



**ALLIED MACHINE
& ENGINEERING**

Holemaking Solutions for Today's Manufacturing



Drilling



Reaming



Burnishing



Threading



Specials



Wohlhaupter®

► *BORING*

Fine Boring Tools

WOHLHAUPTER®

SECTION

B10-B

Fine Boring

Wohlhaupter® Fine Boring

420 (410) | 465 (464) | 365 (364) | 565 (564) | 320 (310) | 538 (537)

► **Diameter Range:** 0.787" - 8.071" (20.00 mm - 205.00 mm)



NOTE: Imperial items pictured.

NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.

NOTE: Internal digital and vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

Boring has never been more exciting.

Wohlhaupter's fine boring systems are offered in both vernier and easy-to-read digital readout boring heads and cassettes. The lightweight Alu-Line serrated tool bodies reduce weight on the machine spindle.

Digital 3E^{TECH+} Boring Heads

- 420 (410) / 465 (464) balance fine boring heads
- 420 (410) \varnothing 0.787" - 1.142" (20.00 mm - 29.00 mm)
- 465 (464) \varnothing 1.142" - 8.071" (29.00 mm - 205.00 mm)

Balance Analog Boring Heads

- 365 (364) / 465 (464) fine boring heads
- 365 (364) \varnothing 0.787" - 1.161" (20.00 mm - 29.50 mm)
- 465 (464) \varnothing 1.142" - 8.071" (29.00 mm - 205.00 mm)

Balance Digital Boring Heads

- 565 (564) fine boring heads
- \varnothing 1.969" - 8.071" (50.00 mm - 205.00 mm)

Analog Boring Heads

- 320 (310) fine boring heads
- \varnothing 0.787" - 8.071" (20.00 mm - 205.00 mm)

Analog and Digital Cassettes

- 538 (537) fine boring cassettes
- \varnothing 3.937" - 8.071" (100.00 mm - 205.00 mm)

Applicable Industries



Aerospace



Agriculture



Automotive



Firearms



General
Machining



Oil & Gas



Renewable
Energy

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.

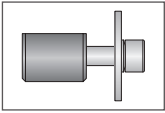
NOTE and **IMPORTANT** are also used. These are important that you read and follow but are not safety-related.

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

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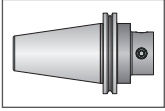
Reference Icons

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



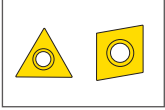
Clamping Elements

For use with insert holders and boring heads



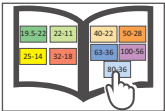
Shanks

A variety of shanks for different machines



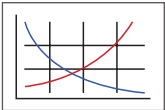
Inserts

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

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Series	Diameter Range	
	Imperial (inch)	Metric (mm)
420 (410)	0.787 - 1.142	20.00 - 29.00
465 (464)	1.142 - 8.071	29.00 - 205.00
365 (364)	0.787 - 1.161	20.00 - 29.50
565 (564)	1.969 - 8.071	50.00 - 205.00
320 (310)	0.787 - 8.071	20.00 - 205.00
538 (537)	3.937 - 8.071	100.00 - 205.00

420 (410) and 465 (464) Balance Product Overview

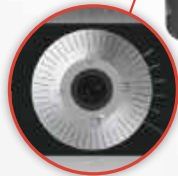
420 (410) and 465 (464) Digital 3E^{TECH+} FINE BORING

Make easy diameter adjustments with our 3E^{TECH+} digital readout module.

Wohlhaupter® 420 (410) and 465 (464) balance digital boring heads are equipped with a 3E^{TECH+} docking port for easy digital adjustments. Boring heads from 1.142" (29.00 mm) and up offer precision boring with automatic balancing. Our boring heads are specifically engineered to minimize the residual imbalance produced by insert holder displacement. Wohlhaupter Alu-Line boring heads, ranging from 2.559" (65.00 mm) and up, offer a lightweight aluminum design with a wear-resistant coating that reduces weight on the spindle up to 50%. The insert holder can also be rotated for reverse machining jobs.

- 420 (410) diameter range: 0.787" - 1.142" (20.00 mm - 29.00 mm).
- 465 (464) balance diameter range: 1.142" - 8.071" (29.00 mm - 205.00 mm).
- 465 (464) balance Alu-Line diameter range: 2.559" - 8.071" (65.00 mm - 205.00 mm).
 - Special coating on Alu-Line for wear-resistant surface.
 - Alu-Line body reduces tool weight by 50%, reducing stress on the spindle.
- Coolant through.
- 3E^{TECH+} diameter adjustment of 0.0001" (0.001 mm).
- Vernier diameter adjustment of 0.0001" (0.002 mm).
- Internal balancing improves tool life and surface finish.
- Insert holder can be rotated for back boring jobs.
- Max cutting speed: 5,577 SFM (1,700 m/min).

Highly accurate
adjustments through
vernier
scale



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.
NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

Versatile 3E^{TECH+} digital
readout compatible with
other boring tools



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

WOHLHAUPTER® 420 (410) and 465 (464) 3E^{TECH+} DIGITAL BORING HEADS

Wohlhaupter 3E^{TECH+}

Improve productivity and quality with the Wohlhaupter 3E^{TECH+} external digital readout module. The 3E^{TECH+} docks onto boring heads and cassettes that offer the 3E^{TECH+} port to make easy diameter adjustments at the machine.

- Make quick and easy micron-accurate diameter adjustments.
- Backlit OLED digital display shows exact diameter adjustments.
- 3E^{TECH+} screen will auto-rotate to match orientation of the display module.
- Toggle between imperial and metric to accommodate all applications.
- 3E^{TECH+} adjustments of 0.0001" (0.001 mm) on diameter.
- Designed to be removed from boring tool before operation (if forgotten 3E^{TECH+} module will fall off at 500 RPM).
- Water and dust resistant IP 56.
- Coolant and chip resistant.
- 3E^{TECH+} will automatically turn off after 30 seconds of not using.
- Adjustment setting is saved directly in the respective tool, even if the digital display is removed.
- WEEE-Reg.-Nr. DE 15820388.

- ✓ High-production fine boring
- ✓ Easy diameter adjustment with 3E^{TECH+}
- ✓ Self-balancing 465 (464) boring heads
- ✓ Imperial and metric

420 (410) and 465 (464) BORING HEADS WITH 3E ^{TECH+}		
	Diameter Range	Part No.
i	0.787 - 0.965	420001
	0.965 - 1.142	420002
	1.142 - 1.496	465003
	1.496 - 1.969	465004
	1.969 - 2.579	465005
	2.559 - 3.268	465006
	3.228 - 4.055	465007
	3.937 - 5.118	465008
	4.921 - 6.594	465009
	6.398 - 8.071	465010
m	20.00 - 24.50	410001
	24.50 - 29.00	410002
	29.00 - 38.00	464003
	38.00 - 50.00	464004
	50.00 - 65.50	464005
	65.00 - 83.00	464006
	82.00 - 103.00	464007
	100.00 - 130.00	464008
	125.00 - 167.50	464009
	162.50 - 205.00	464010



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.
 NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

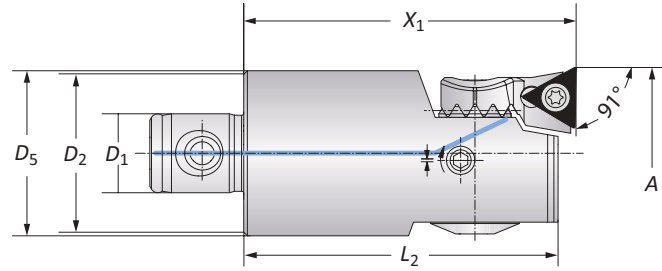
IMPORTANT: Max spindle speed refers to maximum possible speed for an individual boring head and is not a recommended parameter. Refer to page B10-M: 12 for recommended application-specific parameters. Factory technical assistance is available for your specific applications through our Application Engineering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

420 (410) Digital 3E^{TECH+} Boring Heads

Diameter Range: 0.787" - 1.142" (20.00 mm - 29.00 mm)



Form 101



Form 20

NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

420 Digital 3E^{TECH+} Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
		D ₂ D ₁	A	X ₁	L ₂			D ₅	Insert Holder
i	19 - 11	0.787 - 0.965	1.811	1.693	–	0.198 (lbs)	20*	364077	420001
	22 - 11	0.965 - 1.142	1.811	1.713	0.906	0.286 (lbs)	20	210059	420002
	22 - 11	0.965 - 1.142	1.811	1.713	0.906	0.286 (lbs)	101	210069	420002

*Not suitable for indexable inserts with a radius of 0.031" (0.80 mm).

NOTE: 3E^{TECH+} module, charging unit, insert holders, and inserts sold separately.

410 Digital 3E^{TECH+} Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
		D ₂ D ₁	A	X ₁	L ₂			D ₅	Insert Holder
m	19 - 11	20.00 - 24.50	46.00	43.00	–	0.09 (kg)	20*	364077	410001
	22 - 11	24.50 - 29.00	46.00	43.50	23.00	0.13 (kg)	20	210059	410002
	22 - 11	24.50 - 29.00	46.00	43.50	23.00	0.13 (kg)	101	210069	410002

*Not suitable for indexable inserts with a radius of 0.031" (0.80 mm).

NOTE: 3E^{TECH+} module, charging unit, insert holders, and inserts sold separately.

3E^{TECH+} Digital Readout Module

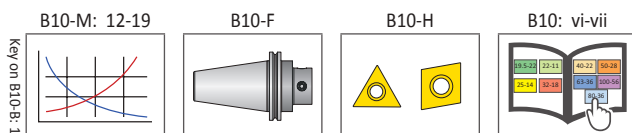
Part No.	Charging Unit*
536015	536016

NOTE: WEEE-Reg.-Nr. DE 15820388

*Charging unit sold separately.



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.



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

Inserts sold separately

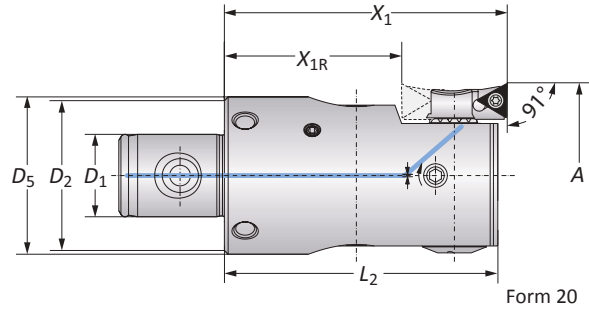
IMPORTANT: Max spindle speed refers to maximum possible speed for an individual boring head and is not a recommended parameter. Refer to page B10-M: 12 for recommended application-specific parameters. Factory technical assistance is available for your specific applications through our Application Engineering department.
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465 (464) Balance Digital 3E^{TECH+} Boring Heads

Diameter Range: 1.142" - 2.579" (29.00 mm - 65.50 mm)



Form 101



Form 20

NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

465 Balance Digital 3E^{TECH+} Boring Heads

	MVS Connection		Boring Range				Boring Head		Part No.	
	D ₂ D ₁	A	X ₁	X _{1R}	L ₂	D ₅	Weight	Insert Form	Insert Holder	Boring Head
i	25 - 14	1.142 - 1.496	2.205	-	2.106	1.063	0.463 (lbs)	20	210059	465003
	25 - 14	1.142 - 1.496	2.205	-	2.106	1.063	0.463 (lbs)	101	210069	465003
	32 - 18	1.496 - 1.969	2.598	1.496	2.500	1.339	0.904 (lbs)	20	264051	465004
	32 - 18	1.496 - 1.969	2.598	1.496	2.500	1.339	0.904 (lbs)	101	264077	465004
	40 - 22	1.969 - 2.579	2.953	1.850	2.854	1.654	1.764 (lbs)	20	210052	465005
	40 - 22	1.969 - 2.579	2.953	1.850	2.854	1.654	1.764 (lbs)	101	210062	465005

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: 3E^{TECH+} module, charging unit, insert holders, and inserts sold separately.

