ALLIED MACHINE & ENGINEERING | WOHLHAUPTER®

Holemaking Solutions for Today's Manufacturing

Boring

Reaming

Burnishing

Threading

Specials

# Drilling

## ▶ Opening Drill™

Large Diameter Replacable
IC Insert Drilling System

# Opening Drill™

Large Diameter Replaceable IC Insert Drilling System

- **Diameter Range:** 50.80mm - 142.75mm (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, CAT V40, CAT V50, 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 |

### 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.

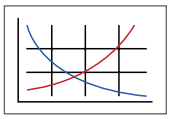
**NOTICE** means that failure to follow the precautions in this message could result in damage to the tool or machine but not result in personal injury.

**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.**

**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

| Series | Diameter Range | |
|---|---|---|
| | Metric (mm) | Imperial (inch) |
| **OP1** | 50.80 - 63.50 | 2.00 - 2.50 |
| **OP2** | 63.50 - 76.20 | 2.50 - 3.00 |
| **OP3** | 76.20 - 104.64 | 3.00 - 4.12 |
| **OP4** | 104.64 - 142.75 | 4.12 - 5.62 |

## Opening Drill™ Contents

## 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 3.175mm (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**


Straight


CAT40


CAT50


BT40


BT50


HSK63


HSK100

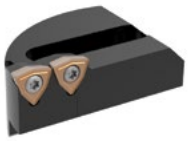

DIN50


ABS63


**AM300®**


**AM200®**


**TiN**


**2 Inserts**
(OP1 - OP3 series)


**3 Inserts**
(OP4 series)

**Insert Application Recommendations**

| Carbide Grade Options | |
|---|---|
| P35 (C5) | General purpose carbide grade suitable for most applications.<br>▶ *Common application in steels and stainless steels.* |
| K35 (C1) | Toughest carbide grade. Provides the best combination of edge strength and tool life.<br>▶ *Recommended for less rigid applications.* |
| K25 (C2) | Higher wear resistant carbide suitable for abrasive material applications.<br>▶ *Recommended for grey, ductile, and nodular irons.* |
| **Additional Geometry Option** | |
| High Rake (HR) | Provides superior chip control and tool life in long chipping carbon and alloy steels below 200 Bhn. |

**IC Inserts**

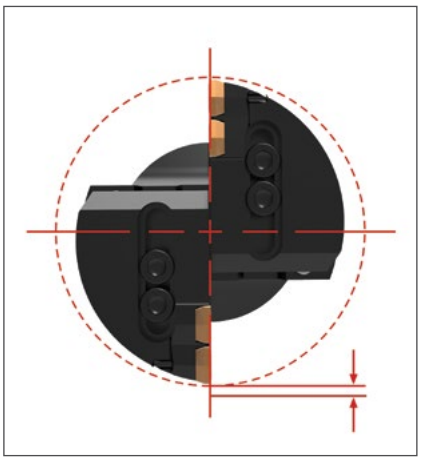
- The design allows for excellent chip control and aggressive penetration rates
- The proprietary AM200® and AM300® coatings increase tool life above competitors’ premium coatings
- The same inserts are used for both Revolution Drill™ and Opening Drill™ products

## Set-up Instructions

**Step 1:**
Loosen the mounting screws on both cartridges.

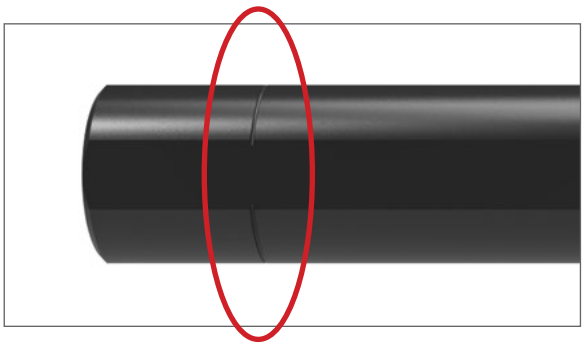
**Step 2:**
Set one cartridge to the finish diameter by tightening the adjustment screw against the adjustment pin.

