# REGAL DIAMOND PRODUCTS

Taking the grind out of grinding

# INTRODUCTION

Regal Diamond Products Corp. has been a leader in the superabrasive industry since its founding in 1958. As a market leader we have provided solutions for environments as industries have evolved. True, we weren't present when God created the diamond, but Regal Diamond Products has been involved with the grinding industry dating back to the development of Cubic Boron Nitride (CBN). In fact, Regal Diamond Products was a front-runner incorporating the superabrasive CBN into a large number of applications allowing a number of businesses to take advantage of the benefits resulting in their own success in becoming market leaders. Going beyond the huge milestone of CBN, Regal Diamond Products has been on the leading edge of every development within the family of bonds that have resulted over the span of 50 plus years. As such, we've enjoyed helping our customers leverage our experience and expertise into making their products among the best in their respective industries.

Through the years, we've witnessed a number of organizations try to acquire what we have already experienced and just as many that are recently beginning their journey. Give us a call and allow the experienced team at Regal Diamond Products help in taking the grind out of grinding.

# QUALITY CONTROL

Regal Diamond Products Corp. is recognized in the market as the standard of consistency in high performance superabrasive grinding wheels. Identifying and implementing the advantages of advancements in state of the art equipment, measuring devices, and practices has enabled Regal Diamond Products to continue to maintain that status. As a result of our attention to detail, meticulous quality and manufacturing controls you can be assured of receiving the same market leading performance from the 100th wheel as you enjoyed with the first.



REGAL DIAMOND PRODUCTS CORP.
1405 East 286th Street, Wickliffe, Ohio 44092-0198
Phone: 440.944.7700 | Fax: 440.944.7722 | Toll Free: 800.327.3425 | Web: regaldiamond.com

# HOW TO ORDER REGAL DIAMOND AND CBN WHEELS

In order to supply you the correct wheel for your particular grinding operation, we need to know the following information:

1. Type — such as 1A1, 6A2C, 11V9, etc., as identified in the Shape Index on pages 6-7.
2. All required dimensions listed under "To order, specify" instructions found with each type of wheel diagram.
3. Specify how the wheel is to be used, listing material to be ground, wet or dry grinding, stock removal, wheel speed and surface finish required.
4. Specify grit size, concentration and abrasive depth along with bond type desired.

Remember, if you need help, we can give you our experienced recommendation.

Our goal is to match a proper wheel type and Regal specification for your unique grinding operation to satisfy your expectations. Information that will help achieve this goal includes:

- Describe work piece being ground and work piece material such as:
  - Solid carbide or carbide with another material (% of each)
  - Hardened steel, stainless steel (type/Rockwell hardness)
  - Ceramic (type)
  - Other
- General information about the equipment:
  - Machine name (and model) and type (surface, OD, CNC tool & cutter, etc.)
  - Spindle RPM (variable?) and horsepower
  - Flood coolant (oil, water soluble or water), mist or dry, coolant pressure
- Current wheel specifications:
  - Manufacturer along with their wheel marking
  - Shape, diameter, thickness, hole, abrasive depth, angle and radius callouts
- What is your main emphasis/problem with current wheel you are using:
  - Cycle time
  - Form retention
  - Finish
  - Overall life
  - Other



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# WHEEL MARKING SYSTEM

## Example: WD 120 R 100 B 10-1/8

| Type of Diamond or CBN Abrasive | Grit Size | Hardness | Concentration | Bond Type | Abrasive Depth |
|---|---|---|---|---|---|
| D | 60 | J (Soft) | 125 (High) | B (Resin) | 1/16" |
| WD | 80 | N | 100 | BC | 1/8" |
| XD | 100 | P | 75 | (Copper) | 1/4" |
| YD | 120 | R | 50 | M (Metal) | 3/8" |
| Y3D | 150 | S | 25 (Low) | V (Vitrified) | 1/2" |
| Y6D | 180 | (Hard) | | | |
| ZD | 220 | | | | |
| B | 240 | | | | |
| BL | 320 | | | | |
| BB | 400 | | | | |
| BX | 500 | | | | |
| | 600 | | | | |
| | 800 | | | | |
| | 1000 | | | | |
| | 1500 | | | | |

