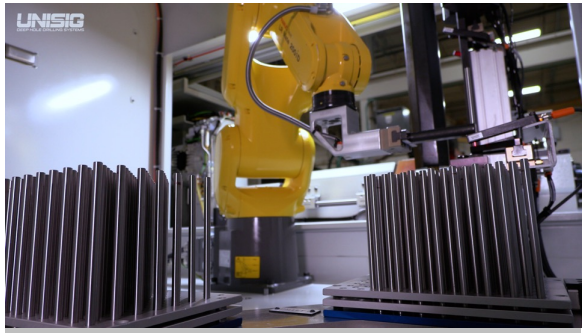
Automotive

Mold

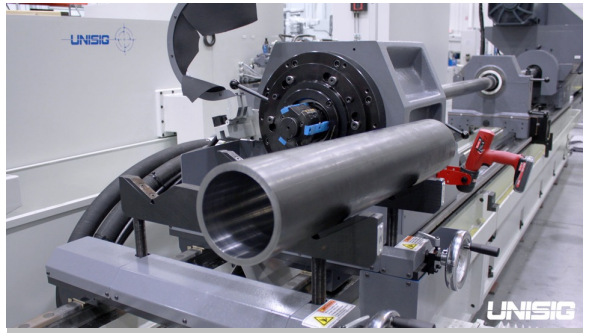
Defense/Firearms



Oil and Gas



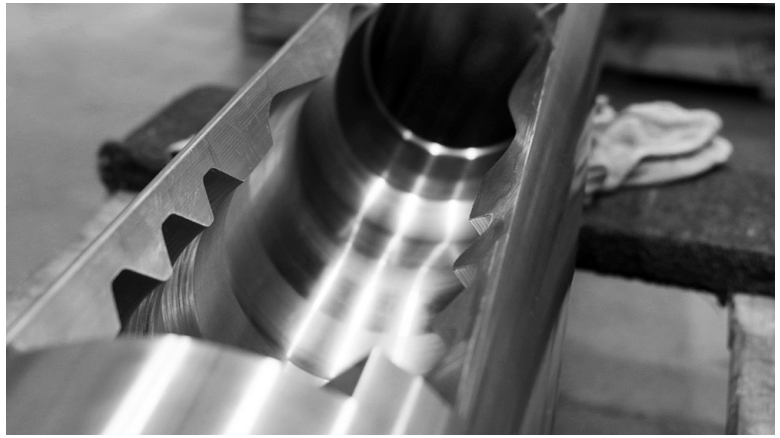
Medical

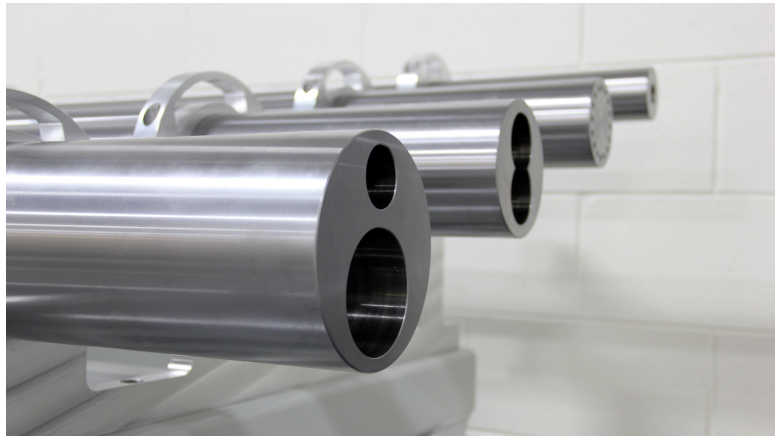


Agriculture/Construction

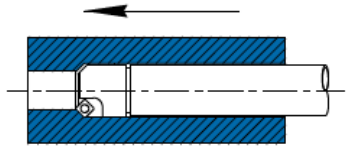
Job Shop

Deep Hole Machining (not just drilling)

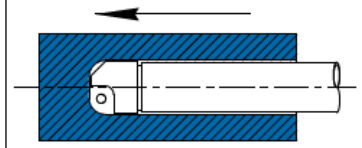




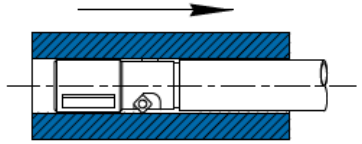
PUSH- COUNTER BORING/ REAMING
20 - 630 mm
[0.79 – 24.8 in]
External coolant



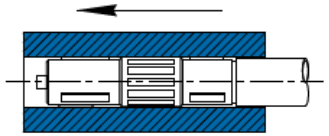
BOTTOM FORMING
20 - 500 mm
[0.79 – 20.0 in]
External coolant