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



**Step 4:**
Set the opposing cartridge with 4mm to 5mm 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 Nm (11-14 ft-lbf).



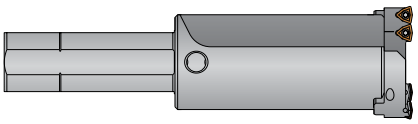
**Straight Shanks**

- Designed for lathe applications
- Can be cut off for use in end-mill 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 end-mill holder

# Product Nomenclature

## Opening Drill™ Holders

| OP1 | – | 1S | – | SS1.5 |
|---|---|---|---|---|
| 1 | | 2 | | 3 |



**1. Series**

- **OP1** = 50.8mm - 63.5mm (2.00” - 2.50”)
- **OP2** = 63.5mm - 76.2mm (2.50” - 3.00”)
- **OP3** = 76.2mm - 104.7mm (3.00” - 4.12”)
- **OP4** = 104.7mm - 142.8mm (4.12” - 5.62”)

**2. Length**

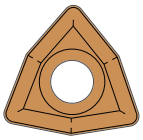
- **1S** = Short
- **1L** = Long

**3. Shank Type**

- **SS1.5** = 38.1mm (1.5”) Ø straight
- **SS2.5** = 63.5mm (2.5”) Ø straight
- **40M** = 40mm straight
- **50M** = 50mm straight
- **CV40** = CAT40
- **CV50** = CAT50
- **BT40** = BT40
- **BT50** = BT50
- **HSK63** = HSK 63A/C
- **HSK100** = HSK 100A/C
- **ABS63** = ABS63
- **DV50** = DIN50

## 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** = 7.94mm

**3. Thickness**

- **T3** = 3.97mm

**4. Radius**

- **08** = 0.79mm

**5. Carbide Grade**

- **Blank** = P35 (C5)
- **1** = K35 (C1)
- **2** = K25 (C2)

**6. Coating**

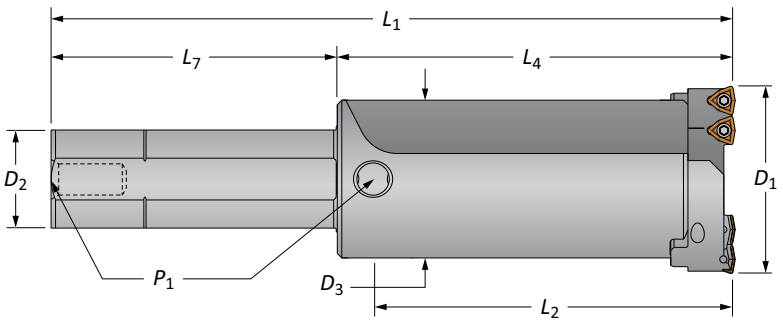
- **P** = AM300®
- **H** = AM200®
- **T** = TiN
- **A** = TiAlN
- **N** = TiCN
- **U** = Uncoated