464 Balance Digital 3E^{TECH+} Boring Heads

	MVS Connection		Boring Range				Boring Head		Part No.	
	D ₂ D ₁	A	X ₁	X _{1R}	L ₂	D ₅	Weight	Insert Form	Insert Holder	Boring Head
m	25 - 14	29.00 - 38.00	56.00	-	53.50	27.00	0.21 (kg)	20	210059	464003
	25 - 14	29.00 - 38.00	56.00	-	53.50	27.00	0.21 (kg)	101	210069	464003
	32 - 18	38.00 - 50.00	66.00	38.00	63.50	34.00	0.41 (kg)	20	264051	464004
	32 - 18	38.00 - 50.00	66.00	38.00	63.50	34.00	0.41 (kg)	101	264077	464004
	40 - 22	50.00 - 65.50	75.00	47.00	72.50	42.00	0.80 (kg)	20	210052	464005
	40 - 22	50.00 - 65.50	75.00	47.00	72.50	42.00	0.80 (kg)	101	210062	464005

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: 3E^{TECH+} module, charging unit, insert holders, and inserts sold separately.

3E^{TECH+} Digital Readout Module

Part No.	Charging Unit*
536015	536016

NOTE: WEEE-Reg.-Nr. DE 15820388

*Charging unit sold separately.



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.

Key on B10-B: I

B10-M: 12-19

B10-F

B10-H

B10: vi-vii

i = Imperial (in)

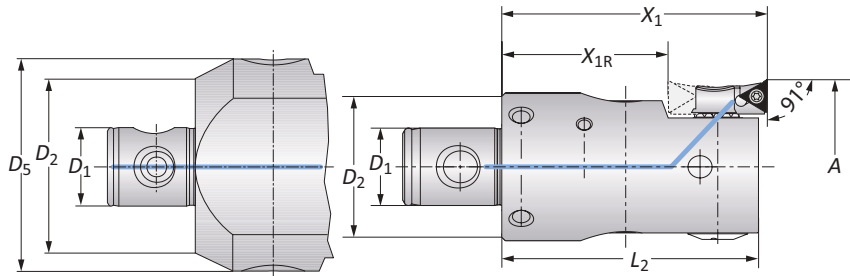
m = Metric (mm)

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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465 Balance Digital 3E^{TECH+} Boring Heads

Imperial | Alu-Line | Diameter Range: 2.559" - 8.071"



NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

Form 101

Form 20

465 Balance Digital 3E^{TECH+} Alu-Line Boring Heads

MVS Connection	Boring Range	Boring Head					Weight	Insert Form	Part No.	
		$D_2 D_1$	A	X_1	X_{1R}	L_2			D_5	Insert Holder
	50 - 28	2.559 - 3.268	2.953	1.535	2.874	-	1.323 (lbs)	20	210020	465006
	50 - 28	2.559 - 3.268	2.953	1.535	2.874	-	1.323 (lbs)	101	210063	465006
	50 - 28	2.559 - 3.268	2.953	1.535	2.874	-	1.323 (lbs)	103	210064	465006
	63 - 36	3.228 - 4.055	3.543	2.126	3.464	-	2.205 (lbs)	20	210020	465007
	63 - 36	3.228 - 4.055	3.543	2.126	3.464	-	2.205 (lbs)	101	210063	465007
	63 - 36	3.228 - 4.055	3.543	2.126	3.464	-	2.205 (lbs)	103	210064	465007
	80 - 36	3.937 - 5.118	3.543	2.126	3.464	-	3.307 (lbs)	20	210020	465008
i	80 - 36	3.937 - 5.118	3.543	2.126	3.464	-	3.307 (lbs)	101	210063	465008
	80 - 36	3.937 - 5.118	3.543	2.126	3.464	-	3.307 (lbs)	103	210064	465008
	80 - 36	4.921 - 6.594	3.543	2.126	3.464	3.937	3.307 (lbs)	20	210020	465009
	80 - 36	4.921 - 6.594	3.543	2.126	3.464	3.937	4.189 (lbs)	101	210063	465009
	80 - 36	4.921 - 6.594	3.543	2.126	3.464	3.937	4.189 (lbs)	103	210064	465009
	80 - 36	6.398 - 8.071	3.543	2.126	3.464	5.315	4.189 (lbs)	20	210020	465010
	80 - 36	6.398 - 8.071	3.543	2.126	3.464	5.315	4.189 (lbs)	101	210063	465010
	80 - 36	6.398 - 8.071	3.543	2.126	3.464	5.315	5.512 (lbs)	103	210064	465010

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: 3E^{TECH+} module, charging unit, insert holders, and inserts sold separately.

3E^{TECH+} Digital Readout Module

Part No.	Charging Unit*
536015	536016

NOTE: WEEE-Reg.-Nr. DE 15820388

*Charging unit sold separately.



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.

B10-M: 12-19

B10-F

B10-H

B10: vi-vii

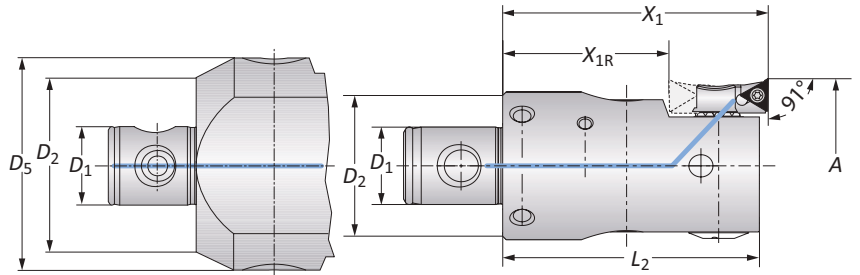
i = Imperial (in)
m = Metric (mm)

Inserts sold separately

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464 Balance Digital 3E^{TECH+} Boring Heads

Metric | Alu-Line | Diameter Range: 65.00 mm - 205.00 mm



NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

Form 101

Form 20

464 Balance Digital 3E^{TECH+} Alu-Line Boring Heads

MVS Connection	Boring Range	Boring Head					Weight	Insert Form	Part No.	
		D_2 D_1	A	X_1	X_{1R}	L_2			D_5	Insert Holder
m	50 - 28	65.00 - 83.00	75.00	39.00	73.00	-	0.60 (kg)	20	210020	464006
	50 - 28	65.00 - 83.00	75.00	39.00	73.00	-	0.60 (kg)	101	210063	464006
	50 - 28	65.00 - 83.00	75.00	39.00	73.00	-	0.60 (kg)	103	210064	464006
	63 - 36	82.00 - 103.00	90.00	54.00	88.00	-	1.00 (kg)	20	210020	464007
	63 - 36	82.00 - 103.00	90.00	54.00	88.00	-	1.00 (kg)	101	210063	464007
	63 - 36	82.00 - 103.00	90.00	54.00	88.00	-	1.00 (kg)	103	210064	464007
	80 - 36	100.00 - 130.00	90.00	54.00	88.00	-	1.50 (kg)	20	210020	464008
	80 - 36	100.00 - 130.00	90.00	54.00	88.00	-	1.50 (kg)	101	210063	464008
	80 - 36	100.00 - 130.00	90.00	54.00	88.00	-	1.50 (kg)	103	210064	464008
	80 - 36	125.00 - 167.50	90.00	54.00	88.00	100.00	1.90 (kg)	20	210020	464009
	80 - 36	125.00 - 167.50	90.00	54.00	88.00	100.00	1.90 (kg)	101	210063	464009
	80 - 36	125.00 - 167.50	90.00	54.00	88.00	100.00	1.90 (kg)	103	210064	464009
	80 - 36	162.50 - 205.00	90.00	54.00	88.00	135.00	2.50 (kg)	20	210020	464010
	80 - 36	162.50 - 205.00	90.00	54.00	88.00	135.00	2.50 (kg)	101	210063	464010
	80 - 36	162.50 - 205.00	90.00	54.00	88.00	135.00	2.50 (kg)	103	210064	464010

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: 3E^{TECH+} module, charging unit, insert holders, and inserts sold separately.

3E^{TECH+} Digital Readout Module

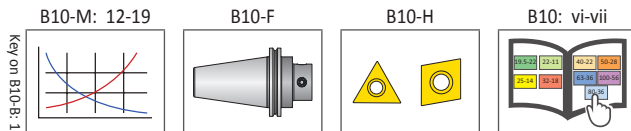
Part No.	Charging Unit*
536015	536016

NOTE: WEEE-Reg.-Nr. DE 15820388

*Charging unit sold separately.



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.



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

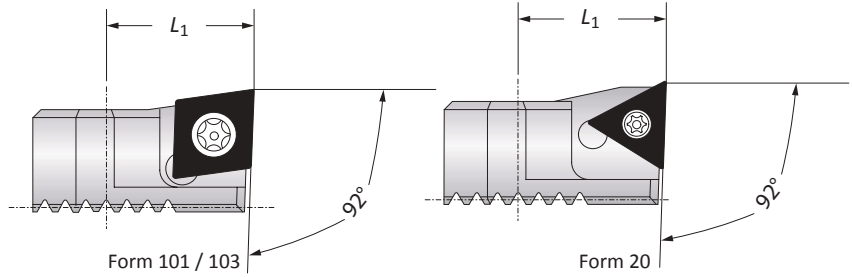
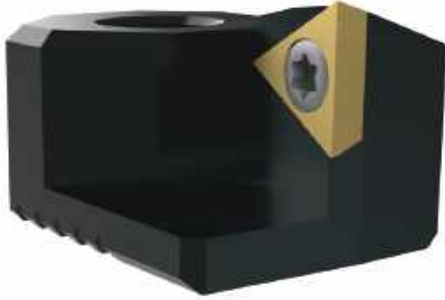
Inserts sold separately

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ext: 7611 | email: appeng@alliedmachine.com

Insert Holders for Abrasive Materials

Diameter Range: 2.559" - 8.071" (65.00 mm - 205.00 mm)

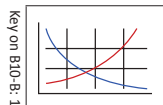


	Boring Range	Insert Holder L_1	Weight	Insert Form	Part No.
i	2.559 - 8.071	0.709	0.066 (lbs)	20	211061
	2.559 - 8.071	0.709	0.066 (lbs)	101	211063
	2.559 - 8.071	0.709	0.066 (lbs)	103	211065
m	65.00 - 205.00	18.00	0.03 (kg)	20	211061
	65.00 - 205.00	18.00	0.03 (kg)	101	211063
	65.00 - 205.00	18.00	0.03 (kg)	103	211065

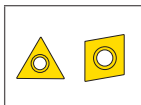
NOTE: Insert holders used for abrasive materials to protect boring head against chip wash.

