



**ALLIED MACHINE
& ENGINEERING**

WOHLHAUPTER®

Holemaking Solutions for Today's Manufacturing



Boring



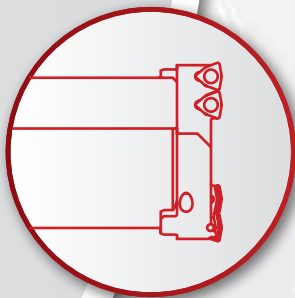
Reaming



Burnishing



Threading



Specials



Opening Drill®

▶ *DRILLING*

Replaceable IC Insert Drilling System

SECTION

A70

Opening Drill®

Opening Drill®

Large Diameter Replaceable IC Insert Drilling System

► **Diameter Range:** 50.80 mm - 142.75 mm (2.000" - 5.620")



Need larger holes? No problem.

The Opening Drill is an extremely effective tool designed to enlarge existing holes. It is available in nine different shank styles: Straight, ABS 63, CV40, CV50, HSK 63A/C, HSK 100A/C, BT 40, BT 50, and DIN50.

In a *single* operation, an existing hole can be opened and large amounts of material can be removed. The insert design reduces chip size and improves evacuation. Also, inventory and cost are reduced by the adjustable diameters.

Excellent chip control	Improves hole quality and surface finish	Provides maximum durability and stability
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Applicable Industries



Aerospace



Agriculture



Automotive



Firearms



General Machining



Oil & Gas



Renewable Energy

Your safety and the safety of others is very important. This catalogue contains important safety messages. Always read and follow all safety precautions.



This triangle is a safety hazard symbol. It alerts you to potential safety hazards that can cause tool failure and serious injury.

When you see this symbol in the catalogue, look for a related safety message that may be near this triangle or referred to in the nearby text.

There are safety signal words also used in the catalogue. Safety messages follow these words.

WARNING

WARNING (shown above) means that failure to follow the precautions in this message could result in tool failure and serious injury.

NOTICE means that failure to follow the precautions in this message could result in damage to the tool or machine but not result in personal injury.

NOTE and **IMPORTANT** are also used. These are important that you read and follow but are not safety-related.

Visit www.alliedmachine.com for the most up-to-date information and procedures.

Opening Drill® Contents

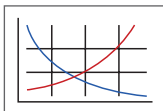
Reference Icons

The following icons will appear throughout the catalogue to help you navigate between products.



Setup / Assembly Information

Detailed instructions and information regarding the corresponding part(s)



Recommended Cutting Data

Speed and feed recommendations for optimum and safe drilling



Through Coolant Option

Indicates that the product is through coolant

Series	Diameter Range	
	Metric (mm)	Imperial (inch)
OP1	50.80 - 63.50	2.000 - 2.500
OP2	63.50 - 76.20	2.500 - 3.000
OP3	76.20 - 104.64	3.000 - 4.120
OP4	104.64 - 142.75	4.120 - 5.620

Introduction Information

Product Overview	2
Setup Instructions	3
Product Nomenclature.	4 - 5

Drill Shank Style

Straight Metric	6
Straight Imperial	7
BT40	8
BT50	9
CV40.	10
CV50.	11
HSK63	12
HSK100	13
ABS63	14
DIN50	15

Recommended Cutting Data

Metric (mm)	16 - 17
Imperial (inch)	18 - 19

Product Overview

Features

- Can be used as a rotating or stationary tool
- Can be used in rough boring operations
- Available in multiple different shanks (see chart below)
- Smooth cutting action and quiet operations in lathes and mills
- Special lengths, diameters, and shanks are available upon request

Advantages

- Opens an existing hole in a single operation
- Ignores core shifts up to 3.18 mm (1/8") providing straight and true holes without the need for boring
- Allows for large amounts of material removal
- Unique design enables larger holes to be made on low horsepower machines
- Replaceable cartridges protect your investment
- Adjustable diameters reduce inventory and cost

Shank Options



AM300®



AM200®



TiN



2 Inserts
(OP1 - OP3 series)



3 Inserts
(OP4 series)

Insert Application Recommendations

Carbide Grade Options

P 35 (C5)	General purpose carbide grade suitable for most applications. ▶ <i>Common application in steels and stainless steels.</i>
K35 (C1)	Toughest carbide grade. Provides the best combination of edge strength and tool life. ▶ <i>Recommended for less rigid applications.</i>
K25 (C2)	Higher wear-resistant carbide suitable for abrasive material applications. ▶ <i>Recommended for grey, ductile, and nodular irons.</i>

Additional Geometry Option

High Rake (HR)	Provides superior chip control and tool life in long chipping carbon and alloy steels below 200 Bhn.
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IC Inserts

- The design allows for excellent chip control and aggressive penetration rates
- The proprietary AM200® and AM300® coatings increase tool life above competitors' premium coatings
- The same inserts are used for both Revolution Drill and Opening Drill products

Setup Instructions



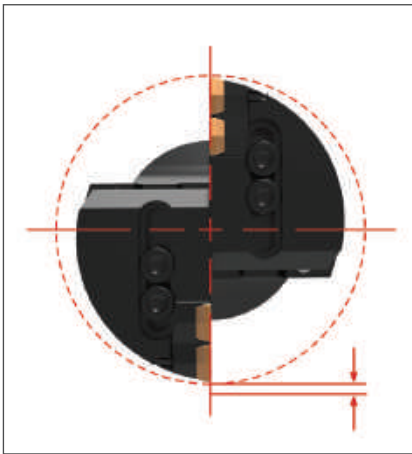
Step 1:
Loosen the mounting screws on both cartridges.