**7. Geometry**

- **Blank** = General Purpose
- **HR** = High Rake

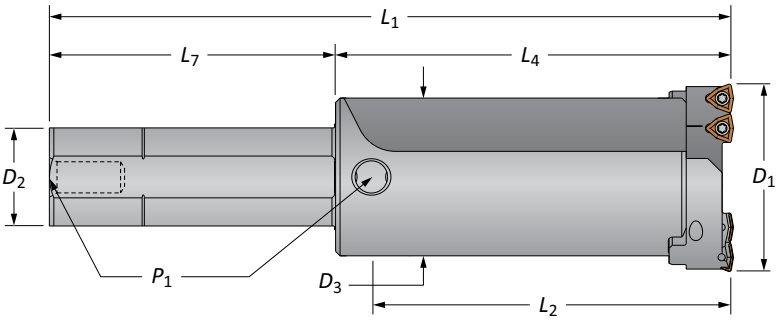
**Reference Key**

| 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 |



## Opening Drill™Holders

Straight Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Holder $L_1$ | Shank $D_2$ | Shank $L_7$ | Shank $P_1$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ⓜ | Short | 50.8 - 63.5 | 46.74 | 83.5 | 102.9 | 172.9 | 40 | 70 | – | **OP1-1S-40M** | OP1-WC05 |
| | Long | 50.8 - 63.5 | 46.74 | 140.6 | 160.1 | 230.1 | 40 | 70 | – | **OP1-1L-40M** | OP1-WC05 |
| | Short | 63.5 - 76.2 | 56.39 | 118.5 | 139.8 | 209.8 | 40 | 70 | – | **OP2-1S-40M** | OP2-WC05 |
| | Long | 63.5 - 76.2 | 56.39 | 194.7 | 216.0 | 286.0 | 40 | 70 | – | **OP2-1L-40M** | OP2-WC05 |
| | Short | 76.2 - 104.7 | 71.27 | 129.9 | 152.5 | 222.5 | 40 | 70 | – | **OP3-1S-40M** | OP3-WC05 |
| | Long | 76.2 - 104.7 | 71.27 | 231.5 | 254.1 | 324.1 | 40 | 70 | – | **OP3-1L-40M** | OP3-WC05 |
| | Short | 104.7 - 142.8 | 88.90 | 127.4 | 152.5 | 232.5 | 50 | 80 | – | **OP4-1S-50M** | OP4-WC05 |
| | Long | 104.7 - 142.8 | 88.90 | 254.4 | 292.2 | 372.2 | 50 | 80 | – | **OP4-1L-50M** | OP4-WC05 |
| ⓘ | Short | 2.00 - 2.50 | 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 | 2.00 - 2.50 | 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 | 2.50 - 3.00 | 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 | 2.50 - 3.00 | 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 | 3.00 - 4.12 | 2.806 | 5-7/64 | 6 | 10 | 1-1/2 | 4 | 1/4 NPT | **OP3-1S-SS1.5** | OP3-WC05 |
| | Long | 3.00 - 4.12 | 2.806 | 9-7/64 | 10 | 14 | 1-1/2 | 4 | 1/4 NPT | **OP3-1L-SS1.5** | OP3-WC05 |
| | Short | 4.12 - 5.62 | 3.500 | 5-1/64 | 6 | 10-1/2 | 2 | 4-1/2 | 1/4 NPT | **OP4-1S-SS2.0** | OP4-WC05 |
| | Long | 4.12 - 5.62 | 3.500 | 10-33/64 | 11-1/2 | 16 | 2 | 4-1/2 | 1/4 NPT | **OP4-1L-SS2.0** | OP4-WC05 |

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

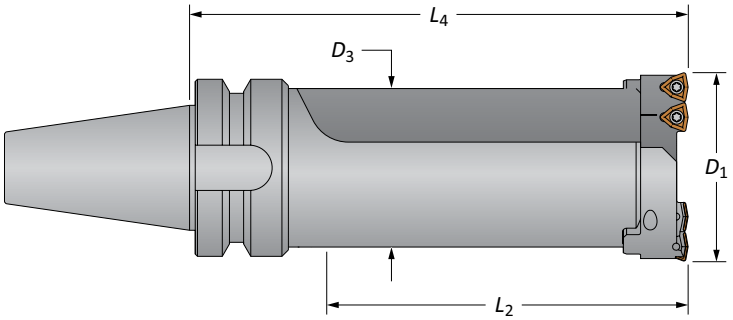
A70: 14 - 17
Key on A70: 1
A70: 2 - 3

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

ⓜ = Metric (mm)
ⓘ = Imperial (in)

