Wohlhaupter® Rough and Finish Boring

Combi-Line

- Diameter Range: 0.965" - 7.913" (24.50 mm - 201.00 mm)

One tool. Two operations.

The Wohlhaupter Combi-Line combines both rough and finish boring into one operation. The front insert holder is the roughing cutting edge while the shorter holder finishes the hole, saving you time and money.

Your safety and the safety of others is very important. This catalog 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 catalog, 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 catalog. 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.

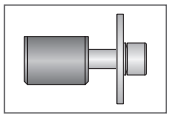
NOTE and **IMPORTANT** are also used. These are important that you read and follow but are not safety-related.

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

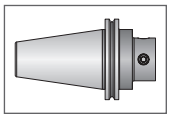
Applicable Industries

Aerospace | Agriculture | Automotive | Firearms | General Machining | Oil & Gas | Renewable Energy

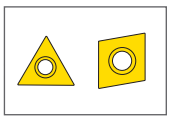
Reference Icons
The following icons will appear throughout the catalog to help you navigate between products.



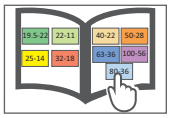
Clamping Elements
For use with insert holders and boring heads



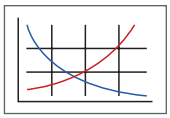
Shanks
A variety of shanks for different machines



Inserts
For use with insert holder boring heads and boring bars using indexable inserts



MVS Connection Color Guide
Detailed instructions and information regarding the MVS connection(s)



Recommended Cutting Data
Speed and feed recommendations for optimum and safe boring

Coolant-Through Option
Indicates that the product is coolant through

Combined Rough and Finish Boring Table of Contents

Combi-Line Introduction

Series	Diameter Range	
	Imperial (inch)	Metric (mm)
Combi-Line 404 (401)	0.965 - 7.913	24.50 - 201.00

Combi-Line Product Overview

Combi-Line
ROUGH & FINISH BORING

Two operations. One Tool.

Decrease cycle time and tool changes with the Wohlhaupter Combi-Line. The Combi-Line combines rough and finish boring into one tool with height displaced insert holders.

Reduce your ***cycle time*** with the Combi-Line.

- Diameter range: 0.965" - 7.913" (24.50 mm - 201.00 mm)
- Reduce cycle and tool changing time
- Available in semi-standard same level or height displaced insert holders
- Coolant through
- 0.0001" (0.002 mm) vernier adjustment on finishing insert holder
- Max spindle speed: 5,000 SFM

IMPORTANT: Max spindle speed refers to maximum possible speed for an individual boring head and is not a recommended parameter. Refer to page B10-M: 12 for recommended application-specific parameters. Factory technical assistance is available for your specific applications through our Application Engineering department.
ext: **7611** | *email:* **appeng@alliedmachine.com**

Cycle time is crucial. Why not choose the best process?

Application: Ductile Cast Iron

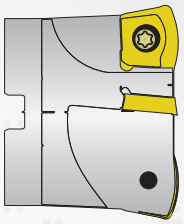
Finish Diameter: 1.968" (50 mm) (+/- 0.0005" [0.013 mm])

Pre-Hole Diameter: 1.771" (45 mm)

Boring Depth: 8.228" (209 mm)

Hole Finish: 32 Ra

Measure	1st Process Option	
	Step 1 Rough 49 mm Competitor 1.5" High Feed Milling Tool	Step 2 Finish 50 mm Wohlhaupter 320 Boring Head
Speed	1000 SFM (2500 RPM)	600 SFM (1165 PRM)
Feed Rate	0.020 IPT (153 IPM)	0.004 IPR (0.466 IPM)
Total Passes	77	1
Cycle Time (per hole)	1.93 min	1.77 min
Tool Change Time	15 sec	
Cycle Time (per part)	**3 min 54 sec**	