NOTE: When machining grey cast iron, we recommend using insert holders for abrasive materials with CBN inserts for optimized chip removal.

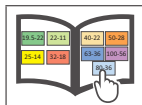
B10-M: 12-19



B10-H



B10: vi-vii



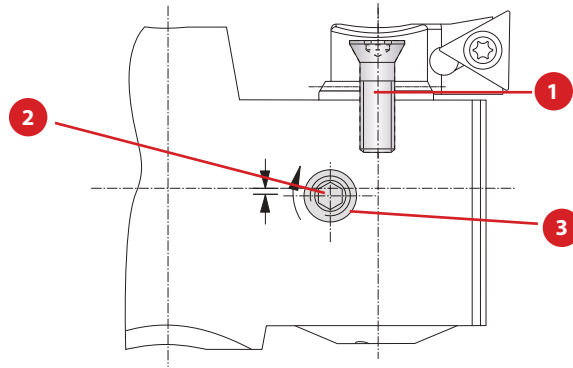
Key on B10-B: 1

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

Inserts sold separately

Accessories

Screws | 3E^{TECH+} Charging Unit



Screws

Boring Head	Part No.				
	1 Countersunk Screw	Countersunk Screw Service Key	2 Clamping Screw	Clamping Screw Service Key	3 Ball
420001 (410001)	215323	T15 / H	410151	S2 / A	364270
420002 (410002)	215338	T15 / H	410152	s2 / A	364270
465003 (464003)	215338	T15 / H	364138	s2.5 / A	364139
465004 (464004)	215338	T15 / H	115180	s2.5 / A	-
465005 (464005)	215338	T15 / H	115505	s3 / B	-
465006 (464006)	215462	T20 / H	315943	s4 / B	-
465007 (464007)	215462	T20 / H	515178	s4 / B	-
465008 (464008)	215462	T20 / H	515178	s4 / B	-
465009 (464009)	215462	T20 / H	515178	s4 / B	-
465010 (464010)	215462	T20 / H	515178	s4 / B	-

3E^{TECH+} Accessories

1 Charging Unit
Part No.
536016

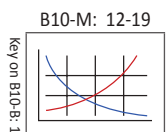
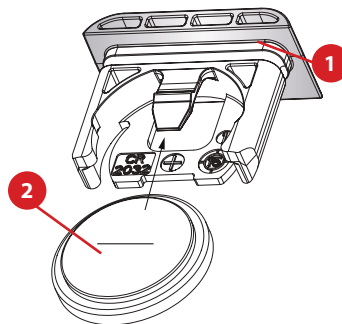
NOTE: Charging unit sold separately from 3E^{TECH+}.



3E^{TECH} (Old Display) Accessories

1 Sealing Ring	2 Battery CR2032
Part No.	Part No.
215483	515491

NOTE: Not required for 3E^{TECH+} (new display).



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365 (364) Balance and 465 (464) Balance Product Overview

Analog 365 (364) Balance and 465 (464) Balance **FINE BORING**

Analog fine boring tools for high-production jobs

Wohlhaupter® 365 (364) balance and 465 (464) balance analog boring heads offer precision boring with automatic balancing. Our boring heads are specifically engineered to minimize the residual imbalance produced by insert holder displacement. Wohlhaupter Alu-Line boring heads offer a lightweight aluminum design with a wear-resistant coating that reduces weight on the spindle up to 50% yet remains durable in challenging boring applications. The insert holder can also be rotated for reverse machining jobs.

- 365 (364) balance diameter range: 0.787" - 1.161" (20.00 mm - 29.50 mm).
- 465 (464) balance diameter range: 1.142" - 8.071" (29.00 mm - 205.00 mm).
- 465 (464) balance Alu-Line diameter range: 2.559" - 8.071" (65.00 mm - 205.00 mm).
 - Special coating on Alu-Line for wear-resistant surface.
 - Alu-Line body reduces tool weight by 50%, reducing stress on the spindle.
- Internal balancing improves tool life and surface finish.
- Coolant through.
- Vernier diameter adjustment of 0.0001" (0.002 mm).
- Insert holder can be rotated for back boring jobs.
- Max cutting speed: 3,281 SFM (1,000 m/min).



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

WOHLHAUPTER® ANALOG 465 (464) BALANCE **BORING HEADS**

ANALOG BORING HEAD PART NUMBER CONVERSION			
Diameter Range	Old Part No.	<i>UPDATED</i> Part No.	
i	0.787 - 0.965	365030	<i>No Change</i>
	0.965 - 1.161	365031	<i>No Change</i>
	1.142 - 1.516	365032	465033
	1.496 - 1.988	365033	465034
	1.969 - 2.579	365034	465035
	2.559 - 3.268	365045	465036
	3.228 - 4.055	365046	465037
	3.937 - 5.118	365047	465038
	4.921 - 6.594	365048	465039
6.398 - 8.071	365049	465040	
m	20.00 - 24.50	364030	<i>No Change</i>
	24.50 - 29.50	364031	<i>No Change</i>
	29.00 - 38.00	364032	464033
	38.00 - 50.00	364033	464034
	50.00 - 65.50	364034	464035
	65.00 - 83.00	364045	464036
	82.00 - 103.00	364046	464037
	100.00 - 130.00	364047	464038
	125.00 - 167.50	364048	464039
162.50 - 205.00	364049	464040	

✓ High-production fine boring

✓ Easy diameter adjustment

✓ Self-balancing

✓ Imperial and metric

FEATURES AN **ENHANCED** CLAMPING MECHANISM
FROM OUR TRUSTED LINE OF 565 (564) BALANCE
DIGITAL FINE BORING HEADS

Aluminum bodies with
wear-resistant coating from
2.559" - 8.071"
(65.00 mm - 205.00 mm)



Highly accurate
adjustments through
vernier scale



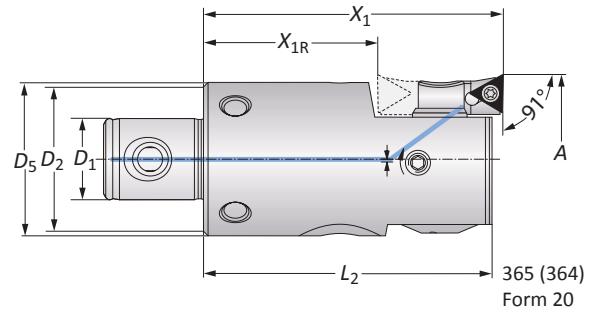
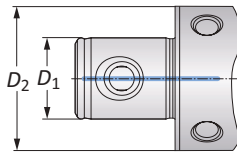
Equipped with
self-balancing mechanism

365 (364) Balance / 465 (464) Balance Analog Boring Heads

Diameter Range: 0.787" - 2.579" (20.00 mm - 65.50 mm)



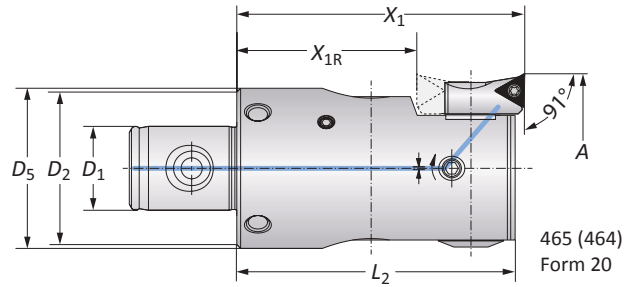
365 (364)
Form 101



365 (364)
Form 20



465 (464)
Form 101



465 (464)
Form 20

365/465 Balance Analog Boring Heads

MVS Connection	Boring Range	Boring Head					Weight	Insert Form	Part No.	
		$D_2 D_1$	A	X_1	X_{1R}	L_2			D_5	Insert Holder
	19 - 11	0.787 - 0.965	1.811	-	1.693	-	0.198 (lbs)	20*	364077	365030
	22 - 11	0.965 - 1.161	1.811	-	1.713	0.906	0.331 (lbs)	20	210059	365031
	22 - 11	0.965 - 1.161	1.811	-	1.713	0.906	0.331 (lbs)	101	210069	365031
	25 - 14	1.142 - 1.516	2.205	-	2.106	1.063	0.441 (lbs)	20	210059	465033
i	25 - 14	1.142 - 1.516	2.205	-	2.106	1.063	0.441 (lbs)	101	210069	465033
	32 - 18	1.496 - 1.988	2.598	1.496	2.450	1.339	0.882 (lbs)	20	264051	465034
	32 - 18	1.496 - 1.988	2.598	1.496	2.450	1.339	0.882 (lbs)	101	264077	465034
	40 - 22	1.969 - 2.579	2.953	1.850	2.854	1.654	1.764 (lbs)	20	210052	465035
	40 - 22	1.969 - 2.579	2.953	1.850	2.854	1.654	1.764 (lbs)	101	210062	465035

*Not suitable for indexable inserts with a radius of 0.031" (0.80 mm).

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

364/464 Balance Analog Boring Heads

MVS Connection	Boring Range	Boring Head					Weight	Insert Form	Part No.	
		$D_2 D_1$	A	X_1	X_{1R}	L_2			D_5	Insert Holder
	19 - 11	20.00 - 24.50	46.00	-	43.00	-	0.09 (kg)	20*	364077	364030
	22 - 11	24.50 - 29.50	46.00	-	43.50	23.00	0.15 (kg)	20	210059	364031
	22 - 11	24.50 - 29.50	46.00	-	43.50	23.00	0.15 (kg)	101	210069	364031
	25 - 14	29.00 - 38.00	56.00	-	53.50	27.00	0.20 (kg)	20	210059	464033
m	25 - 14	29.00 - 38.00	56.00	-	53.50	27.00	0.20 (kg)	101	210069	464033
	32 - 18	38.00 - 50.00	66.00	38.00	63.50	34.00	0.40 (kg)	20	264051	464034
	32 - 18	38.00 - 50.00	66.00	38.00	63.50	34.00	0.40 (kg)	101	264077	464034
	40 - 22	50.00 - 65.50	75.00	47.00	72.50	42.00	0.80 (kg)	20	210052	464035
	40 - 22	50.00 - 65.50	75.00	47.00	72.50	42.00	0.80 (kg)	101	210062	464035

*Not suitable for indexable inserts with a radius of 0.031" (0.80 mm).

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

B10-M: 12-19

B10-F

B10-H

B10: vi-vii

Key on B10-B: 1

i = Imperial (in)

m = 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.