## Opening Drill™ Holders

BT40 Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|
| | Short | 50.8 - 63.5 | 46.73 | 83.5 | 137.8 | **OP1-1S-BT40** | OP1-WC05 |
| | Long | 50.8 - 63.5 | 46.73 | 140.6 | 195.0 | **OP1-1L-BT40** | OP1-WC05 |
| | Short | 63.5 - 76.2 | 56.39 | 118.5 | 174.7 | **OP2-1S-BT40** | OP2-WC05 |
| ⓜ | Long | 63.5 - 76.2 | 56.39 | 194.7 | 250.9 | **OP2-1L-BT40** | OP2-WC05 |
| | Short | 76.2 - 104.7 | 71.27 | 129.9 | 187.4 | **OP3-1S-BT40** | OP3-WC05 |
| | Long | 76.2 - 104.7 | 71.27 | 231.5 | 289.0 | **OP3-1L-BT40** | OP3-WC05 |
| | Short | 104.7 - 142.8 | 88.90 | 127.4 | 187.4 | **OP4-1S-BT40** | OP4-WC05 |

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

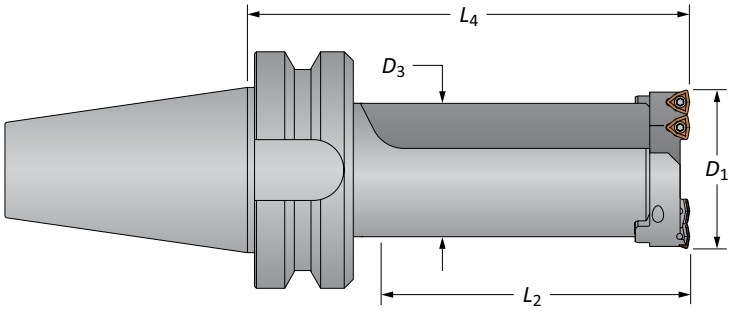
A70: 14 - 17
Key on A70: 1
A70: 2 - 3

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

ⓜ = Metric (mm)
ⓘ = Imperial (in)

## Opening Drill™ Holders

BT50 Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|
| ⓜ | Short | 50.8 - 63.5 | 46.73 | 83.5 | 147.4 | **OP1-1S-BT50** | OP1-WC05 |
| | Long | 50.8 - 63.5 | 46.73 | 140.6 | 204.5 | **OP1-1L-BT50** | OP1-WC05 |
| | Short | 63.5 - 76.2 | 56.39 | 118.5 | 174.7 | **OP2-1S-BT50** | OP2-WC05 |
| | Long | 63.5 - 76.2 | 56.39 | 194.7 | 260.4 | **OP2-1L-BT50** | OP2-WC05 |
| | Short | 76.2 - 104.7 | 71.27 | 129.9 | 196.9 | **OP3-1S-BT50** | OP3-WC05 |
| | Long | 76.2 - 104.7 | 71.27 | 231.5 | 298.5 | **OP3-1L-BT50** | OP3-WC05 |
| | Short | 104.7 - 142.8 | 88.90 | 127.4 | 196.9 | **OP4-1S-BT50** | OP4-WC05 |
| | Long | 104.7 - 142.8 | 188.90 | 254.4 | 336.5 | **OP4-1L-BT50** | OP4-WC05 |

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

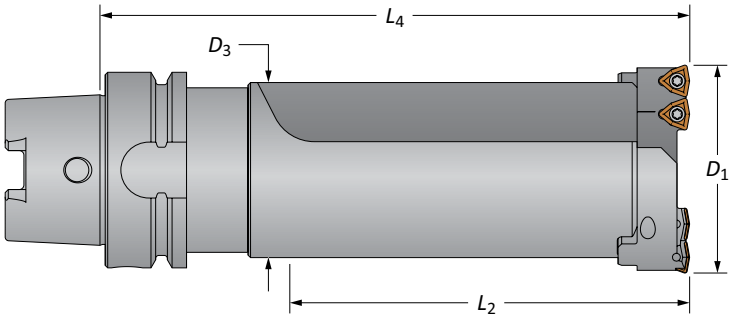
A70: 14 - 17
Key on A70: 1
A70: 2 - 3

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

ⓜ = Metric (mm)
ⓘ = Imperial (in)