1.5" High Feed Milling Tool

Wohlhaupter 320 Boring Head

Measure	2nd Process Option	
	Step 1 Rough 49 mm Wohlhaupter Twin Cutter at 49 mm Ø	Step 2 Finish 50 mm Wohlhaupter 320 Boring Head
Speed	500 SFM (990 RPM)	600 SFM (1165 PRM)
Feed Rate	0.012 IPR (11.88 IPM)	0.004 IPR (0.466 IPM)
Total Passes	1	1
Cycle Time (per hole)	.69 min	1.77 min
Tool Change Time	15 sec	
Cycle Time (per part)	**2 min 46 sec**	

Wohlhaupter Twin Cutter

Wohlhaupter 320 Boring Head

OUR ***SOLUTION***

Combi-Line Rough and Finish Boring

Measure	3rd Process Option Finish 50mm Wohlhaupter Combi-Line
Speed	600 SFM (1165 RPM)
Feed Rate	0.004 IPR (0.466 IPM)
Total Passes	1
Cycle Time (per hole)	1.77 min
Tool Change Time	0
Cycle Time (per part)	**1 min 46 sec**

60 seconds of total cycle time saved

- Combi-Line assembly:
  (1) ***Insert holders (x2): 402021***
  (2) ***Serrated tool body: 404006***
  (3) ***Shank: 353014***

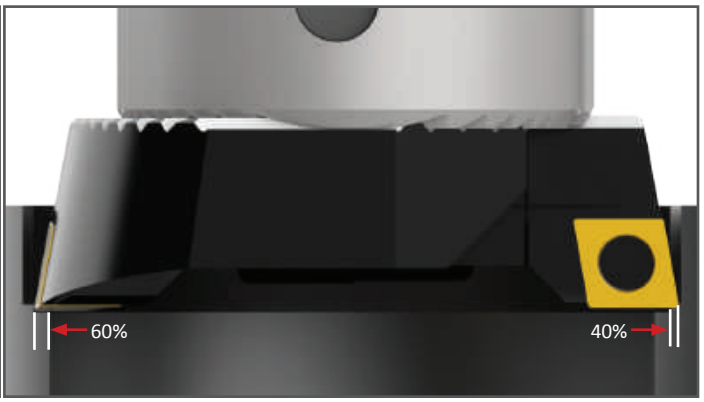
Boring inserts
- ***Item No. 297653WHC19***

1 tool vs. 2 tools saves you time and money

Material Removal Percentages | Tool Usage | Same-Level Cutting

Material Removal Percentages

Material removal up to 0.157" (4.00 mm) on diameter: **50% roughing 50% finishing**



Material removal up to 0.157" - 0.276" (4.00 mm - 7.00 mm) on diameter: **60% roughing 40% finishing**

Material removal up to 0.276" - 0.394" (7.00 mm - 10.00 mm) on diameter: **70% roughing 30% finishing**

- For tools with a length-to-diameter ratio greater than 4:1, the existing hole diameter should be no more than 0.157" (4.00 mm) smaller than the finish diameter. The 50% roughing and 50% finishing rule should be applied.
- When boring with severe interruptions, the existing hole diameter should be no more than 0.157" (4.00 mm) smaller than the finish diameter. The 50% roughing and 50% finishing rule should be applied.

IMPORTANT: Consult application engineering for technical support when using Combi-Line tools in holes with interruptions.
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Tool Usage

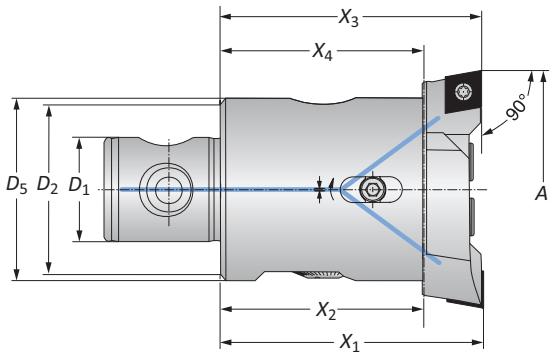
- For most applications, the same inserts should be used in both the roughing and finishing insert holders.
- To insure proper chip breaking, the finishing insert holder DOC must be at least 0.020" (0.50 mm)
- Up to a 4:1 length-to-diameter ratio, standard insert holders with a height displacement of up to 0.012" (0.30 mm) can be used.
- Inserts with wiper geometry are recommended only for special Combi-Line applications.