Step 2:
Set one cartridge to the finish diameter by tightening the adjustment screw against the adjustment pin.



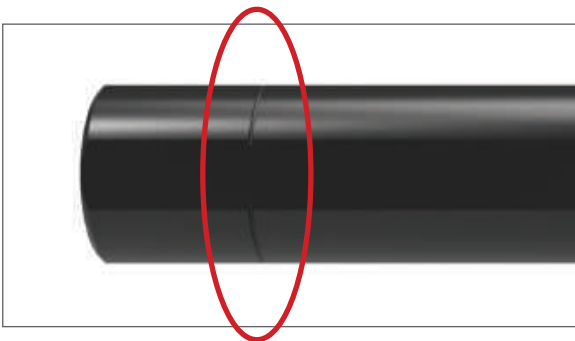
Step 3:
Tighten the mounting screws on the cartridge to 15-19 N-m (11-14 ft-lbf).



Step 4:
Set the opposing cartridge with 4.06 mm (0.160") to 5.08 mm (0.200") radial offset inward by tightening the adjustment screw against the adjustment pin (optimum situation for each insert to remove equal material).



Step 5:
Tighten the mounting screws on the cartridge to 15-19 N-m (11-14 ft-lbf).



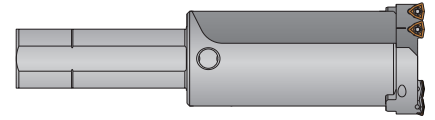
Straight Shanks

- Designed for lathe applications
- Can be cut off for use in endmill holders
- The score mark (circled above) is provided for recommended cut length
- Cut and deburr at the score mark
- This improves rigidity when the body sits against the face of an endmill holder



Product Nomenclature

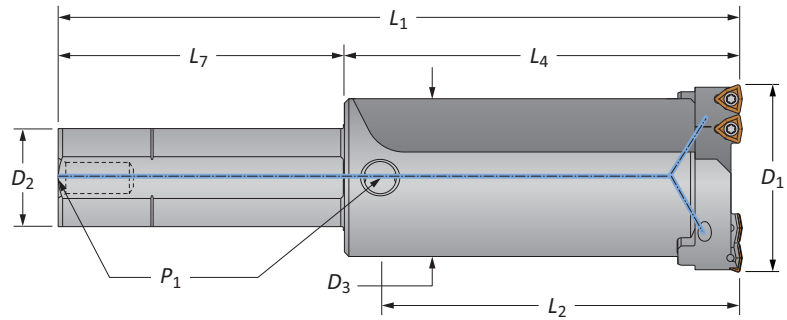
Opening Drill Holders



1. Series	2. Length	3. Shank Type	
OP1 = 50.80 mm - 63.50 mm (2.000" - 2.500")	1S = Short	SS1.5 = 1-1/2 ϕ straight	BT40 = BT40
OP2 = 63.50 mm - 76.20 mm (2.500" - 3.000")	1L = Long	SS2.5 = 2-1/2 ϕ straight	BT50 = BT50
OP3 = 76.20 mm - 104.65 mm (3.000" - 4.120")		40M = 40 mm straight	HSK63 = HSK 63A/C
OP4 = 104.65 mm - 142.75 mm (4.120" - 5.620")		50M = 50 mm straight	HSK100 = HSK 100A/C
		CV40 = CV40	ABS63 = ABS63
		CV50 = CV50	DV50 = DIN50

Reference Key

Symbol	Attribute
D_1	Drill diameter range
D_2	Shank diameter
D_3	Body diameter
L_1	Overall length
L_2	Maximum drill depth
L_4	Holder length
L_7	Shank length
P_1	Rear pipe tap



A DRILLING

B BORING

C REAMING

D BURINISHING

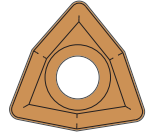
F THREADING

X SPECIALS

Product Nomenclature

Opening Drill Inserts

OP	-	05	T3	08	-	1	H	HR
1		2	3	4		5	6	7



1. Compatible with: Opening Drill Revolution Drill®	2. IC Type 05 = 5/16"	3. Thickness T3 = 5/32"	4. Radius 08 = 1/32"	5. Carbide Grade Blank = P 35 (C5) 1 = K35 (C1) 2 = K25 (C2)
6. Coating P = AM300® H = AM200® T = TiN A = TiAlN N = TiCN U = Uncoated	7. Geometry Blank = General Purpose HR = High Rake			

A

DRILLING

B

BORING

C

REAMING

D

BURNISHING

F

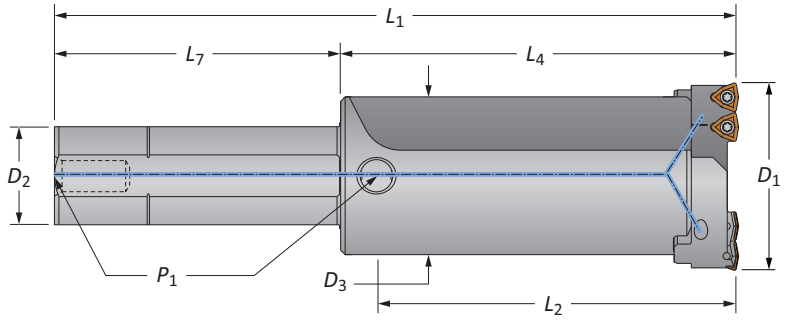
THREADING

X

SPECIALS

Opening Drill Holders

Straight Shank | Metric | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holdings