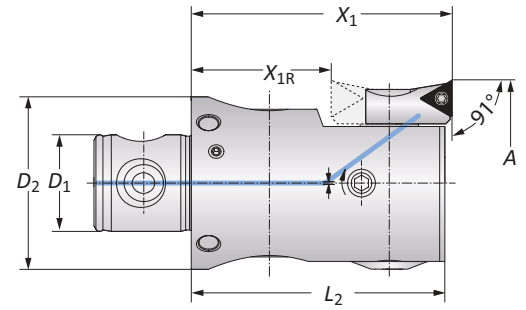
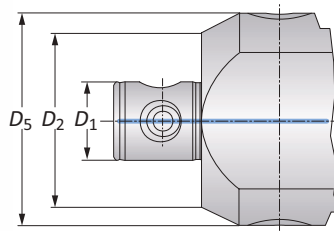
ext: 7611 | email: appeng@alliedmachine.com

465 (464) Balance Analog Boring Heads

Alu-Line | Diameter Range: 2.559" - 8.071" (65.00 mm - 205.00 mm)



Form 101



Form 20

465 Balance Analog Alu-Line Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.		
		$D_2 D_1$	A	X_1	X_{1R}			L_2	D_5	Insert Holder
i	50 - 28	2.559 - 3.268	2.953	1.535	2.854	-	1.323 (lbs)	20	210020	465036
	50 - 28	2.559 - 3.268	2.953	1.535	2.854	-	1.323 (lbs)	101	210063	465036
	50 - 28	2.559 - 3.268	2.953	1.535	2.854	-	1.323 (lbs)	103	210064	465036
	63 - 36	3.228 - 4.055	3.543	2.126	3.445	-	2.205 (lbs)	20	210020	465037
	63 - 36	3.228 - 4.055	3.543	2.126	3.445	-	2.205 (lbs)	101	210063	465037
	63 - 36	3.228 - 4.055	3.543	2.126	3.445	-	2.205 (lbs)	103	210064	465037
	80 - 36	3.937 - 5.118	3.543	2.126	3.445	-	3.307 (lbs)	20	210020	465038
	80 - 36	3.937 - 5.118	3.543	2.126	3.445	-	3.307 (lbs)	101	210063	465038
	80 - 36	3.937 - 5.118	3.543	2.126	3.445	-	3.307 (lbs)	103	210064	465038
	80 - 36	4.921 - 6.594	3.543	2.126	3.445	3.937	4.189 (lbs)	20	210020	465039
	80 - 36	4.921 - 6.594	3.543	2.126	3.445	3.937	4.189 (lbs)	101	210063	465039
	80 - 36	4.921 - 6.594	3.543	2.126	3.445	3.937	4.189 (lbs)	103	210064	465039
	80 - 36	6.398 - 8.071	3.543	2.126	3.445	5.315	5.512 (lbs)	20	210020	465040
	80 - 36	6.398 - 8.071	3.543	2.126	3.445	5.315	5.512 (lbs)	101	210063	465040
	80 - 36	6.398 - 8.071	3.543	2.126	3.445	5.315	5.512 (lbs)	103	210064	465040

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

464 Balance Analog Alu-Line Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.		
		$D_2 D_1$	A	X_1	X_{1R}			L_2	D_5	Insert Holder
m	50 - 28	65.00 - 83.00	75.00	39.00	72.50	-	0.60 (kg)	20	210020	464036
	50 - 28	65.00 - 83.00	75.00	39.00	72.50	-	0.60 (kg)	101	210063	464036
	50 - 28	65.00 - 83.00	75.00	39.00	72.50	-	0.60 (kg)	103	210064	464036
	63 - 36	82.00 - 103.00	90.00	54.00	87.50	-	1.00 (kg)	20	210020	464037
	63 - 36	82.00 - 103.00	90.00	54.00	87.50	-	1.00 (kg)	101	210063	464037
	63 - 36	82.00 - 103.00	90.00	54.00	87.50	-	1.00 (kg)	103	210064	464037
	80 - 36	100.00 - 130.00	90.00	54.00	87.50	-	1.50 (kg)	20	210020	464038
	80 - 36	100.00 - 130.00	90.00	54.00	87.50	-	1.50 (kg)	101	210063	464038
	80 - 36	100.00 - 130.00	90.00	54.00	87.50	-	1.50 (kg)	103	210064	464038
	80 - 36	125.00 - 167.50	90.00	54.00	87.50	100.00	1.90 (kg)	20	210020	464039
	80 - 36	125.00 - 167.50	90.00	54.00	87.50	100.00	1.90 (kg)	101	210063	464039
	80 - 36	125.00 - 167.50	90.00	54.00	87.50	100.00	1.90 (kg)	103	210064	464039
	80 - 36	162.50 - 205.00	90.00	54.00	87.50	135.00	2.50 (kg)	20	210020	464040
	80 - 36	162.50 - 205.00	90.00	54.00	87.50	135.00	2.50 (kg)	101	210063	464040
	80 - 36	162.50 - 205.00	90.00	54.00	87.50	135.00	2.50 (kg)	103	210064	464040

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

B10-M: 12-19

B10-F

B10-H

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Key on B10-B: I

i = Imperial (in)

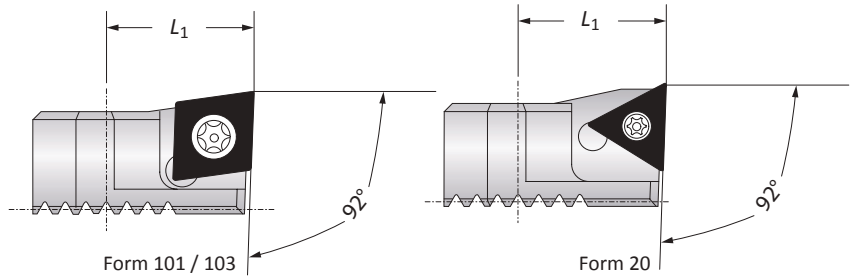
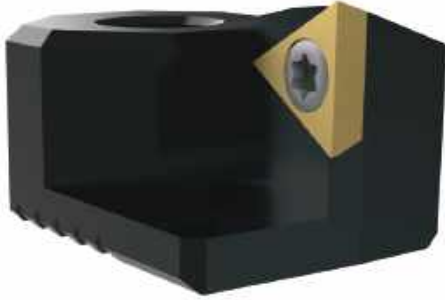
m = Metric (mm)

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.
 ext: 7611 | email: appeng@alliedmachine.com

Insert Holders for Abrasive Materials

Diameter Range: 2.559" - 8.071" (65.00 mm - 205.00 mm)

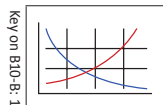


	Boring Range	Insert Holder L_1	Weight	Insert Form	Part No.
i	2.559 - 8.071	0.709	0.066 (lbs)	20	211061
	2.559 - 8.071	0.709	0.066 (lbs)	101	211063
	2.559 - 8.071	0.709	0.066 (lbs)	103	211065
m	65.00 - 205.00	18.00	0.03 (kg)	20	211061
	65.00 - 205.00	18.00	0.03 (kg)	101	211063
	65.00 - 205.00	18.00	0.03 (kg)	103	211065

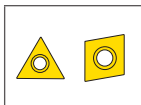
NOTE: Insert holders used for abrasive materials to protect boring head against chip wash.

NOTE: When machining grey cast iron, we recommend using insert holders for abrasive materials with CBN inserts for optimized chip removal.

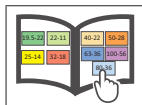
B10-M: 12-19



B10-H



B10: vi-vii

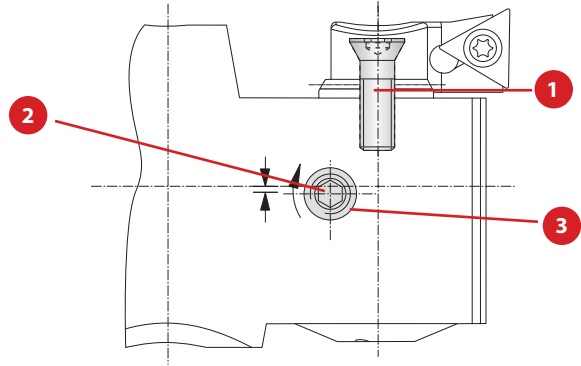


Key on B10-B: 1

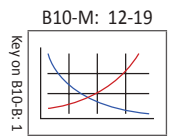
i = Imperial (in)
m = Metric (mm)
Inserts sold separately

Accessories

Screws



Boring Head	Part No.				
	1 Countersunk Screw	Countersunk Screw Service Key	2 Clamping Screw	Clamping Screw Service Key	3 Ball
365030 (364030)	215323	T15 / H	364260	s2 / A	364270
365031 (364031)	215338	T15 / H	364138	s2.5 / A	364139
465033 (464033)	215338	T15 / H	364138	s2.5 / A	364139
465034 (464034)	215338	T15 / H	115180	s2.5 / A	-
465035 (464035)	215338	T15 / H	115505	s3 / B	-
465036 (464036)	215462	T20 / H	315943	s4 / B	-
465037 (464037)	215462	T20 / H	515178	s4 / B	-
465038 (464038)	215462	T20 / H	515178	s4 / B	-
465039 (464039)	215462	T20 / H	515178	s4 / B	-
465040 (464040)	215462	T20 / H	515178	s4 / B	-



Key on B10-B: 1

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565 (564) Balance Digital Product Overview



565 (564) Balance Digital FINE BORING

Adjustable diameter for precise machining.

Wohlhaupter® digital 565 (564) balance boring heads feature automatic balancing with an easy-to-read digital display. For diameter ranges above 2.559" (65.00 mm), 565 (564) boring heads are made of lightweight aluminum. 565 (564) boring heads are specifically engineered to minimize the residual imbalance produced by insert holder displacement. Reverse boring applications can be achieved by rotating the insert holders.

Test the *engineered lightweight* boring head today.

- Diameter range: 1.969" - 8.071" (50.00 mm - 205.00 mm).
- Alu-Line diameter range: 2.559" - 8.071" (65.00 mm - 205.00 mm).
 - Special coating on Alu-Line for wear-resistant surface.
 - Alu-Line body reduces tool weight by 50%, reducing stress on the spindle.
- Digital readout advantage for diameter adjustments of 0.0001" (0.002 mm).
- Coolant through.
- Internal balancing improves tool life and surface finish.
- Insert holder can be rotated for back boring jobs.
- Max cutting speed: 6,562 SFM (2,000 m/min).
- Max coolant pressure: 580 PSI (40 bar).



Aluminum Boring Head
2.559" - 8.071"
(65.00 mm - 205.00 mm)



Steel Boring Head
1.969" - 2.579"
(50.00 mm - 65.50 mm)

NOTE: Imperial items pictured.

NOTE: Digital adjustment accuracy of 0.0001" or 0.002 mm on diameter.

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

565 (564) DIGITAL BORING HEAD

Balance with NOVI^{TECH}[®]

Product:	Wohlhaupter 565 (564) balance digital boring head with NOVI ^{TECH}	Measure	565 (564) Balance Digital Boring Head with NOVI^{TECH}
Objectives:	0.0002" (0.005 mm) concentricity over the length of two bores spaced 14" (355.60 mm) apart	RPM	430 RPM
Material:	Cast iron	Speed	352 SFM (107.28 m/min)
Hole Ø:	3.125" (79.38 mm)	Feed Rate	0.003 IPR (0.08 mm/rev)
Depth:	18.5" (469.9 mm)	Penetration Rate	1.29 IPM (33 mm/min)
Stock Removal:	0.030" (0.80 mm) on diameter		

- ▶ Boring head
565 (564) series
Item No. 565045
- ▶ NOVI^{TECH} vibration dampening intermediate module
Item No. 519005
- ▶ Wohlhaupter boring insert:
Item No. 397239WHC79
(F103 04MN158 WHC79)

The balanced 565 (564) digital boring head with the NOVI^{TECH} vibration damper module provided:

✓ Precision concentricity over 7xD

✓ Eliminated vibration and chatter



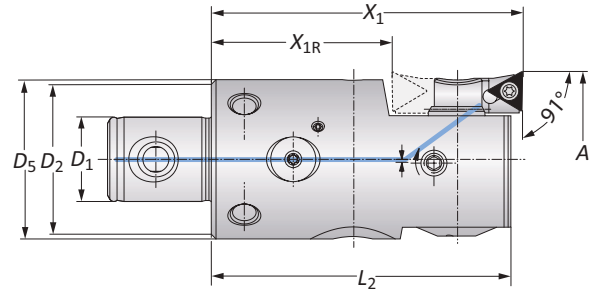
NOTE: Imperial item pictured.
NOTE: Digital adjustment accuracy of 0.0001" or 0.002 mm on diameter.