Same-Level Cutting (0.003" (0.08 mm) Height Displacement)

- With length-to-diameter ratios greater than 4:1, same-level insert holders are recommended to reduce the risk of vibration.
- Same-level cutting inserts will create a 0.003" (0.08 mm) step between the roughing and finishing sides.
- Boring blind holes may require the use of same-level insert holders. (If a true 90° flat bottom is required, a secondary operation to clean up the bottom step may be needed.)
- Combi-Line should be applied as a single-effective cutting tool even when same-level insert holders are used.

Boring Heads and Insert Holders

Diameter Range: 0.965" - 7.913" (24.50 mm - 201.00 mm)



COMBI LINE

	Connection D_2 | D_1	Boring Range A	Boring Head X_1	X_3	X_2	X_4	D_5	Weight	Insert Form	Part No. (x2)* Insert Holder**	Part No. Boring Head
	22 - 11	0.965 - 1.161	1.811	1.801	1.339	1.329	–	0.220 (lbs)	101	**402029**	**404003**
	25 - 14	1.142 - 1.457	2.205	2.195	1.614	1.604	1.024	0.440 (lbs)	101	**402009**	**404004**
	25 - 14	1.142 - 1.457	2.205	2.195	1.614	1.604	1.024	0.440 (lbs)	103	**402011**	**404004**
	25 - 14	1.417 - 1.732	2.205	2.195	1.614	1.604	1.181	0.661 (lbs)	101	**402017**	**404005**
	25 - 14	1.417 - 1.732	2.205	2.195	1.614	1.604	1.181	0.661 (lbs)	103	**402019**	**404005**
	32 - 18	1.693 - 2.126	2.598	2.587	1.890	1.878	1.339	0.881 (lbs)	103	**402021**	**404006**
ⓘ	40 - 22	2.087 - 2.598	2.953	2.941	2.165	2.154	–	1.543 (lbs)	103	**402005**	**404007**
	50 - 28	2.559 - 3.268	2.953	2.941	2.165	2.154	–	2.425 (lbs)	103	**402013**	**404008**
	63 - 36	3.228 - 4.055	3.543	3.531	2.756	2.744	–	4.850 (lbs)	103	**402001**	**404009**
	80 - 36	4.016 - 5.000	3.543	3.531	2.598	2.587	3.346	6.613 (lbs)	103	**402025**	**404010**
	80 - 36	5.000 - 5.984	3.543	3.531	2.598	2.587	3.346	6.834 (lbs)	103	**402026**	**404010**
	80 - 36	5.945 - 6.929	3.543	3.531	2.598	2.587	5.276	8.377 (lbs)	103	**402025**	**404011**
	80 - 36	6.929 - 7.913	3.543	3.531	2.598	2.587	5.276	8.598 (lbs)	103	**402026**	**404011**
	22 - 11	24.50 - 29.50	46.00	45.75	34.00	33.75	–	0.10 (kg)	101	**402029**	**401003**
	25 - 14	29.00 - 37.00	56.00	55.75	41.00	40.75	26.00	0.20 (kg)	101	**402009**	**401004**
	25 - 14	29.00 - 37.00	56.00	55.75	41.00	40.75	26.00	0.20 (kg)	103	**402011**	**401004**
	25 - 14	36.00 - 44.00	56.00	55.75	41.00	40.75	30.00	0.30 (kg)	101	**402017**	**401005**
	25 - 14	36.00 - 44.00	56.00	55.75	41.00	40.75	30.00	0.30 (kg)	103	**402019**	**401005**
	32 - 18	43.00 - 54.00	66.00	65.70	48.00	47.70	34.00	0.40 (kg)	103	**402021**	**401006**
ⓜ	40 - 22	53.00 - 66.00	75.00	74.70	55.00	54.70	–	0.70 (kg)	103	**402005**	**401007**
	50 - 28	65.00 - 83.00	75.00	74.70	55.00	54.70	–	1.10 (kg)	103	**402013**	**401008**
	63 - 36	82.00 - 103.00	90.00	89.70	70.00	69.70	–	2.20 (kg)	103	**402001**	**401009**
	80 - 36	102.00 - 127.00	90.00	89.70	66.00	65.70	85.00	3.00 (kg)	103	**402025**	**401010**
	80 - 36	127.00 - 152.00	90.00	89.70	66.00	65.70	85.00	3.10 (kg)	103	**402026**	**401010**
	80 - 36	151.00 - 176.00	90.00	89.70	66.00	65.70	134.00	3.80 (kg)	103	**402025**	**401011**
	80 - 36	176.00 - 201.00	90.00	89.70	66.00	65.70	134.00	3.90 (kg)	103	**402026**	**401011**