Length	D ₁ Range	Holder				Shank			Part No.	Cartridges
		D ₃	L ₂	L ₄	L ₁	D ₂	L ₇	P ₁		
Short	50.80 - 63.50	46.74	83.46	104.44	174.45	40.00	70.00	-	OP1-1S-40M	OP1-WC05
	Long	50.80 - 63.50	46.74	140.61	161.59	231.60	40.00	70.00		
Short	63.50 - 76.20	56.39	118.52	141.25	211.25	40.00	70.00	-	OP2-1S-40M	OP2-WC05
	Long	63.50 - 76.20	56.39	194.72	217.45	287.45	40.00	70.00		
Short	76.20 - 104.65	71.27	129.90	153.95	223.95	40.00	70.00	-	OP3-1S-40M	OP3-WC05
	Long	76.20 - 104.65	71.27	231.50	255.55	325.55	40.00	70.00		
Short	104.65 - 142.65	88.90	127.43	153.95	233.96	50.00	80.00	-	OP4-1S-50M	OP4-WC05
	Long	104.65 - 142.65	88.90	267.13	293.65	373.66	50.00	80.00		

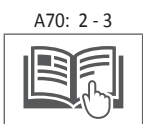
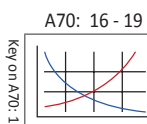
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-	IS-10-1	8T-9

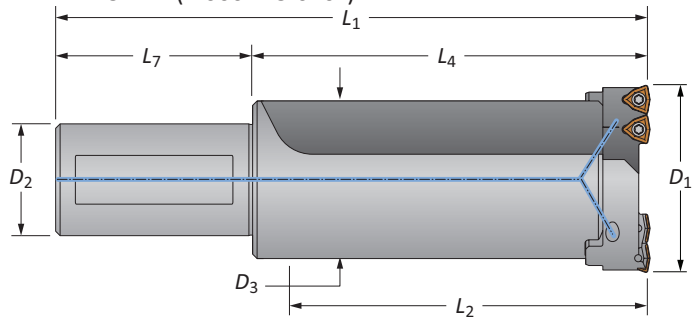


IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

Ⓜ = Metric (mm)
 ⓘ = Imperial (in)

Opening Drill Holders

Straight Shank | Imperial | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holder

Length	D ₁ Range	Holder				Shank			Part No.	Cartridges
		D ₃	L ₂	L ₄	L ₁	D ₂	L ₇	P ₁		
Short	2.000 - 2.500	1.840	3-9/32	4-3/64	8-3/64	1-1/2	4	1/4 NPT	OP1-1S-SS1.5	OP1-WC05
Long	2.000 - 2.500	1.840	5-17/32	6-19/64	10-19/64	1-1/2	4	1/4 NPT	OP1-1L-SS1.5	OP1-WC05
Short	2.500 - 3.000	2.220	4-43/64	5-1/2	9-1/2	1-1/2	4	1/4 NPT	OP2-1S-SS1.5	OP2-WC05
Long	2.500 - 3.000	2.220	7-43/64	8-1/2	12-1/2	1-1/2	4	1/4 NPT	OP2-1L-SS1.5	OP2-WC05
Short	3.000 - 4.120	2.806	5-7/64	6	10	1-1/2	4	1/4 NPT	OP3-1S-SS1.5	OP3-WC05
Long	3.000 - 4.120	2.806	9-7/64	10	14	1-1/2	4	1/4 NPT	OP3-1L-SS1.5	OP3-WC05
Short	4.120 - 5.620	3.500	5-1/64	6	10-1/2	2	4-1/2	1/4 NPT	OP4-1S-SS2.0	OP4-WC05
Long	4.120 - 5.620	3.500	10-33/64	11-1/2	16	2	4-1/2	1/4 NPT	OP4-1L-SS2.0	OP4-WC05

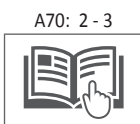
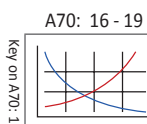
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-	IS-10-1	8T-9



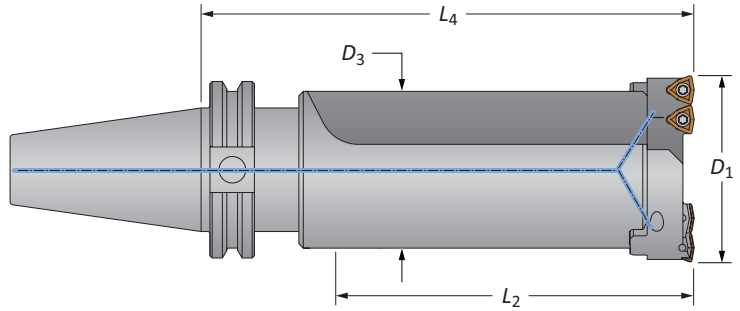
IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

= Metric (mm)
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A
DRILLING
B
BORING
C
REAMING
D
BURNISHING
E
THREADING
X
SPECIALS

Opening Drill Holders

BT40 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holdings

Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	50.80 - 63.50	46.74	83.46	137.85	OP1-1S-BT40	OP1-WC05
Long	50.80 - 63.50	46.74	140.61	195.00	OP1-1L-BT40	OP1-WC05
Short	63.50 - 76.20	56.39	118.52	174.68	OP2-1S-BT40	OP2-WC05
Long	63.50 - 76.20	56.39	194.72	250.88	OP2-1L-BT40	OP2-WC05
Short	76.20 - 104.65	71.27	129.90	187.38	OP3-1S-BT40	OP3-WC05
Long	76.20 - 104.65	71.27	231.50	288.98	OP3-1L-BT40	OP3-WC05
Short	104.65 - 142.75	88.90	127.43	187.38	OP4-1S-BT40	OP4-WC05

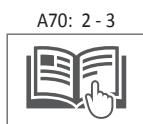
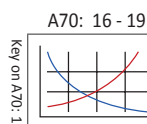
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	—	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	—	IS-10-1	8T-9