## Opening Drill™ Holders

HSK63 Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|
| | Short | 50.80 - 63.50 | 46.74 | 82.55 | 143.51 | **OP1-1S-HSK63** | OP1-WC05 |
| | Long | 50.80 - 63.50 | 46.74 | 139.70 | 200.66 | **OP1-1L-HSK63** | OP1-WC05 |
| | Short | 63.50 - 76.20 | 56.39 | 120.65 | 181.61 | **OP2-1S-HSK63** | OP2-WC05 |
| ⓜ | Long | 63.50 - 76.20 | 56.39 | 196.85 | 257.81 | **OP2-1L-HSK63** | OP2-WC05 |
| | Short | 76.20 - 104.65 | 71.27 | 127.00 | 194.31 | **OP3-1S-HSK63** | OP3-WC05 |
| | Long | 76.20 - 104.65 | 71.27 | 228.60 | 295.91 | **OP3-1L-HSK63** | OP3-WC05 |
| | Short | 104.65 - 142.75 | 88.90 | 127.00 | 194.31 | **OP4-1S-HSK63** | OP4-WC05 |

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

A70: 14 - 17
Key on A70: 1
A70: 2 - 3

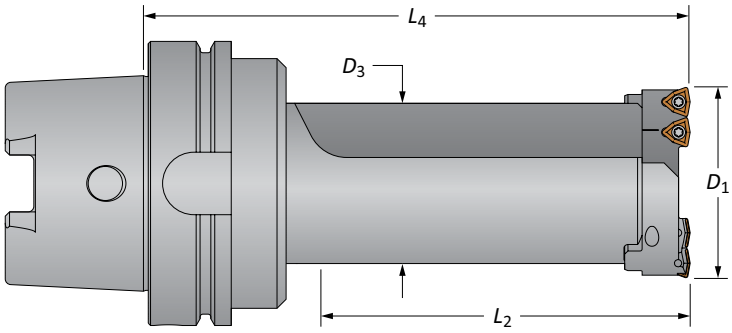
Mounting screws sold in multiples of 4 | Adjusting screws sold in multiples of 4
IC inserts sold in multiples of 10 | Insert screws sold in multiples of 10

ⓜ = Metric (mm)
ⓘ = Imperial (in)


www.alliedmachine.com | +44 (0) 1384 400 900 | enquiries.eu@alliedmachine.com

# Opening Drill™ Holders

HSK100 Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|
| | Short | 50.80 - 63.50 | 46.74 | 82.55 | 149.86 | **OP1-1S-HSK100** | OP1-WC05 |
| | Long | 50.80 - 63.50 | 46.74 | 139.70 | 207.01 | **OP1-1L-HSK100** | OP1-WC05 |
| | Short | 63.50 - 76.20 | 56.39 | 120.65 | 187.96 | **OP2-1S-HSK100** | OP2-WC05 |
| ⓘ | Long | 63.50 - 76.50 | 56.39 | 196.85 | 264.16 | **OP2-1L-HSK100** | OP2-WC05 |
| | Short | 76.20 - 104.65 | 71.27 | 127.00 | 200.66 | **OP3-1S-HSK100** | OP3-WC05 |
| | Long | 76.20 - 106.65 | 71.27 | 228.60 | 302.26 | **OP3-1L-HSK100** | OP3-WC05 |
| | Short | 104.65 - 142.75 | 88.90 | 127.00 | 200.66 | **OP4-1S-HSK100** | OP4-WC05 |
| | Long | 104.65 - 142.75 | 88.90 | 266.70 | 340.36 | **OP4-1L-HSK100** | OP4-WC05 |