*(2) insert holders are required
**Insert holders sold individually

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Key on B10-C: 1

ⓘ = Imperial (in)
ⓜ = Metric (mm)
Inserts sold separately

IMPORTANT: Max spindle speed refers to maximum possible speed for an individual boring head and is not a recommended parameter. Refer to page B10-M: 12 for recommended application-specific parameters. Factory technical assistance is available for your specific applications through our Application Engineering department.
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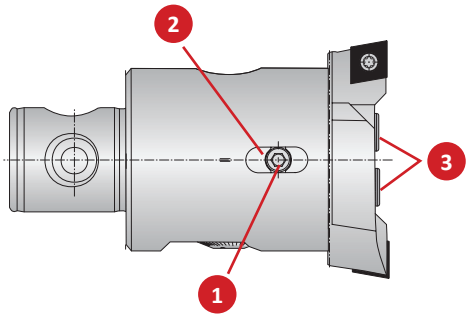
Accessories

Screws | Clamping Elements



	Boring Head Part No.	Part No. 1 Clamp Screw	Service Key	2 Clamping Piece	3 Cap Screw	Service Key
	404003	**401223**	s2.5 / A	–	**401323**	s3 / B
	404004	**401224**	s2.5 / B	**401204**	**401324**	s4 / B
	404005	**401225**	s2.5 / B	**401205**	**401324**	s4 / B
	404006	**401226**	s3 / B	**401206**	**401324**	s4 / B
i	404007	**401227**	s3 / B	**401207**	**401327**	s5 / B
	404008	**115288**	s4 / B	**401208**	**401329**	s6 / B
	404009	**215501**	s4 / B	**401209**	**401329**	s6 / B
	404010	**401230**	s4 / B	**401210**	**019183**	s8 / C
	404011	**401230**	s4 / B	**401210**	**019183**	s8 / C
	401003	**401223**	s2.5 / A	–	**401323**	s3 / B
	401004	**401224**	s2.5 / B	**401204**	**401324**	s4 / B
	401005	**401225**	s2.5 / B	**401205**	**401324**	s4 / B
	401006	**401226**	s3 / B	**401206**	**401324**	s4 / B
m	401007	**401227**	s3 / B	**401207**	**401327**	s5 / B
	401008	**115288**	s4 / B	**401208**	**401329**	s6 / B
	401009	**215501**	s4 / B	**401209**	**401329**	s6 / B
	401010	**401230**	s4 / B	**401210**	**019183**	s8 / C
	401011	**401230**	s4 / B	**401210**	**019183**	s8 / C

B10-M: 12-15
Key on B10-C:1
B10: vi-vii

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