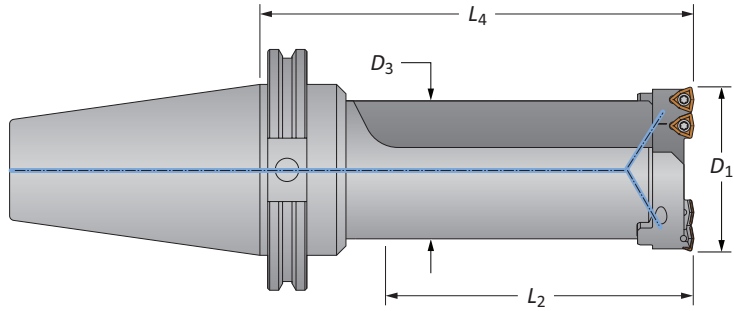
IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

Ⓜ = Metric (mm)
 ⓘ = Imperial (in)

A DRILLING
 B BORING
 C REAMING
 D BURINISHING
 E THREADING
 X SPECIALS

Opening Drill Holders

BT50 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holder




Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	50.80 - 63.50	46.74	83.46	147.37	OP1-1S-BT50	OP1-WC05
			140.61	204.52		
Long	50.80 - 63.50	46.74	118.52	184.20	OP2-1S-BT50	OP2-WC05
			194.72	260.40		
Short	63.50 - 76.20	56.39	129.90	196.90	OP3-1S-BT50	OP3-WC05
			231.50	298.50		
Long	63.50 - 76.20	56.39	127.43	196.90	OP4-1S-BT50	OP4-WC05
			267.13	336.60		
Short	76.20 - 104.65	71.27	127.43	196.90	OP4-1S-BT50	OP4-WC05
			267.13	336.60		
Long	76.20 - 104.65	71.27	127.43	196.90	OP4-1S-BT50	OP4-WC05
			267.13	336.60		
Short	104.65 - 142.75	88.90	127.43	196.90	OP4-1S-BT50	OP4-WC05
			267.13	336.60		
Long	104.65 - 142.75	88.90	127.43	196.90	OP4-1S-BT50	OP4-WC05
			267.13	336.60		

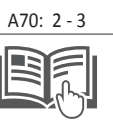
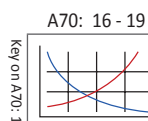
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		 AM300®	 AM200®	 TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-	IS-10-1	8T-9

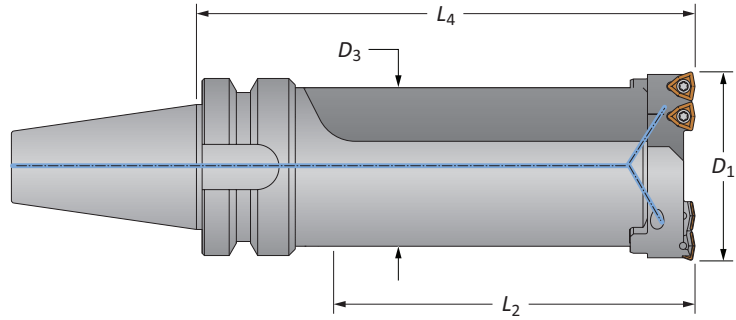


IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

 = Metric (mm)
 = Imperial (in)

Opening Drill Holders

CV40 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holdings

Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	2.000 - 2.500	1.840	3-9/32	5-27/64	OP1-1S-CV40	OP1-WC05
Long	2.000 - 2.500	1.840	5-17/32	7-43/64	OP1-1L-CV40	OP1-WC05
Short	2.500 - 3.000	2.220	4-43/64	6-7/8	OP2-1S-CV40	OP2-WC05
Long	2.500 - 3.000	2.220	7-43/64	9-7/8	OP2-1L-CV40	OP2-WC05
Short	3.000 - 4.120	2.806	5-7/64	7-3/8	OP3-1S-CV40	OP3-WC05
Long	3.000 - 4.120	2.806	9-7/64	11-3/8	OP3-1L-CV40	OP3-WC05
Short	4.120 - 5.620	3.500	5-1/64	7-3/8	OP4-1S-CV40	OP4-WC05

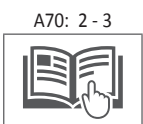
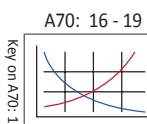
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	—	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	—	IS-10-1	8T-9

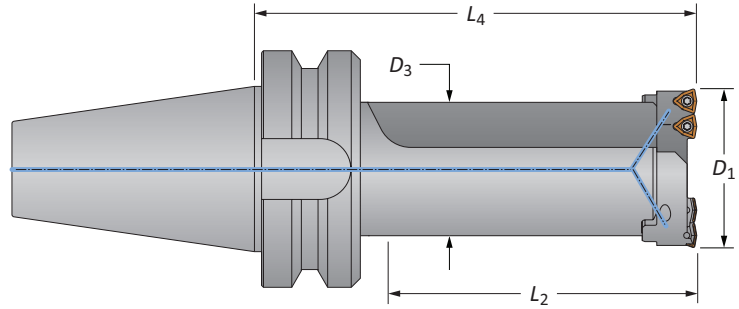


IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

m = Metric (mm)
i = Imperial (in)

Opening Drill Holders

CV50 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holders

Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	2.000 - 2.500	1.840	3-9/32	5-27/64	OP1-1S-CV50	OP1-WC05
			5-17/32	7-43/64		
Long	2.000 - 2.500	1.840	4-43/64	6-7/8	OP2-1S-CV50	OP2-WC05
			7-43/64	9-7/8		
Short	2.500 - 3.000	2.220	5-7/64	7-3/8	OP3-1S-CV50	OP3-WC05
			9-7/64	11-3/8		
Long	2.500 - 3.000	2.220	5-1/64	7-3/8	OP4-1S-CV50	OP4-WC05
			10-33/64	12-7/8		