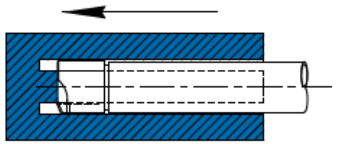
PULL BORING
20 - 630 mm
[0.79 – 24.8 in]
External coolant



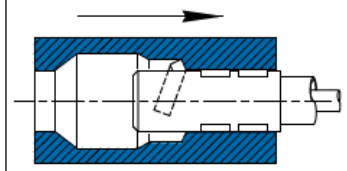
SKIVING AND ROLLER BURNISHING
20 - 500 mm
[0.79 – 20.0 in]
External coolant



TREPANNING
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.

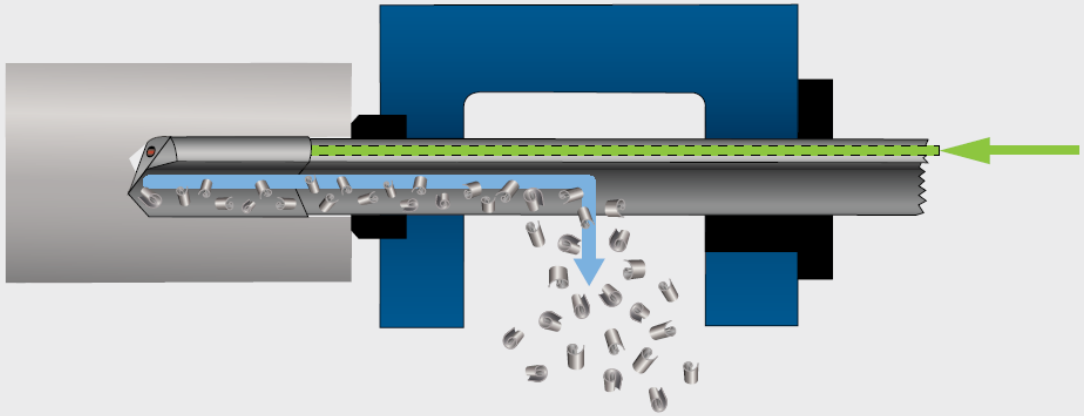
Common examples:

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

Primary Deep Hole Drilling Tool Systems

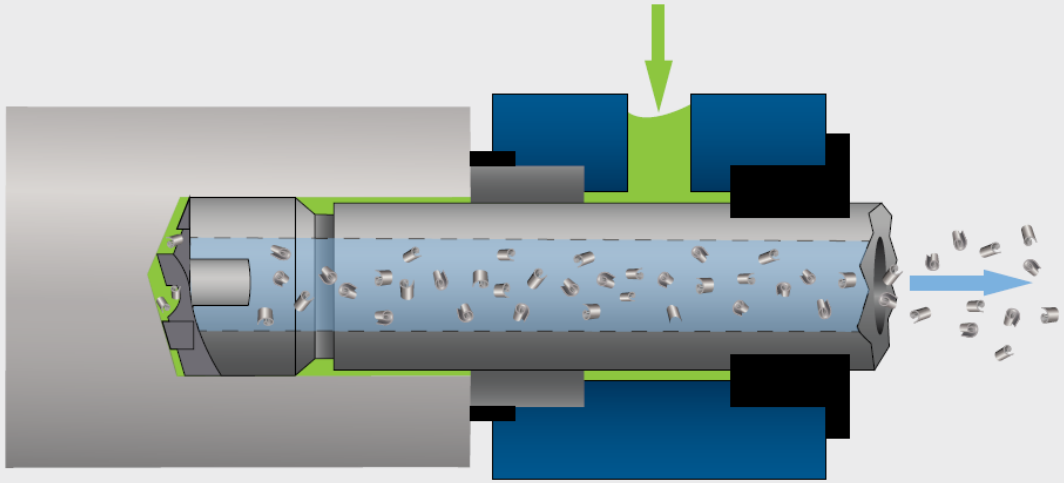
GUNDRILL

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 – **B**oring and **T**repanning **A**ssociation

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?

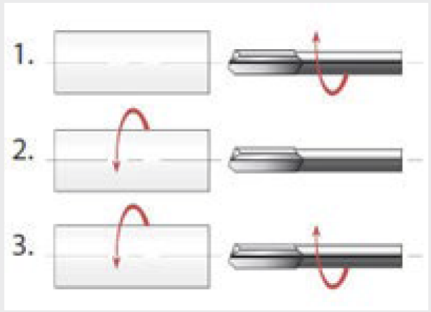
PROCESS	CONFIGURATION	HOLE SIZE	HOLE STRAIGHTNESS		SURFACE FINISH	
			(inch/foot)	(mm/meter)	µ-inch Ra	µ-m Ra
Gundrilling	Tool rotate-Work rotate	IT6-IT11 (heavily influenced by work material)	0.001-0.004	0.08-0.33	8-248	0.2-6.3
	Tool stationary-Work rotate		0.002-0.006	0.16-0.5		
	Tool rotate-Work stationary		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.