565 (564) Balance Digital Boring Heads

Diameter Range: 1.969" - 2.579" (50.00 mm - 65.50 mm)



NOTE: Imperial item pictured.
NOTE: Digital adjustment accuracy of 0.0001" or 0.002 mm on diameter.



565 Balance Digital Boring Heads

Form 101

Form 20

	MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
	$D_2 D_1$	A	X_1	X_{1R}	L_2	D_5			Insert Holder	Boring Head
i	40 - 22	1.969 - 2.579	2.953	1.850	2.854	1.654	1.764 (lbs)	20	210052	565034
	40 - 22	1.969 - 2.579	2.953	1.850	2.854	1.654	1.764 (lbs)	101	210062	565034

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

564 Balance Digital Boring Heads

	MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
	$D_2 D_1$	A	X_1	X_{1R}	L_2	D_5			Insert Holder	Boring Head
m	40 - 22	50.00 - 65.50	75.00	47.00	72.50	42.00	0.80 (kg)	20	210052	564034
	40 - 22	50.00 - 65.50	75.00	47.00	72.50	42.00	0.80 (kg)	101	210062	564034

NOTE: X_{1R} = rotated insert holder for reverse machining.

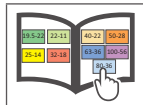
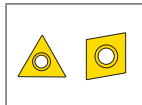
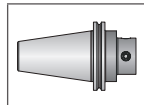
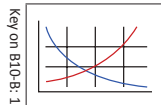
NOTE: Insert holders and inserts sold separately.

B10-M: 12-19

B10-F

B10-H

B10: vi-vii



i = Imperial (in)
m = 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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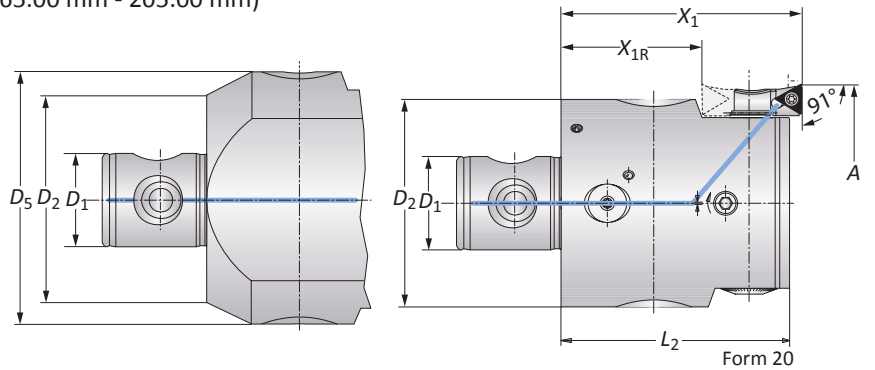
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565 (564) Balance Digital Boring Heads

Alu-Line | Diameter Range: 2.559" - 8.070" (65.00 mm - 205.00 mm)



NOTE: Imperial item pictured.
NOTE: Digital adjustment accuracy of 0.0001" or 0.002 mm on diameter.



565 Balance Digital Alu-Line Boring Heads Form 301

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.		
		$D_2 D_1$	A	X_1	X_{1R}			L_2	D_5	Insert Holder
i	50 - 28	2.559 - 3.268	2.953	1.535	2.874	-	1.323 (lbs)	20	210020	565045
	50 - 28	2.559 - 3.268	2.953	1.535	2.874	-	1.323 (lbs)	101	210063	565045
	50 - 28	2.559 - 3.268	2.953	1.535	2.874	-	1.323 (lbs)	103	210064	565045
	63 - 36	3.228 - 4.055	3.543	2.126	3.464	-	2.205 (lbs)	20	210020	565046
	63 - 36	3.228 - 4.055	3.543	2.126	3.464	-	2.205 (lbs)	101	210063	565046
	63 - 36	3.228 - 4.055	3.543	2.126	3.464	-	2.205 (lbs)	103	210064	565046
	80 - 36	3.937 - 5.118	3.543	2.126	3.464	-	3.307 (lbs)	20	210020	565047
	80 - 36	3.937 - 5.118	3.543	2.126	3.464	-	3.307 (lbs)	101	210063	565047
	80 - 36	3.937 - 5.118	3.543	2.126	3.464	-	3.307 (lbs)	103	210064	565047
	80 - 36	4.921 - 6.594	3.543	2.126	3.464	3.397	3.307 (lbs)	20	210020	565048
	80 - 36	4.921 - 6.594	3.543	2.126	3.464	3.937	4.189 (lbs)	101	210063	565048
	80 - 36	4.921 - 6.594	3.543	2.126	3.464	3.937	4.189 (lbs)	103	210064	565048
	80 - 36	6.398 - 8.071	3.543	2.126	3.464	5.315	4.189 (lbs)	20	210020	565049
	80 - 36	6.398 - 8.071	3.543	2.126	3.464	5.315	4.189 (lbs)	101	210063	565049
	80 - 36	6.398 - 8.071	3.543	2.126	3.464	5.315	5.512 (lbs)	103	210064	565049

NOTE: X_{1R} = rotated insert holder for reverse machining.
NOTE: Insert holders and inserts sold separately.

564 Balance Digital Alu-Line Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.		
		$D_2 D_1$	A	X_1	X_{1R}			L_2	D_5	Insert Holder
m	50 - 28	65.00 - 83.00	75.00	39.00	73.00	-	0.60 (kg)	20	210020	564045
	50 - 28	65.00 - 83.00	75.00	39.00	73.00	-	0.60 (kg)	101	210063	564045
	50 - 28	65.00 - 83.00	75.00	39.00	73.00	-	0.60 (kg)	103	210064	564045
	63 - 36	82.00 - 103.00	90.00	54.00	88.00	-	1.00 (kg)	20	210020	564046
	63 - 36	82.00 - 103.00	90.00	54.00	88.00	-	1.00 (kg)	101	210063	564046
	63 - 36	82.00 - 103.00	90.00	54.00	88.00	-	1.00 (kg)	103	210064	564046
	80 - 36	100.00 - 130.00	90.00	54.00	88.00	-	1.50 (kg)	20	210020	564047
	80 - 36	100.00 - 130.00	90.00	54.00	88.00	-	1.50 (kg)	101	210063	564047
	80 - 36	100.00 - 130.00	90.00	54.00	88.00	-	1.50 (kg)	103	210064	564047
	80 - 36	125.00 - 167.50	90.00	54.00	88.00	100.00	1.90 (kg)	20	210020	564048
	80 - 36	125.00 - 167.50	90.00	54.00	88.00	100.00	1.90 (kg)	101	210063	564048
	80 - 36	125.00 - 167.50	90.00	54.00	88.00	100.00	1.90 (kg)	103	210064	564048
	80 - 36	162.50 - 205.00	90.00	54.00	88.00	135.00	2.50 (kg)	20	210020	564049
	80 - 36	162.50 - 205.00	90.00	54.00	88.00	135.00	2.50 (kg)	101	210063	564049
	80 - 36	162.50 - 205.00	90.00	54.00	88.00	135.00	2.50 (kg)	103	210064	564049

NOTE: X_{1R} = rotated insert holder for reverse machining.
NOTE: Insert holders and inserts sold separately.

B10-M: 12-19

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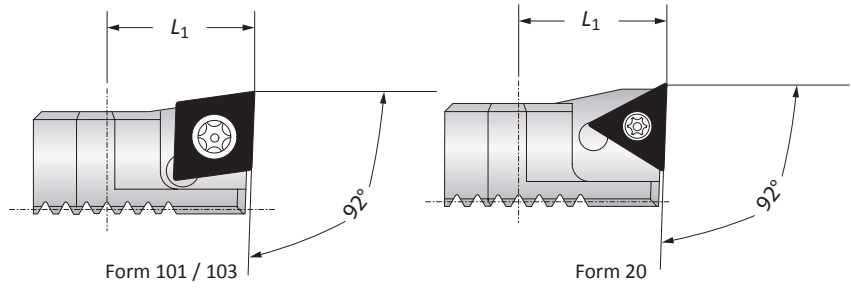
Key on B10-B: 1

i = Imperial (in)
m = 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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Insert Holder for Abrasive Materials

Diameter Range: 2.559" - 8.071" (65.00 mm - 205.00 mm)

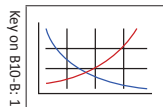


		Insert Holder			
		L_1	Weight	Insert Form	Part No.
i	Boring Range				
	2.559 - 8.071	0.709	0.066 (lbs)	20	211061
	2.559 - 8.071	0.709	0.066 (lbs)	101	211063
	2.559 - 8.071	0.709	0.066 (lbs)	103	211065
m	Boring Range				
	65.00 - 205.00	18.00	0.03 (kg)	20	211061
	65.00 - 205.00	18.00	0.03 (kg)	101	211063
	65.00 - 205.00	18.00	0.03 (kg)	103	211065

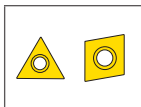
NOTE: Insert holders used for abrasive materials to protect boring head against chip wash.

NOTE: When machining grey cast iron, we recommend using insert holders for abrasive materials with CBN inserts for optimized chip removal.

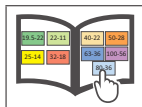
B10-M: 12-19



B10-H



B10: vi-vii

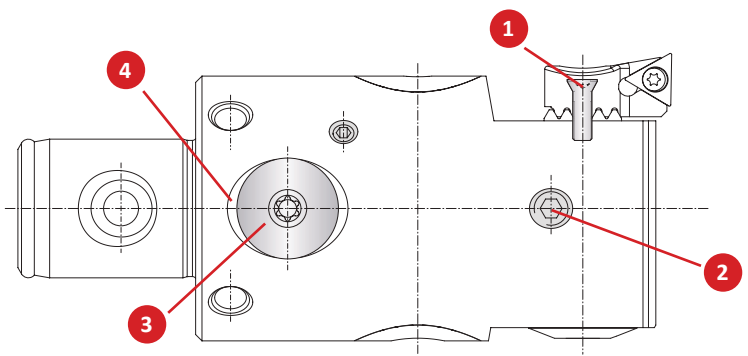


Key on B10-B: 1

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

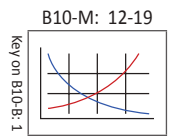
Accessories

Screws | Battery Cover | Batteries



Boring Head	Part No.							
	1 Countersunk Screw	Service Key	2 Clamping Screw	Service Key	3 Battery Cover	Service Key	4 Sealing Ring	Battery*
565034 (564034)	215338	T15 / H	115505	s3 / B	501016	T20 / H	415895	415896
565045 (564045)	215462	T20 / H	315943	s4 / B	501016	T20 / H	415895	415896
565046 (564046)	215462	T20 / H	515178	s4 / B	501016	T20 / H	415895	415896
565047 (564047)	215462	T20 / H	515178	s4 / B	501016	T20 / H	415895	415896
565048 (564048)	215462	T20 / H	515178	s4 / B	501016	T20 / H	415895	415896
565049 (564049)	215462	T20 / H	515178	s4 / B	501016	T20 / H	415895	415896

*Replace both batteries.