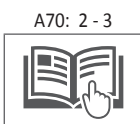
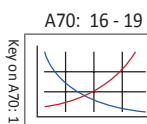
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-	IS-10-1	8T-9



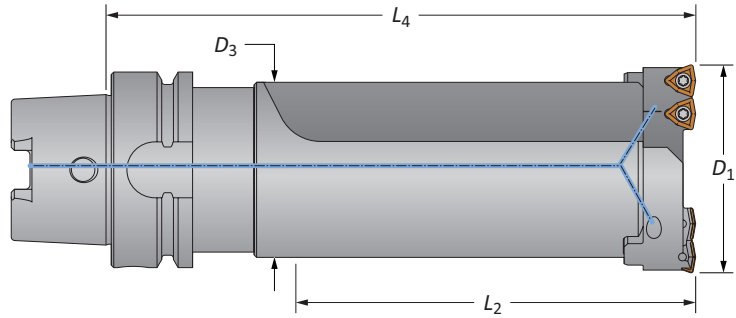
IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

 = Metric (mm)
 = Imperial (in)

A
DRILLING
B
BORING
C
REAMING
D
BURNISHING
E
THREADING
X
SPECIALS

Opening Drill Holders

HSK63 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holdings

Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	2.000 - 2.500	1.840	3-9/32	5-59/64	OP1-1S-HSK63	OP1-WC05
Long	2.000 - 2.500	1.840	5-17/32	8-11/64	OP1-1L-HSK63	OP1-WC05
Short	2.500 - 3.000	2.220	4-43/64	7-3/8	OP2-1S-HSK63	OP2-WC05
Long	2.500 - 3.000	2.220	7-43/64	10-3/8	OP2-1L-HSK63	OP2-WC05
Short	3.000 - 4.120	2.806	5-7/64	7-7/8	OP3-1S-HSK63	OP3-WC05
Long	3.000 - 4.120	2.806	9-7/64	11-7/8	OP3-1L-HSK63	OP3-WC05
Short	4.120 - 5.620	3.500	5-1/64	7-7/8	OP4-1S-HSK63	OP4-WC05

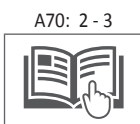
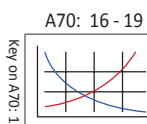
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-	IS-10-1	8T-9

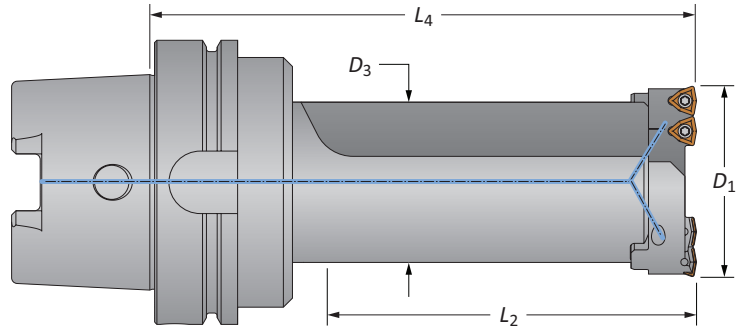


IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

Ⓜ = Metric (mm)
 ⓘ = Imperial (in)

Opening Drill Holders

HSK100 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holder

Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	2.000 - 2.500	1.840	3-9/32	6-1/64	OP1-1S-HSK100	OP1-WC05
			5-17/32	8-17/64	OP1-1L-HSK100	OP1-WC05
Long	2.000 - 2.500	1.840	4-43/64	7-15/32	OP2-1S-HSK100	OP2-WC05
			7-43/64	10-15/32	OP2-1L-HSK100	OP2-WC05
Short	2.500 - 3.000	2.220	5-7/64	7-31/32	OP3-1S-HSK100	OP3-WC05
			9-7/64	11-31/32	OP3-1L-HSK100	OP3-WC05
Long	2.500 - 3.000	2.220	5-1/64	7-31/32	OP4-1S-HSK100	OP4-WC05
			10-33/64	13-15/32	OP4-1L-HSK100	OP4-WC05

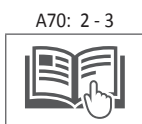
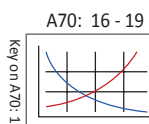
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-	IS-10-1	8T-9



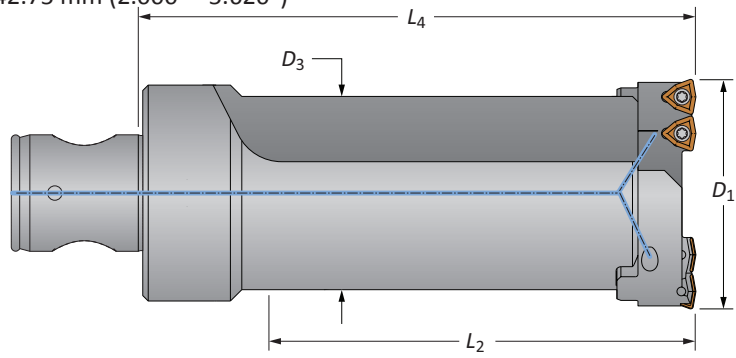
IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

= Metric (mm)
 = Imperial (in)