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

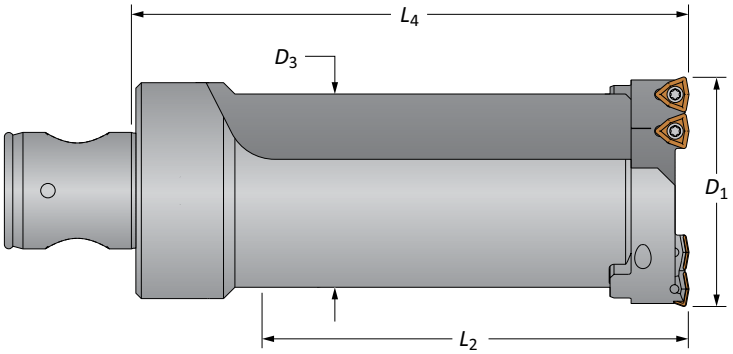
A70: 14 - 17
Key on A70: 1
A70: 2 - 3

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

ⓜ = Metric (mm)
ⓘ = Imperial (in)

## Opening Drill™ Holders

ABS63 Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|
| | Short | 50.80 - 63.50 | 82.55 | 82.55 | 139.70 | **OP1-1S-ABS63** | OP1-WC05 |
| | Long | 50.80 - 63.50 | 139.70 | 139.70 | 196.85 | **OP1-1L-ABS63** | OP1-WC05 |
| | Short | 63.50 - 76.20 | 120.65 | 120.65 | 158.75 | **OP2-1S-ABS63** | OP2-WC05 |
| ⓘ | Long | 63.50 - 76.20 | 196.85 | 196.85 | 234.95 | **OP2-1L-ABS63** | OP2-WC05 |
| | Short | 76.20 - 104.65 | 127.00 | 127.00 | 171.45 | **OP3-1S-ABS63** | OP3-WC05 |
| | Long | 76.20 - 104.65 | 228.60 | 228.60 | 273.05 | **OP3-1L-ABS63** | OP3-WC05 |
| | Short | 104.65 - 142.75 | 127.00 | 127.00 | 171.45 | **OP4-1S-ABS63** | OP4-WC05 |

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

A70: 14 - 17
Key on A70: 1
A70: 2 - 3

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

ⓜ = Metric (mm)
ⓘ = Imperial (in)



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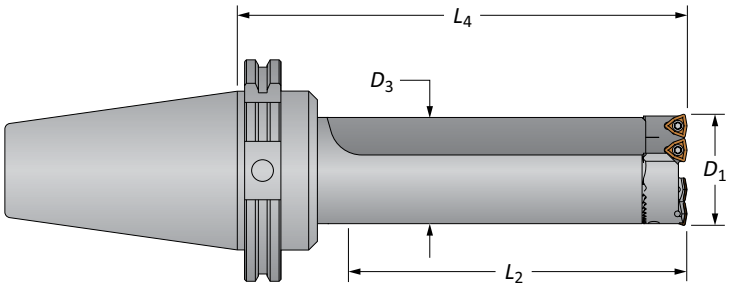
## Opening Drill™ Holders

DIN50 Shank | Diameter Range: 50.8mm - 142.8mm (2.00” - 5.62”)




**Holders**

| | Length | $D_1$ Range | Holder $D_3$ | Holder $L_2$ | Holder $L_4$ | Part No. | Cartridges |
|---|---|---|---|---|---|---|---|
| ⓜ | Short | 50.8 - 63.5 | 59.44 | 83.5 | 137.9 | **OP1-1S-DV50** | OP1-WC05 |
| | Long | 50.8 - 63.5 | 59.44 | 140.6 | 195.1 | **OP1-1L-DV50** | OP1-WC05 |
| | Short | 63.5 - 76.2 | 69.01 | 118.5 | 174.8 | **OP2-1S-DV50** | OP2-WC05 |
| | Long | 63.5 - 76.2 | 69.01 | 194.7 | 251.0 | **OP2-1L-DV50** | OP2-WC05 |
| | Short | 76.2 - 104.7 | 83.97 | 129.9 | 187.5 | **OP3-1S-DV50** | OP3-WC05 |
| | Long | 76.2 - 104.7 | 83.97 | 231.5 | 289.1 | **OP3-1L-DV50** | OP3-WC05 |
| | Short | 104.7 - 142.8 | 101.60 | 127.4 | 187.5 | **OP4-1S-DV50** | OP4-WC05 |
| | Long | 104.7 - 142.8 | 101.60 | 254.4 | 327.2 | **OP4-1L-DV50** | OP4-WC05 |

Note: there is an extended delivery time for this item. Please check when ordering.