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320 (310) Product Overview

320 (310) Analog FINE BORING

Engineered with wear and tear in mind.

320 (310) Wohlhaupter boring heads are made from steel for \varnothing 0.787" - 4.055" (20.00 mm - 103.00 mm) and coated Alu-Line material for \varnothing 3.937" - 8.071" (100.00 mm - 205.00 mm) boring heads to protect against corrosion and wear. The insert holder can be rotated quickly for reverse machining.

- Diameter range: 0.787" - 8.071" (20.00 mm - 205.00 mm).
- Alu-Line diameter range: 3.937" - 8.071" (100.00 mm - 205.00 mm).
 - Special coating on Alu-Line provides hard, durable surface.
 - Alu-Line body reduces tool weight by 50%, reducing stress on the spindle.
- Coolant through.
- Vernier diameter adjustment of 0.0001" (0.002 mm).
- Max cutting speed: 3,281 SFM (1,000 m/min).



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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WOHLHAUPTER® 320 BORING HEAD with NOVI^{TECH}

Time is money, so make it count.

If you want to improve your machining processes, cycle time is a key factor to examine. After all, the longer it takes you to produce a part, the fewer parts you can produce in a given time. Our customer was experiencing lengthy cycle times while machining pumps from grey cast iron. The parts required three bored holes, each with a 12" (304.8 mm) depth and a 22" (558.8 mm) reach.

In order to free up machine time, the customer questioned if their process could be more efficient. The main objectives were to decrease the current cycle time and to maintain the required surface finish to perform the burnishing process that followed.

The previous tooling ran at a slow 0.47 IPM (11.938 mm/min) and a paint-drying 84-minute cycle time to bore the three holes on each part. With our **Wohlhaupter 320 boring head** utilizing the **NOVI^{TECH} vibration dampening module**, the customer increased to a more efficient 3.75 IPM (95.25 mm/min) and slashed the cycle time to 10.5 minutes (an 87% decrease). Along with the increased speed, the Wohlhaupter tooling also achieved a 155 Ra finish, accomplishing everything the customer needed.

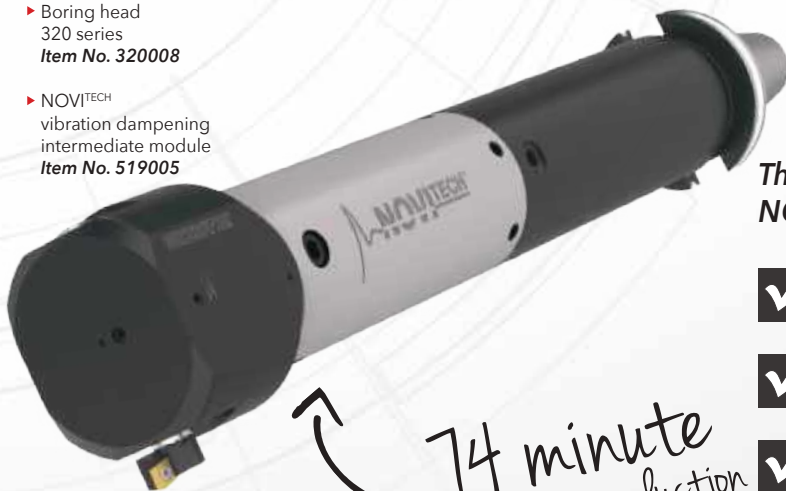
The Wohlhaupter solution reduced the process cycle time by 74 minutes. Improvements in speed and cycle time can free up machine hours, which means more throughput and higher profit for your company. **Are you losing money on applications with substantially long cycle times?**



Product:	Wohlhaupter 320 Boring Head with NOVI ^{TECH}	Measure	Competitor Boring Head	320 Boring Head w/ NOVI ^{TECH}
Objectives:	(1) Decrease cycle time (2) Maintain 160 Ra hole finish	RPM	39	469
Industry:	Oil and gas/petrochemical	Speed Rate	56 SFM (17.069 M/min)	675 SFM (205.74 M/min)
Part:	Pump	Feed Rate	0.012 IPR (0.305 mm/rev)	0.008 IPR (0.203 mm/rev)
Material:	Grey cast iron	Penetration Rate	0.47 IPM (11.938 mm/min)	3.75 IPM (95.25 mm/min)
Hole Ø:	5.500" (139.7 mm)	Cycle Time (per hole)	27 min 54 sec	3 min 32 sec
Hole Depth:	12.000" (304.8 mm)			

▶ Boring head
320 series
Item No. 320008

▶ NOVI^{TECH}
vibration dampening
intermediate module
Item No. 519005



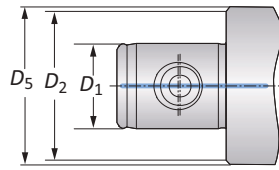
The Wohlhaupter 320 boring head with the NOVI^{TECH} vibration dampening module provided:

- ✓ Increased penetration rate
- ✓ Decreased cycle time
- ✓ Excellent finish in deep hole application

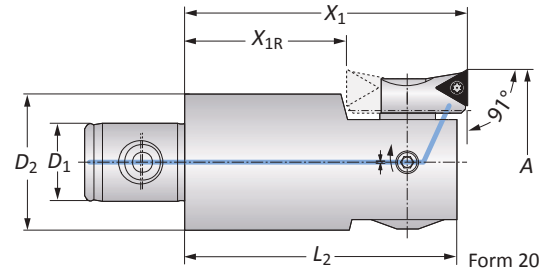
74 minute
cycle time reduction

320 (310) Analog Boring Heads

Diameter Range: 0.787" - 4.055" (20.00 mm - 103.00 mm)



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Form 20

320 Analog Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
		$D_2 D_1$	A	X_1	X_{1R}			L_2	D_5
19 - 11	0.787 - 0.965	1.810	-	1.693	-	0.221 (lbs)	20*	364077	320010
22 - 11	0.965 - 1.161	1.810	-	1.713	0.906	0.331 (lbs)	20	210059	320020
22 - 11	0.965 - 1.161	1.810	-	1.713	0.906	0.331 (lbs)	101	210069	320020
25 - 14	1.142 - 1.457	2.200	-	2.106	1.024	0.441 (lbs)	20	210059	320001
25 - 14	1.142 - 1.457	2.200	-	2.106	1.024	0.441 (lbs)	101	210069	320001
25 - 14	1.417 - 1.732	2.200	1.100	2.106	1.024	0.441 (lbs)	20	210052	320001
25 - 14	1.417 - 1.732	2.200	1.100	2.106	1.024	0.441 (lbs)	101	210062	320001
32 - 18	1.693 - 2.126	2.590	1.490	2.500	-	0.882 (lbs)	20	210052	320003
32 - 18	1.693 - 2.126	2.590	1.490	2.500	-	0.882 (lbs)	101	210062	320003
40 - 22	2.087 - 2.598	2.950	1.530	2.854	-	1.543 (lbs)	20	210020	320004
40 - 22	2.087 - 2.598	2.950	1.530	2.854	-	1.543 (lbs)	101	210063	320004
40 - 22	2.087 - 2.598	2.950	1.530	2.854	-	1.543 (lbs)	103	210064	320004
50 - 28	2.559 - 3.268	2.950	1.530	2.854	-	2.646 (lbs)	20	210020	320005
50 - 28	2.559 - 3.268	2.950	1.530	2.854	-	2.646 (lbs)	101	210063	320005
50 - 28	2.559 - 3.268	2.950	1.530	2.854	-	2.646 (lbs)	103	210064	320005
63 - 36	3.228 - 4.055	3.540	2.120	3.445	-	4.850 (lbs)	20	210020	320006
63 - 36	3.228 - 4.055	3.540	2.120	3.445	-	4.850 (lbs)	101	210063	320006
63 - 36	3.228 - 4.055	3.540	2.120	3.445	-	4.850 (lbs)	103	210064	320006

*Not suitable for indexable inserts with a radius of 0.031" (0.80 mm).

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

310 Analog Boring Heads

MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
		$D_2 D_1$	A	X_1	X_{1R}			L_2	D_5
19 - 11	20.00 - 24.50	46.00	-	43.00	-	0.10 (kg)	20*	364077	310010
22 - 11	24.50 - 29.50	46.00	-	43.50	23.00	0.15 (kg)	20	210059	310020
22 - 11	24.50 - 29.50	46.00	-	43.50	23.00	0.15 (kg)	101	210069	310020
25 - 14	29.00 - 37.00	56.00	-	53.50	26.00	0.20 (kg)	20	210059	310001
25 - 14	29.00 - 37.00	56.00	-	53.50	26.00	0.20 (kg)	101	210069	310001
25 - 14	36.00 - 44.00	56.00	28.00	53.50	26.00	0.20 (kg)	20	210052	310001
25 - 14	36.00 - 44.00	56.00	28.00	53.50	26.00	0.20 (kg)	101	210062	310001
32 - 18	43.00 - 54.00	66.00	38.00	63.50	-	0.40 (kg)	20	210052	310003
32 - 18	43.00 - 54.00	66.00	38.00	63.50	-	0.40 (kg)	101	210062	310003
40 - 22	53.00 - 66.00	75.00	39.00	72.50	-	0.70 (kg)	20	210020	310004
40 - 22	53.00 - 66.00	75.00	39.00	72.50	-	0.70 (kg)	101	210063	310004
40 - 22	53.00 - 66.00	75.00	39.00	72.50	-	0.70 (kg)	103	210064	310004
50 - 28	65.00 - 83.00	75.00	39.00	72.50	-	1.20 (kg)	20	210020	310005
50 - 28	65.00 - 83.00	75.00	39.00	72.50	-	1.20 (kg)	101	210063	310005
50 - 28	65.00 - 83.00	75.00	39.00	72.50	-	1.20 (kg)	103	210064	310005
63 - 36	82.00 - 103.00	90.00	54.00	87.50	-	2.20 (kg)	20	210020	310006
63 - 36	82.00 - 103.00	90.00	54.00	87.50	-	2.20 (kg)	101	210063	310006
63 - 36	82.00 - 103.00	90.00	54.00	87.50	-	2.20 (kg)	103	210064	310006

*Not suitable for indexable inserts with a radius of 0.031" (0.80 mm).

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.

i = Imperial (in)

m = 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.