A
DRILLING
B
BORING
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REAMING
D
BURNISHING
E
THREADING
X
SPECIALS

Opening Drill Holders

ABS63 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holdings

Length	D ₁ Range	D ₃	Holder			Part No.	Cartridges
			L ₂	L ₄			
Short	2.000 - 2.500	1.840	3-9/32	5-1/2	OP1-1S-ABS63	OP1-WC05	
Long	2.000 - 2.500	1.840	5-17/32	7-3/4	OP1-1L-ABS63	OP1-WC05	
Short	2.500 - 3.000	2.220	4-43/64	6-1/4	OP2-1S-ABS63	OP2-WC05	
Long	2.500 - 3.000	2.220	7-43/64	9-1/4	OP2-1L-ABS63	OP2-WC05	
Short	3.000 - 4.120	2.806	5-7/64	6-3/4	OP3-1S-ABS63	OP3-WC05	
Long	3.000 - 4.120	2.806	9-7/64	10-3/4	OP3-1L-ABS63	OP3-WC05	
Short	4.120 - 5.620	3.500	5-1/64	6-3/4	OP4-1S-ABS63	OP4-WC05	

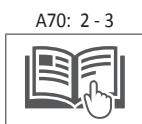
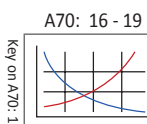
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T	IS-10-1	8T-9
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	—	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	—	IS-10-1	8T-9



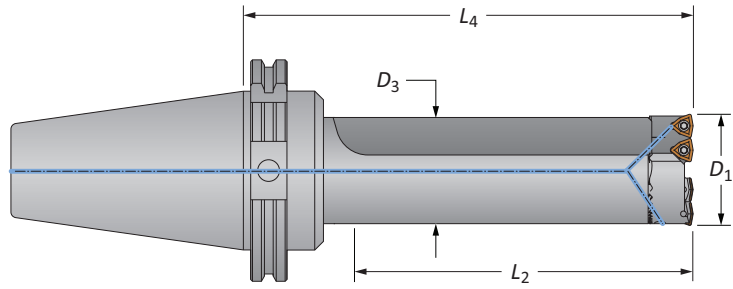
IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

m = Metric (mm)
i = Imperial (in)

A DRILLING
B BORING
C REAMING
D BURNISHING
E THREADING
X SPECIALS

Opening Drill Holders

DIN50 Shank | Diameter Range: 50.80 mm - 142.75 mm (2.000" - 5.620")



Holder

Length	D ₁ Range	Holder			Part No.	Cartridges
		D ₃	L ₂	L ₄		
Short	50.80 - 63.50	46.74	83.46	137.92	OP1-1S-DV50	OP1-WC05
	Long		140.61	195.07		
Short	63.50 - 76.20	56.39	118.52	174.75	OP2-1S-DV50	OP2-WC05
	Long		194.72	250.95		
Short	76.20 - 104.65	71.27	129.90	187.45	OP3-1S-DV50	OP3-WC05
	Long		231.50	289.05		
Short	104.65 - 142.75	88.90	127.43	187.45	OP4-1S-DV50	OP4-WC05
	Long		267.13	327.15		

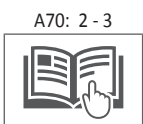
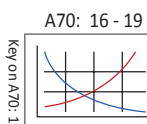
*Holder includes cartridges; however, inserts are sold separately.

Cartridges

Replacement Cartridges	Qty. Inserts Needed	Mounting Screw	Key Size	Adjusting Screw	Driver
OP1-WC05	2	MS-13M-1	5 mm	AS-10T9-1	8T-9
OP2-WC05	2	MS-15M-1	5 mm	AS-10T9-1	8T-9
OP3-WC05	2	MS-15M-1	5 mm	AS-12T9-1	8T-9
OP4-WC05	3	MS-15M-1	5 mm	AS-14T9-1	8T-9

IC Inserts

Carbide Grade	Geometry	Part No.			Insert Screws	Driver
		AM300®	AM200®	TiN		
P 35 (C5)	Standard	OP-05T308-P	OP-05T308-H	OP-05T308-T	IS-10-1	8T-9
K35 (C1)	Standard	OP-05T308-1P	OP-05T308-1H	OP-05T308-1T		
K25 (C2)	Standard	OP-05T308-2P	OP-05T308-2H	-	IS-10-1	8T-9
P 35 (C5)	High Rake	OP-05T308-PHR	OP-05T308-HHR	-		



IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10
 Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4

Ⓜ = Metric (mm)
 ⓘ = Imperial (in)

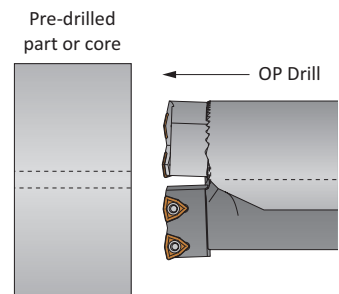
A
DRILLING
B
BORING
C
REAMING
D
BURNISHING
E
THREADING
X
SPECIALS

Recommended Cutting Data | Metric (mm)