Three drilling process types

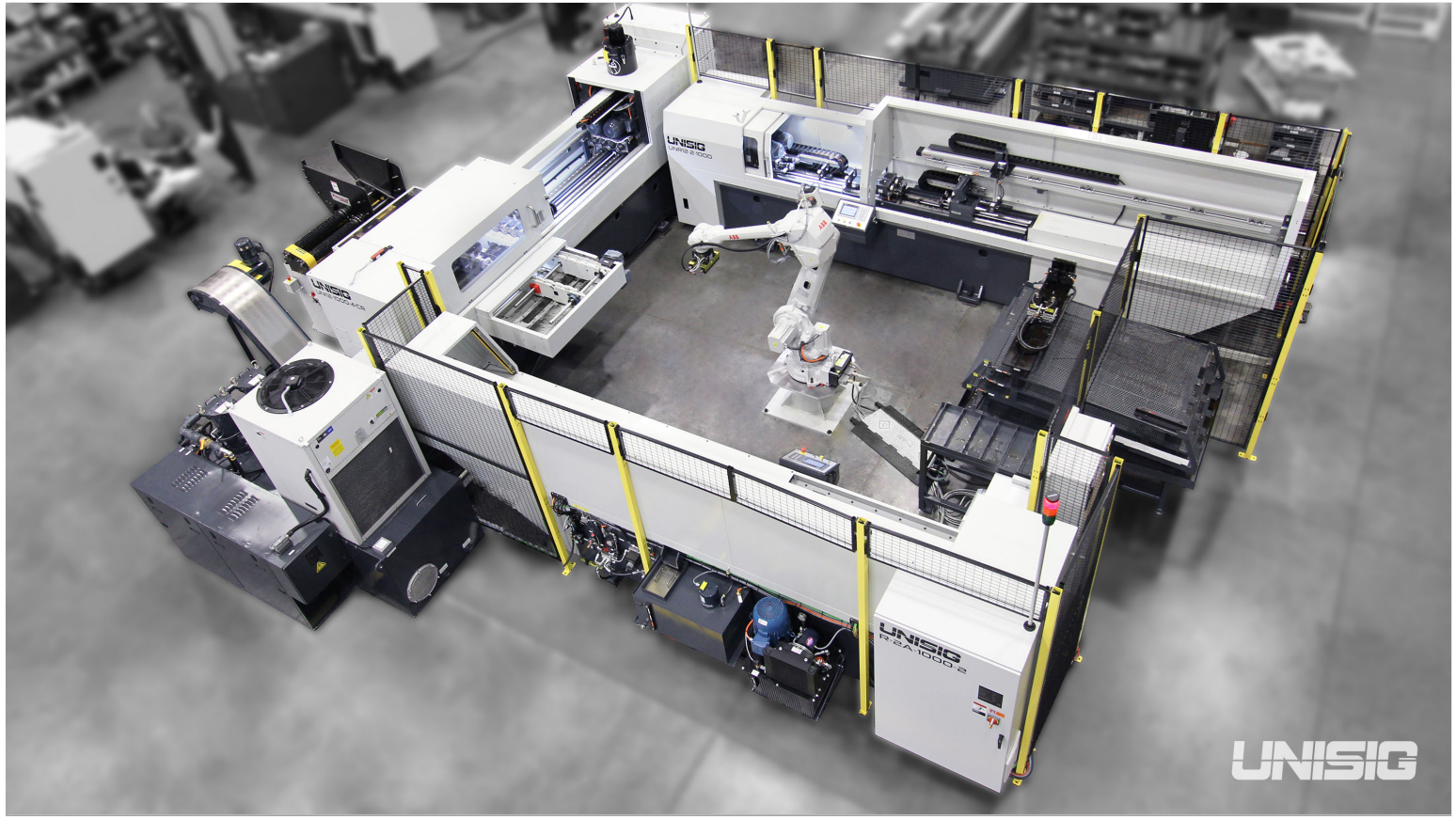
The drilling process type will improve drill drift in concentric holes:

Rotating tool only
= poor concentricity

Rotating work only
= better concentricity

Counter-rotating tool and work
= best concentricity

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?

unisig.com - knowledge center, downloads, videos