**Cartridges**

| Replacement Cartridges | Qty. Inserts Needed | Mounting Screw | Adjusting Screw |
|---|---|---|---|
| **OP1-WC05** | 2 | MS-13M-1 | AS-10T9-1 |
| **OP2-WC05** | 2 | MS-15M-1 | AS-10T9-1 |
| **OP3-WC05** | 2 | MS-15M-1 | AS-12T9-1 |
| **OP4-WC05** | 3 | MS-15M-1 | AS-14T9-1 |

**IC Inserts**

| Carbide Grade | Geometry | Part No. AM300® | Part No. AM200® | Part No. TiN | Insert Screws |
|---|---|---|---|---|---|
| P35 (C5) | Standard | **OP-05T308-P** | **OP-05T308-H** | **OP-05T308-T** | IS-10-1 |
| K35 (C1) | Standard | **OP-05T308-1P** | **OP-05T308-1H** | **OP-05T308-1T** | IS-10-1 |
| K25 (C2) | Standard | **OP-05T308-2P** | **OP-05T308-2H** | – | IS-10-1 |
| P35 (C5) | High Rake | **OP-05T308-PHR** | **OP-05T308-HHR** | – | IS-10-1 |

A70: 14 - 17
Key on A70: 1
A70: 2 - 3

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

ⓜ = Metric (mm)
ⓘ = Imperial (in)

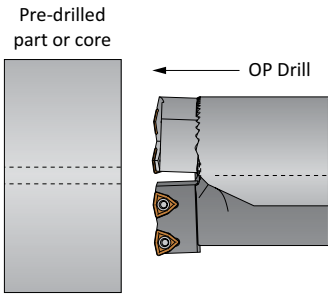
## Recommended Cutting Data | Metric (mm)

| ISO | Material | Hardness (BHN) | Speed (M/min) AM300® | AM200® | TiN | Feed Rate (mm/rev) |
|---|---|---|---|---|---|---|
| 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, 0-2, 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 – Opening Range**

Ex: To open an existing diameter hole to 69.85mm 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 | Opening Range Diameter |
|---|---|---|
| OP1 | 50.8 - 63.5 | 47.75 |
| OP2 | 63.5 - 76.2 | 47.75 |
| OP3 | 76.2 - 104.6 | 47.75 |
| OP4 | 104.6 - 142.7 | 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) | $K_m$ (lbs/in²) |
|---|---|---|
| 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** = $(318.31 \bullet M/min) / DIA_F$

*where:*

| | |
|---|---|
| RPM | = revolutions per minute (rev/min) |
| M/min | = speed (M/min) |
| $DIA_F$ | = finish diameter of drill (mm) |

2. **kW** = $((DIA_F^2 - DIA_P^2) \bullet mm/rev \bullet RPM \bullet K_m) / 205{,}154$

*where:*

| | |
|---|---|
| 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** = $148.78 \bullet mm/rev \bullet (DIA_F - DIA_P) \bullet K_m$

*where:*

| | |
|---|---|
| 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** = $(kW \bullet 9549.3) / RPM$

*where:*

| | |
|---|---|
| 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*.