ISO	Material	Hardness (BHN)	Speed (M/min)			Feed Rate (mm/rev)
			AM300®	AM200®	TiN	
P	Free-Machining Steel 1118, 1215, 12L14, etc.	100 - 250	274 - 396	259 - 366	213 - 274	0.09 - 0.18
	Low-Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 275	259 - 381	244 - 351	198 - 259	0.08 - 0.17
	Medium-Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 325	244 - 320	229 - 290	183 - 259	0.09 - 0.17
	Alloy Steel 4140, 5140, 8640, etc.	125 - 375	229 - 305	213 - 274	183 - 259	0.09 - 0.17
	High-Strength Alloy 4340, 4330V, 300M, etc.	225 - 400	183 - 259	168 - 229	122 - 198	0.08 - 0.13
	Structural Steel A36, A285, A516, etc.	100 - 350	259 - 320	244 - 290	198 - 259	0.08 - 0.17
	Tool Steel H-13, H-21, A-4, O-2, S-3, etc.	150 - 250	122 - 244	107 - 213	76 - 198	0.06 - 0.13
S	High-Temp Alloy Hastelloy B, Inconel 600, etc.	140 - 310	76 - 137	76 - 107	46 - 91	0.06 - 0.11
M	Stainless Steel 400 Series 416, 420, etc.	185 - 350	183 - 259	168 - 229	122 - 198	0.08 - 0.15
	Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 275	183 - 259	168 - 229	122 - 198	0.08 - 0.15
	Super Duplex Stainless Steel	135 - 275	152 - 228	137 - 198	91 - 152	0.05 - 0.12
K	Nodular, Grey, Ductile Cast Iron	120 - 320	213 - 274	198 - 244	152 - 213	0.10 - 0.20
N	Cast Aluminium	30 - 180	381 - 503	381 - 472	290 - 335	0.15 - 0.30
	Wrought Aluminium	30 - 180	381 - 503	381 - 472	290 - 335	0.15 - 0.30
	Brass	30 - 100	290 - 411	274 - 381	229 - 335	0.13 - 0.23

Minimum Pilot Hole Diameter = Finish Diameter – C

Ex: To open an existing diameter hole to 69.85 mm diameter, an OP2 tool would be used. The minimum pilot hole diameter would be: **69.85 - 47.75 = 22.10**



Opening Drill Series	Drill Diameter Range	C
OP1	50.80 - 63.50	47.75
OP2	63.50 - 76.20	47.75
OP3	76.20 - 104.64	47.75
OP4	104.64 - 142.75	68.07

IMPORTANT: The speeds and feeds listed above are considered a general starting point for all applications. Factory technical assistance is available for your specific applications through our Application Engineering department.

Formulas and Constants | Metric (mm)

Material Constants

Type of Material	Hardness (BHN)	K _m (kPa)
Free-Machining Steel	100 - 250	5.17
Low-Carbon Steel	85 - 275	5.86
Medium-Carbon Steel	125 - 325	6.21
Alloy Steel	125 - 375	6.90
High-Strength Steel	225 - 400	7.93
Structural Steel	100 - 350	6.90
Tool Steel	150 - 250	6.21
High-Temperature Alloy	140 - 310	9.93
Titanium Alloy	140 - 310	4.97
Aerospace Alloy	185 - 350	4.48
Stainless Steel 400 Series	185 - 350	7.45
Stainless Steel 300 Series	135 - 275	6.48
Super Duplex Stainless Steel	135 - 275	6.48
Wear Plate	400 - 600	11.04
Hardened Steel	300 - 500	9.66
Nodular, Ductile Cast Iron	120 - 320	4.48
Grey Cast Iron	120 - 320	5.17
Cast Aluminium	30 - 180	2.76
Wrought Aluminium	30 - 180	2.76
Aluminium Bronze	100 - 250	3.45
Brass	100	2.41
Copper	60	2.07

Formulas

1. RPM	= (318.31 • m/min) / DIA_F <i>where:</i> RPM = revolutions per minute (rev/min) M/min = speed (m/min) DIA _F = finish diameter of drill (mm)
2. kW	= ((DIA_F² - DIA_P²) • mm/rev • RPM • K_m) / 205,154 <i>where:</i> kW = tool power (kW) DIA _F = finish diameter of drill (mm) DIA _P = pre-drill diameter (mm) mm/rev = feed rate (mm/rev) RPM = revolutions per minute (rev/min) K _m = specific cutting energy (kPa) machine efficiency (using 205,154 as constant)
3. Thrust	= 148.78 • mm/rev • (DIA_F - DIA_P) • K_m <i>where:</i> Thrust = axial thrust (N) IPR = feed rate (mm/rev) DIA _F = finish diameter of drill (mm) DIA _P = predrill diameter (mm) K _m = specific cutting energy (kPa)
4. Torque	= (kW • 9549.3) / RPM <i>where:</i> Torque = torque (Nm) kW = tool power (kW) RPM = revolutions per minute (rev/min)

The table and equations on this page are found in the *Machinery's Handbook*. Permission to simplify and print the equations is granted by the Editor of the *Machinery's Handbook*.

A
DRILLING
B
BORING
C
REAMING
D
BURNISHING
E
THREADING
X
SPECIALS

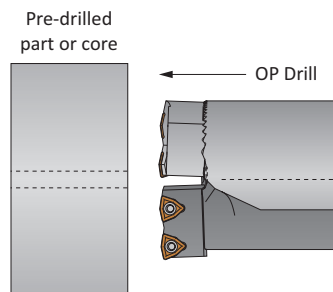
Recommended Cutting Data | Imperial (inch)