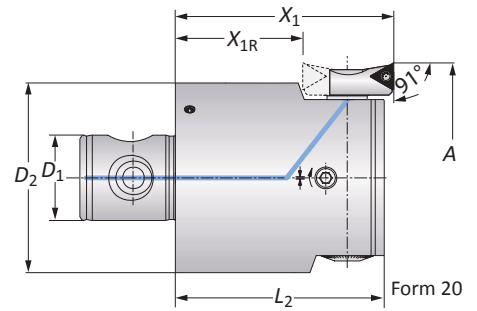
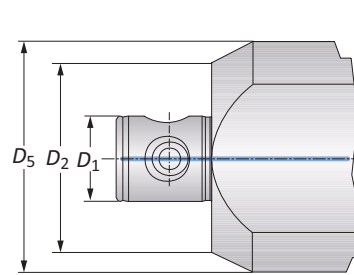
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320 (310) Boring Heads

Alu-Line | Diameter Range: 3.937" - 8.071" (100.00 mm - 205.00 mm)



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Form 20

320 Analog Alu-Line Boring Heads

	MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
			D_2 D_1	A	X_1	X_{1R}			L_2	D_5
i	80 - 36	3.937 - 5.118	3.543	2.126	3.445	-	3.086 (lbs)	20	210020	320007
	80 - 36	3.937 - 5.118	3.543	2.126	3.445	-	3.086 (lbs)	101	210063	320007
	80 - 36	3.937 - 5.118	3.543	2.126	3.445	-	3.086 (lbs)	103	210064	320007
	80 - 36	4.921 - 6.594	3.543	2.126	3.445	3.937	3.968 (lbs)	20	210020	320008
	80 - 36	4.921 - 6.594	3.543	2.126	3.445	3.937	3.968 (lbs)	101	210063	320008
	80 - 36	4.921 - 6.594	3.543	2.126	3.445	3.937	3.968 (lbs)	103	210064	320008
	80 - 36	6.397 - 8.071	3.543	2.126	3.445	5.315	5.291 (lbs)	20	210020	320009
	80 - 36	6.397 - 8.071	3.543	2.126	3.445	5.315	5.291 (lbs)	101	210063	320009
	80 - 36	6.397 - 8.071	3.543	2.126	3.445	5.315	5.291 (lbs)	103	210064	320009

NOTE: X_{1R} = rotated insert holder for reverse machining.

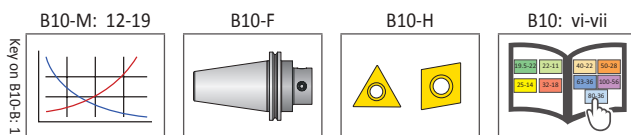
NOTE: Insert holders and inserts sold separately.

310 Analog Alu-Line Boring Heads

	MVS Connection	Boring Range	Boring Head				Weight	Insert Form	Part No.	
			D_2 D_1	A	X_1	X_{1R}			L_2	D_5
m	80 - 36	100.00 - 130.00	90.00	54.00	87.50	-	1.40 (kg)	20	210020	310007
	80 - 36	100.00 - 130.00	90.00	54.00	87.50	-	1.40 (kg)	101	210063	310007
	80 - 36	100.00 - 130.00	90.00	54.00	87.50	-	1.40 (kg)	103	210064	310007
	80 - 36	125.00 - 167.50	90.00	54.00	87.50	100.00	1.80 (kg)	20	210020	310008
	80 - 36	125.00 - 167.50	90.00	54.00	87.50	100.00	1.80 (kg)	101	210063	310008
	80 - 36	125.00 - 167.50	90.00	54.00	87.50	100.00	1.80 (kg)	103	210064	310008
	80 - 36	162.50 - 205.00	90.00	54.00	87.50	135.00	2.40 (kg)	20	210020	310009
	80 - 36	162.50 - 205.00	90.00	54.00	87.50	135.00	2.40 (kg)	101	210063	310009
	80 - 36	162.50 - 205.00	90.00	54.00	87.50	135.00	2.40 (kg)	103	210064	310009

NOTE: X_{1R} = rotated insert holder for reverse machining.

NOTE: Insert holders and inserts sold separately.



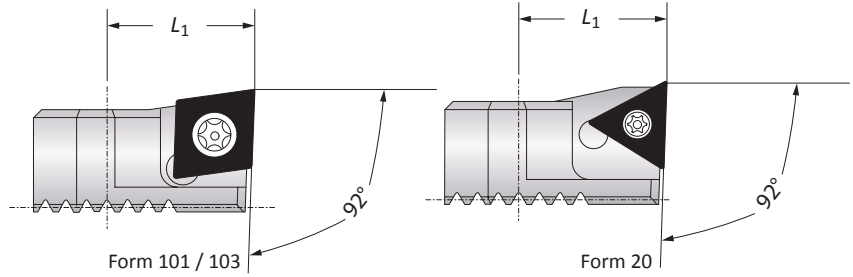
i = Imperial (in)
m = Metric (mm)

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.
ext: 7611 | email: appeng@alliedmachine.com

Insert Holders for Abrasive Materials | Serrated Shims

Diameter Range: 2.087" - 8.071" (53.00 mm - 205.00 mm)

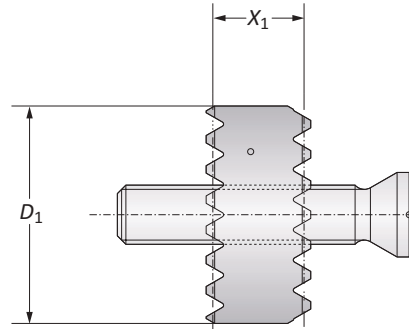


Insert Holders

Boring Range		Insert Holder	Weight	Insert Form	Part No.
		L_1			
i	2.087 - 8.071	0.709	0.066 (lbs)	20	211061
	2.087 - 8.071	0.709	0.066 (lbs)	101	211063
	2.087 - 8.071	0.709	0.066 (lbs)	103	211065
m	53.00 - 205.00	18.00	0.03 (kg)	20	211061
	53.00 - 205.00	18.00	0.03 (kg)	101	211063
	53.00 - 205.00	18.00	0.03 (kg)	103	211065

NOTE: Insert holders used for abrasive materials to protect boring head against chip wash.

NOTE: When machining grey cast iron, we recommend using insert holders for abrasive materials with CBN inserts for optimized chip removal.



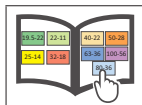
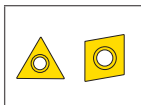
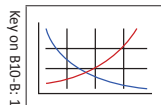
Serrated Shims

Boring Range	Additional Boring Range	Serrated Shim		Weight	Part No.	
		X_1	D_1		Serrated Shim and Screw	Replacement Screw
i	1.141 - 2.126	0.315	0.157	0.022 (lbs)	310070	415360
	1.141 - 2.126	0.472	0.236	0.022 (lbs)	310071	415342
	2.087 - 8.071	0.394	0.196	0.022 (lbs)	310074	515595
	2.087 - 8.071	0.590	0.295	0.022 (lbs)	310075	515596
m	29.00 - 54.00	8.00	4.00	0.01 (kg)	310070	415360
	29.00 - 54.00	12.00	6.00	0.01 (kg)	310071	415342
	53.00 - 205.00	10.00	5.00	0.01 (kg)	310074	515595
	53.00 - 205.00	15.00	7.50	0.01 (kg)	310075	515596

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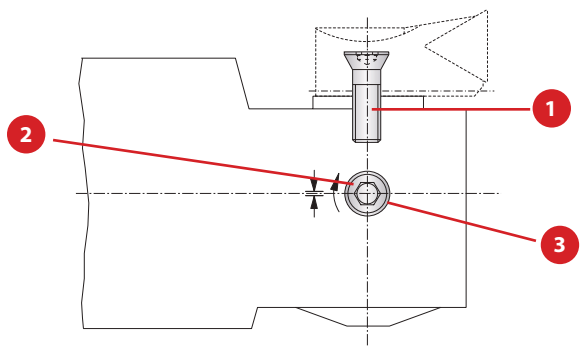
Key on B10-B: 1

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

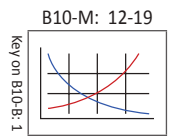
Inserts sold separately

Accessories

Screws



Boring Head	1 Countersunk Screw		2 Clamping Screw		3 Ball
	Part No.	Service Key	Part No.	Service Key	Part No.
320010 (310010)	215323	T15 / H	364260	s2.0 / A	364270
320020 (310020)	215338	T15 / H	364138	s2.5 / A	364139
320001 (310001)	215338	T15 / H	115136	s2.5 / A	-
320003 (310003)	215338	T15 / H	115180	s2.5 / A	-
320004 (310004)	215462	T20 / H	115249	s4 / B	-
320005 (310005)	215462	T20 / H	115185	s4 / B	-
320006 (310006)	215462	T20 / H	315279	s4 / B	-
320007 (310007)	215462	T20 / H	115186	s4 / B	-
320008 (310008)	215462	T20 / H	115186	s4 / B	-
320009 (310009)	215462	T20 / H	115186	s4 / B	-



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538 (537) Product Overview



538 (537) Cassettes FINE BORING

Engineered for easy precision.

538 (537) fine boring cassettes offer high accuracy and are available in an easy-to-use digital or analog version. The digital version features a docking port to attach the 3E^{TECH+} digital readout module for μ -accurate diameter adjustments while the analog cassettes provide highly accurate adjustments through the vernier scale. 538 (537) cassettes are made of hardened steel and can be used on serrated tool bodies and slides from 3.937" - 128.150" (100.00 mm - 3255.00 mm). The insert holder can be rotated easily for reverse machining applications.

Experience **digital precision boring** for yourself.

- Diameter range: 3.937" - 8.071" (100.00 mm - 205.00 mm).
- Cassette can be used on large diameter serrated slides (pg. B10-G: 10 - 11): 7.874" - 128.150" (200.00 mm - 3255.00 mm).
- Coolant through.
- 3E^{TECH+} module provides a simple digital readout.
- Analog version with a vernier scale.
- Max cutting speed: 2,953 SFM (900 m/min).



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.

NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.

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

538 (537) BORING CASSETTES



Vernier scale
on both analog
and digital cassettes

Digital 538 (537)
cassettes with 3E^{TECH+}
docking port

- ✓ Convenient tool handling
- ✓ Large range of applications
- ✓ Hardened steel bodies

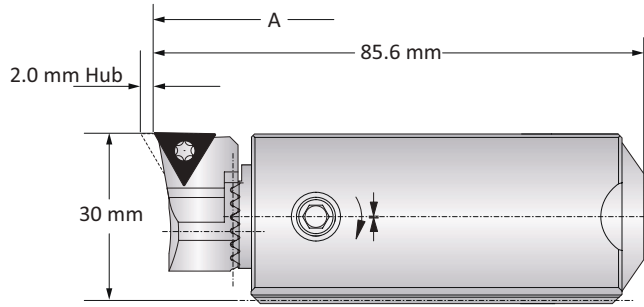
538 (537) Analog Cassettes

Diameter Range: 3.937" - 8.071" (100.00 mm - 205.00 mm)



Form 101 / 103

NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.



Form 20

Analog 538 (537) Cassettes

	Boring Range	Weight	Insert Form	Part No.		
				Insert Holder	Clamping Piece	Cassette*
i	3.937 - 8.071	1.323 (lbs)	20	210020	137026	538051
	3.937 - 8.071	1.323 (lbs)	101	210063	137026	538051
	3.937 - 8.071	1.323 (lbs)	103	210064	137026	538051
m	100.00 - 205.00	0.60 (kg)	20	210020	137026	537051
	100.00 - 205.00	0.60 (kg)	101	210063	137026	537051
	100.00 - 205.00	0.60 (kg)	103	210064	137026	537051

*Required serrated tool body sold separately.