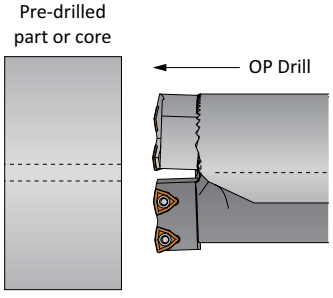
## Recommended Cutting Data | Imperial (inch)

| ISO | Material | Hardness (BHN) | Speed (SFM) AM300® | AM200® | TiN | Feed Rate (IPR) |
|---|---|---|---|---|---|---|
| P | **Free Machining Steel** 1118, 1215, 12L14, etc. | 100 - 250 | 900 - 1300 | 850 - 1200 | 700 - 900 | .0035 - .007 |
| | **Low Carbon Steel** 1010, 1020, 1025, 1522, 1144, etc. | 85 - 275 | 850 - 1250 | 800 - 1150 | 650 - 850 | .003 - .0065 |
| | **Medium Carbon Steel** 1030, 1040, 1050, 1527, 1140, 1151, etc. | 125 - 325 | 800 - 1050 | 750 - 950 | 600 - 850 | .0035 - .0065 |
| | **Alloy Steel** 4140, 5140, 8640, etc. | 125 - 375 | 750 - 1000 | 700 - 900 | 600 - 850 | .0035 - .0065 |
| | **High Strength Alloy** 4340, 4330V, 300M, etc. | 225 - 400 | 600 - 850 | 550 - 750 | 400 - 650 | .003 - .005 |
| | **Structural Steel** A36, A285, A516, etc. | 100 - 350 | 850 - 1050 | 800 - 950 | 650 - 850 | .003 - .0065 |
| | **Tool Steel** H-13, H-21, A-4, 0-2, S-3, etc. | 150 - 250 | 400 - 800 | 350 - 700 | 250 - 650 | .0025 - .005 |
| S | **High Temp Alloy** Hastelloy B, Inconel 600, etc. | 140 - 310 | 250 - 450 | 250 - 350 | 150 - 300 | .0025 - .005 |
| M | **Stainless Steel 400 Series** 416, 420, etc. | 185 - 350 | 600 - 850 | 550 - 750 | 400 - 650 | .003 - .006 |
| | **Stainless Steel 300 Series** 304, 316, 17-4PH, etc. | 135 - 275 | 600 - 850 | 550 - 750 | 400 - 650 | .003 - .006 |
| | **Super Duplex Stainless Steel** | 135 - 275 | 500 - 750 | 450 - 650 | 300 - 550 | .002 - .005 |
| K | **Nodular, Grey, Ductile Cast Iron** | 120 - 320 | 700 - 900 | 650 - 800 | 500 - 700 | .004 - .008 |
| N | **Cast Aluminium** | 30 - 180 | 1250 - 1650 | 1200 - 1550 | 950 - 1100 | .006 - .012 |
| | **Wrought Aluminium** | 30 - 180 | 1250 - 1650 | 1200 - 1550 | 950 - 1100 | .006 - .012 |
| | **Brass** | 30 - 100 | 950 - 1350 | 900 - 1250 | 750 - 1100 | .005 - .009 |

**Minimum Pilot Hole Diameter = Finish Diameter – Opening Range**

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 | Opening Range Diameter |
|---|---|---|
| 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.

## Formulas and Constants | Imperial (inch)

### Material Constants

| Type of Material | Hardness (BHN) | $K_m$ (lbs/in²) |
|---|---|---|
| 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** = $(3.82 \bullet SFM) / DIA_F$

*where:*

| | |
|---|---|
| RPM | = revolutions per minute (rev/min) |
| SFM | = speed (ft/min) |
| $DIA_F$ | = finish diameter of drill (inch) |

2. **HP** = $(0.5891 \bullet (DIA_F^2 - DIA_P^2) \bullet IPR \bullet RPM \bullet K_m) / 0.80$

*where:*

| | |
|---|---|
| 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/in²) |
| | machine efficiency (using 0.80 as constant) |

3. **Thrust** = $148{,}500 \bullet IPR \bullet (DIA_F - DIA_P) \bullet K_m$

*where:*

| | |
|---|---|
| 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/in²) |

5. **Torque** = $(HP \bullet 5252) / RPM$

*where:*

| | |
|---|---|
| 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*.

## Notes