ISO	Material	Hardness (BHN)	Speed (SFM)			Feed Rate (IPR)
			AM300®	AM200®	TIN	
P	Free-Machining Steel 1118, 1215, 12L14, etc.	100 - 250	900 - 1300	850 - 1200	700 - 900	.0035 - 0.007
	Low-Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 275	850 - 1250	800 - 1150	650 - 850	.003 - 0.0065
	Medium-Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 325	800 - 1050	750 - 950	600 - 850	.0035 - 0.0065
	Alloy Steel 4140, 5140, 8640, etc.	125 - 375	750 - 1000	700 - 900	600 - 850	.0035 - 0.0065
	High-Strength Alloy 4340, 4330V, 300M, etc.	225 - 400	600 - 850	550 - 750	400 - 650	.003 - 0.005
	Structural Steel A36, A285, A516, etc.	100 - 350	850 - 1050	800 - 950	650 - 850	.003 - 0.0065
	Tool Steel H-13, H-21, A-4, O-2, S-3, etc.	150 - 250	400 - 800	350 - 700	250 - 650	.0025 - 0.005
S	High-Temp Alloy Hastelloy B, Inconel 600, etc.	140 - 310	250 - 450	250 - 350	150 - 300	.0025 - 0.005
M	Stainless Steel 400 Series 416, 420, etc.	185 - 350	600 - 850	550 - 750	400 - 650	.003 - 0.006
	Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 275	600 - 850	550 - 750	400 - 650	.003 - 0.006
	Super Duplex Stainless Steel	135 - 275	500 - 750	450 - 650	300 - 550	.002 - 0.005
K	Nodular, Grey, Ductile Cast Iron	120 - 320	700 - 900	650 - 800	500 - 700	.004 - 0.008
N	Cast Aluminium	30 - 180	1250 - 1650	1200 - 1550	950 - 1100	.006 - 0.012
	Wrought Aluminium	30 - 180	1250 - 1650	1200 - 1550	950 - 1100	.006 - 0.012
	Brass	30 - 100	950 - 1350	900 - 1250	750 - 1100	.005 - 0.009

Minimum Pilot Hole Diameter = Finish Diameter – C

Ex: To open an existing diameter hole to 2.75" diameter, an OP2 tool would be used. The minimum pilot hole diameter would be: **2.750 - 1.880 = 0.870"**

Opening Drill Series	Drill Diameter Range	C
OP1	2.00 - 2.50	1.880
OP2	2.50 - 3.00	1.880
OP3	3.00 - 4.12	1.880
OP4	4.12 - 5.62	2.680



IMPORTANT: The speeds and feeds listed above are considered a general starting point for all applications. Factory technical assistance is available for your specific applications through our Application Engineering department. *email: engineering.eu@alliedmachine.com*

Formulas and Constants | Imperial (inch)

Material Constants

Type of Material	Hardness (BHN)	K _m (lbs/in ²)
Free-Machining Steel	100 - 250	0.75
Low-Carbon Steel	85 - 275	0.85
Medium-Carbon Steel	125 - 325	0.90
Alloy Steel	125 - 375	1.00
High-Strength Steel	225 - 400	1.15
Structural Steel	100 - 350	1.00
Tool Steel	150 - 250	0.90
High-Temperature Alloy	140 - 310	1.44
Titanium Alloy	140 - 310	0.72
Aerospace Alloy	185 - 350	0.70
Stainless Steel 400 Series	185 - 350	1.08
Stainless Steel 300 Series	135 - 275	0.94
Super Duplex Stainless Steel	135 - 275	0.94
Wear Plate	400 - 600	1.60
Hardened Steel	300 - 500	1.40
Nodular, Ductile Cast Iron	120 - 320	0.65
Grey Cast Iron	120 - 320	0.75
Cast Aluminium	30 - 180	0.40
Wrought Aluminium	30 - 180	0.40
Aluminium Bronze	100 - 250	0.50
Brass	100	0.35
Copper	60	0.30

Formulas

1.	RPM	= (3.82 • SFM) / DIA_F <i>where:</i> RPM = revolutions per minute (rev/min) SFM = speed (ft/min) DIA _F = finish diameter of drill (inch)
2.	HP	= (0.5891 • (DIA_F² – DIA_P²) • IPR • RPM • K_m) / 0.80 <i>where:</i> Tool Power = tool power (HP) DIA _F = finish diameter of drill (inch) DIA _P = pre-drill diameter (inch) IPR = feed rate (in/rev) RPM = revolutions per minute (rev/min) K _m = specific cutting energy (lbs/in ²) machine efficiency (using 0.80 as constant)
3.	Thrust	= 148,500 • IPR • (DIA_F – DIA_P) • K_m <i>where:</i> Thrust = axial thrust (lbs) IPR = feed rate (in/rev) DIA _F = finish diameter of drill (inch) DIA _P = pre-drill diameter (inch) K _m = specific cutting energy (lbs/in ²)
5.	Torque	= (HP • 5252) / RPM <i>where:</i> Torque = torque (ft/lbs) HP = tool power (HP) RPM = revolutions per minute (rev/min)

The table and equations on this page are found in the *Machinery's Handbook*. Permission to simplify and print the equations is granted by the Editor of the *Machinery's Handbook*.

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Europe

Allied Machine & Engineering Co. (Europe) Ltd.

93 Vantage Point
Pensnett Estate
Kingswinford
West Midlands
DY6 7FR England

Phone:

+44 (0) 1384.400900

Wohlhaupter GmbH

Maybachstrasse 4
Postfach 1264
72636 Frickenhausen
Germany

Phone:

+49 (0) 7022.408.0

Fax:

+49 (0) 7022.408.212

United States

Allied Machine & Engineering

120 Deeds Drive
Dover OH 44622
United States

Phone:

+1.330.343.4283

Fax:

+1.330.602.3400

Toll Free USA and Canada:

800.321.5537

Toll Free USA and Canada:

800.223.5140

Allied Machine & Engineering

485 W Third Street
Dover OH 44622
United States

Phone:

+1.330.343.4283

Fax:

+1.330.364.7666
(Engineering Dept.)

Toll Free USA and Canada:

800.321.5537

Asia

Wohlhaupter India Pvt. Ltd.

B-23, 3rd Floor
B Block Community Centre
Janakpuri, New Delhi - 110058
India

Phone:

+91 (0) 11.41827044

Your local Allied Machine representative:

www.alliedmachine.com

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