NOTE: Cassette and insert holder can be used on large diameter serrated slides (B10-G: 10 - 11).

NOTE: Insert holders, inserts, and clamping pieces **sold separately**.

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B10-F

B10-H

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Key on B10-B: 1

i = Imperial (in)
m = 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.
ext: 7611 | email: appeng@alliedmachine.com

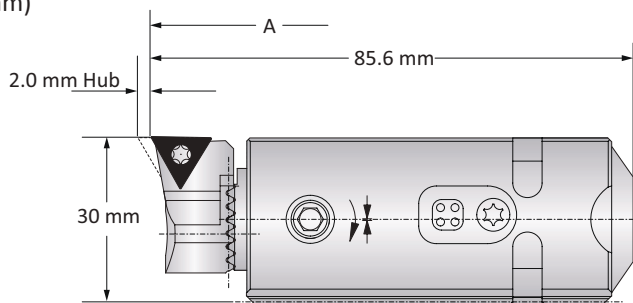
538 (537) Digital Cassettes with 3E^{TECH+}

Diameter Range: 3.937" - 8.071" (100.00 mm - 205.00 mm)



Form 101 / 103

NOTE: Vernier adjustment accuracy of 0.0001" or 0.002 mm on diameter.



Form 20

Digital 538 (537) Cassettes

	Boring Range	Weight	Insert Form	Part No.		
				Insert Holder	Clamping Piece	Cassette*
i	3.937 - 8.071	1.323 (lbs)	20	210020	137026	538052
	3.937 - 8.071	1.323 (lbs)	101	210063	137026	538052
	3.937 - 8.071	1.323 (lbs)	103	210064	137026	538052
m	100.00 - 205.00	0.60 (kg)	20	210020	137026	537052
	100.00 - 205.00	0.60 (kg)	101	210063	137026	537052
	100.00 - 205.00	0.60 (kg)	103	210064	137026	537052

*Required serrated tool body sold separately.

NOTE: Cassette and insert holder can be used on large diameter serrated slides (B10-G: 10 - 11).

NOTE: 3E^{TECH+} digital readout module, charging unit, insert holders, inserts, and clamping pieces **sold separately**.

3E^{TECH+} Digital Readout Module

Part No.	Charging Unit*
536015	536016

NOTE: WEEE-Reg.-Nr. DE 15820388

*Charging unit sold separately.



NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.

B10-M: 12-19

B10-F

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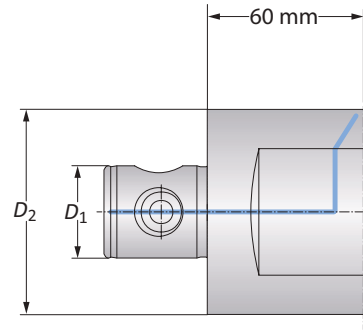
i = Imperial (in)
m = Metric (mm)

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.
ext: 7611 | email: appeng@alliedmachine.com

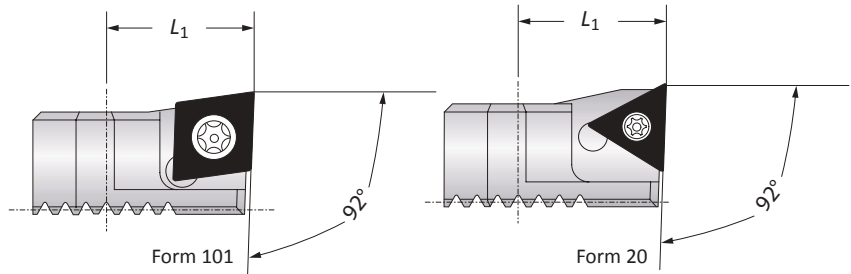
Serrated Tool Bodies | Insert Holders for Abrasive Materials

Diameter Range: 3.937" - 8.071" (100.00 mm - 205.00 mm)



Serrated Tool Bodies

MVS Connection		Serrated Tool Body	
	$D_2 D_1$	Boring Range	Part No.
i	80 - 36	3.937 - 6.102	148007
	80 - 36	5.906 - 8.071	148009
m	80 - 36	100.00 - 155.00	148007
	80 - 36	150.00 - 205.00	148009



Insert Holders for Abrasive Materials

Boring Range		Insert Holder	Weight	Insert Form	Part No.
		L_1			
i	3.937 - 8.071	0.709	0.066 (lbs)	20	211061
	3.937 - 8.071	0.709	0.066 (lbs)	101	211063
	3.937 - 8.071	0.709	0.066 (lbs)	103	211065
m	100.00 - 205.00	18.00	0.03 (kg)	20	211061
	100.00 - 205.00	18.00	0.03 (kg)	101	211063
	100.00 - 205.00	18.00	0.03 (kg)	103	211065

NOTE: Insert holders used for abrasive materials to protect boring head against chip wash.

NOTE: When machining grey cast iron, we recommend using insert holders for abrasive materials with CBN inserts for optimized chip removal.

B10-M: 12-19

B10-H

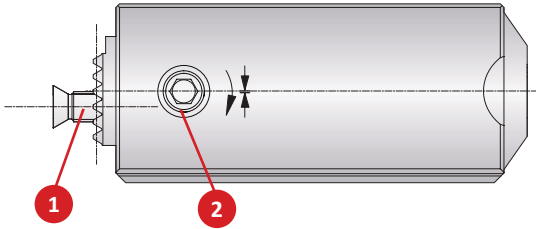
B10: vi-vii

Key on B10-B: 1

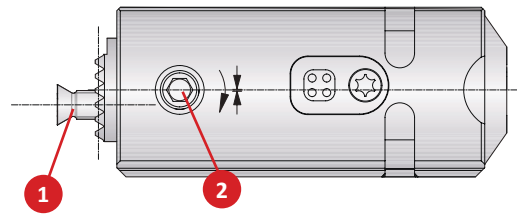
i = Imperial (in)
m = Metric (mm)
Inserts sold separately

Accessories

538 (537) Screws | 3E^{TECH+} Charging Unit | 538 (537) Clamping Pieces



538 (537) Analog Cassette



538 (537) 3E^{TECH+} Cassette

538 (537) Screws

	Cassette Part No.	1 Countersunk Screw		2 Clamping Screw	
		Part No.	Service Key	Part No.	Service Key
i	538051	215462	T20 / H	115249	s4 / F
	538052	215462	T20 / H	315789	s4 / F
m	537051	215462	T20 / H	115249	s4 / F
	537052	215462	T20 / H	315789	s4 / F

3E^{TECH+} Accessories

1
Charging Unit
Part No.
536016

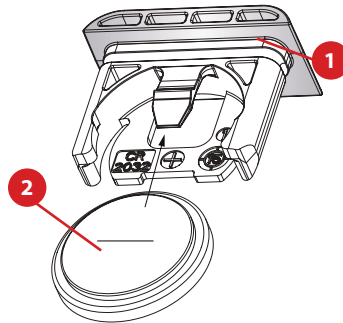


NOTE: Charging unit sold separately from 3E^{TECH+}.

NOTE: 3E^{TECH+} adjustment accuracy of 0.00005" or 0.001 mm on diameter.

3E^{TECH} (Old Display) Accessories

1	2
Sealing Ring	Battery CR2032
Part No.	Part No.
215483	515491

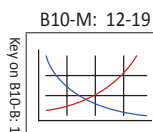
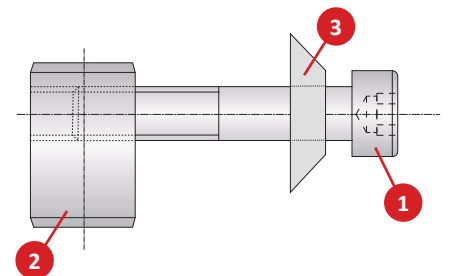


NOTE: Not required for 3E^{TECH+} (new display).

538 (537) Clamping Pieces

Slide Type	Complete Part No.	Replacement Components			
		Service Key	1 Cap Screw	2 Clamping Nut	3 Disk Spring
Serrated Tool Bodies	137026	115578 s6 / B	215101	140118	337105
Basic and Eco Slides	137027		215102	215105	337105
Flex Slides	137019		415900	215105	337105

NOTE: Clamping pieces sold separately.



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

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Guaranteed Test / Demo Application Form

Distributor PO #

The following must be filled out completely before your test will be considered.

IMPORTANT: For processing, send purchase order to your Allied Field Sales Engineer (FSE). Please clearly mark the paperwork as "Test Order."

Distributor Information

Company Name: _____
Contact: _____
Account Number: _____
Phone: _____
Email: _____

End User Information

Company Name: _____
Contact: _____
Industry: _____
Phone: _____
Email: _____

Current Process List all tooling, coatings, substrates, speeds and feeds, tool life, and any problems you are experiencing.

Test Objective List what would make this a successful test (i.e. penetration rate, finish, tool life, hole size, etc.).

Application Information

Hole Diameter: _____ in/mm Tolerance: _____ Material: _____
(4150, A36, cast iron, etc.)
Preexisting Diameter: _____ in/mm Depth of Cut: _____ in/mm Hardness: _____
(BHN, Rc)
Required Finish: _____ RMS State: _____
(Casting, hot rolled, forging)

Machine Information

Machine Type: _____ Builder: _____ Model #: _____
(Lathe, screw machine, machine center, etc.) (Haas, Mori Seiki, etc.)
Shank Required: _____ Power: _____ HP/KW
(CAT50, Morse taper, etc.)
Rigidity: Orientation: Tool Rotating: Thrust: _____ lbs/N
 Excellent Vertical Yes
 Good Horizontal No
 Poor

Coolant Information

Coolant Delivery: _____ Coolant Pressure: _____ PSI / bar
(Through tool, flood)
Coolant Type: _____ Coolant Volume: _____ GPM / LPM
(Air mist, oil, synthetic, water soluble, etc.)

Requested Tooling

QTY	Item Number

QTY	Item Number



Allied Machine & Engineering
120 Deeds Drive
Dover, OH 44622

Telephone: (330) 343-4283
Toll Free USA & Canada: (800) 321-5537
Email: info@alliedmachine.com

Warranty Information



Allied Machine & Engineering ("Allied Machine") warrants to original equipment manufacturers, distributors, industrial and commercial users of its products for one year from the original date of sale that each new product manufactured or supplied by Allied Machine shall be free from defects in material and workmanship.

Allied Machine's sole and exclusive obligation under this warranty is limited to, at its option, without additional charge, replacing or repairing this product or issuing a credit. For this warranty to be applied, the product must be returned freight prepaid to the plant designated by an Allied Machine representative and which, upon inspection, is determined by Allied Machine to be defective in material and workmanship.

Complete information as to operating conditions, machine, setup, and the application of cutting fluid should accompany any product returned for inspection. This warranty shall not apply to any Allied Machine products which have been subjected to misuse, abuse, improper operating conditions, improper machine setup or improper application of cutting fluid or which have been repaired or altered if such repair or alteration, in the judgement of Allied Machine, would adversely affect the performance of the product.

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United States

Allied Machine & Engineering
120 Deeds Drive
Dover OH 44622
United States

Phone:
+1.330.343.4283

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

Toll Free USA and Canada:
800.321.5537

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

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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