**GRIT SIZE:** This is the size of the abrasive particle. It affects stock removal rates and surface finish. The following expected RMS finish chart is to be used as a guide only:

| Grit Size | Expected RMS Finish |
|---|---|
| 80 | 24-30 |
| 100 | 18-24 |
| 120 | 16-18 |
| 150 | 14-16 |
| 180 | 12-14 |
| 200 | 10-12 |
| 240 | 8-10 |
| 320 | 8 |
| 400 | 6-8 |

**CONCENTRATION:** This is the ration of the weight (carats) of superabrasive particles versus the total volume of the abrasive section. Regal's standard practice is to use 72 carats uncoated weight of superabrasive per cubic inch of abrasive section = 100 concentration.

**BOND TYPE AND HARDNESS:** The bond is the material that holds the superabrasive particles securely in the wheel. The determination of what bond and hardness to use depends upon individual grinding operations. Regal prefers to recommend the best combination for your particular needs.

**ABRASIVE DEPTH:** This is the actual depth of the abrasive bearing section. In choosing what depth to purchase, take into consideration that a 1/8" depth wheel is less expensive that two 1/16" depth wheels.



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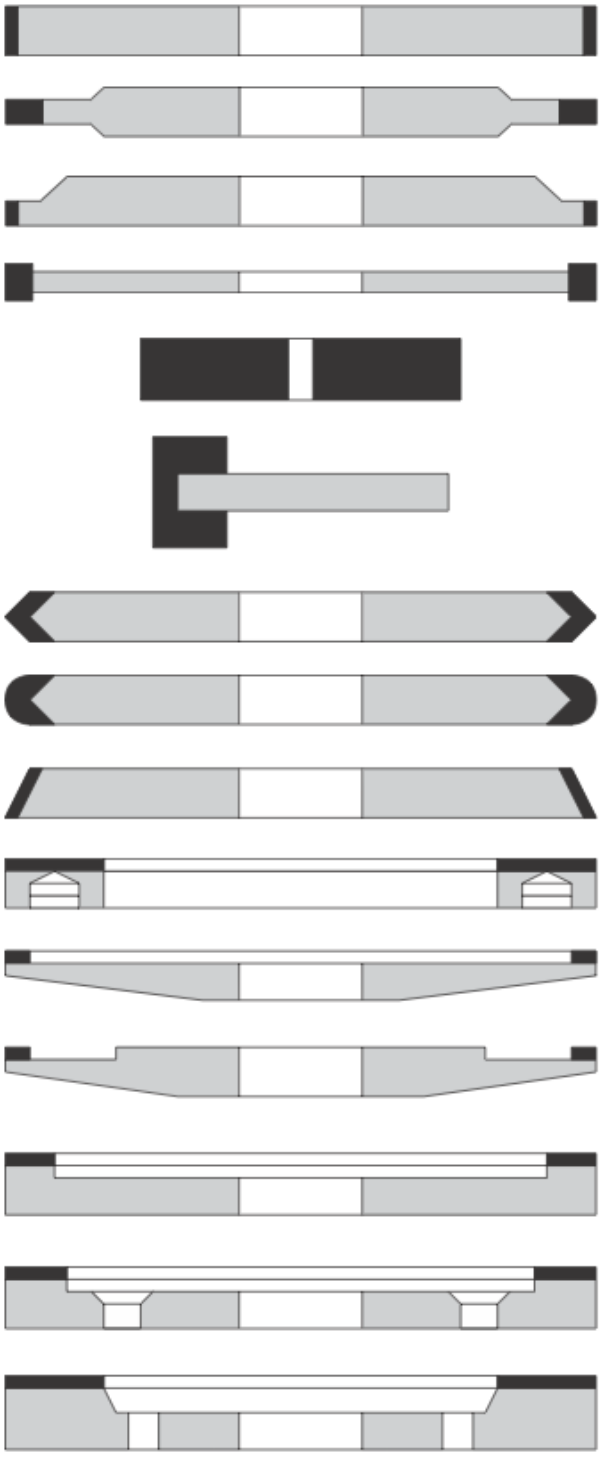
# SHAPE INDEX





*Other shapes available upon request.

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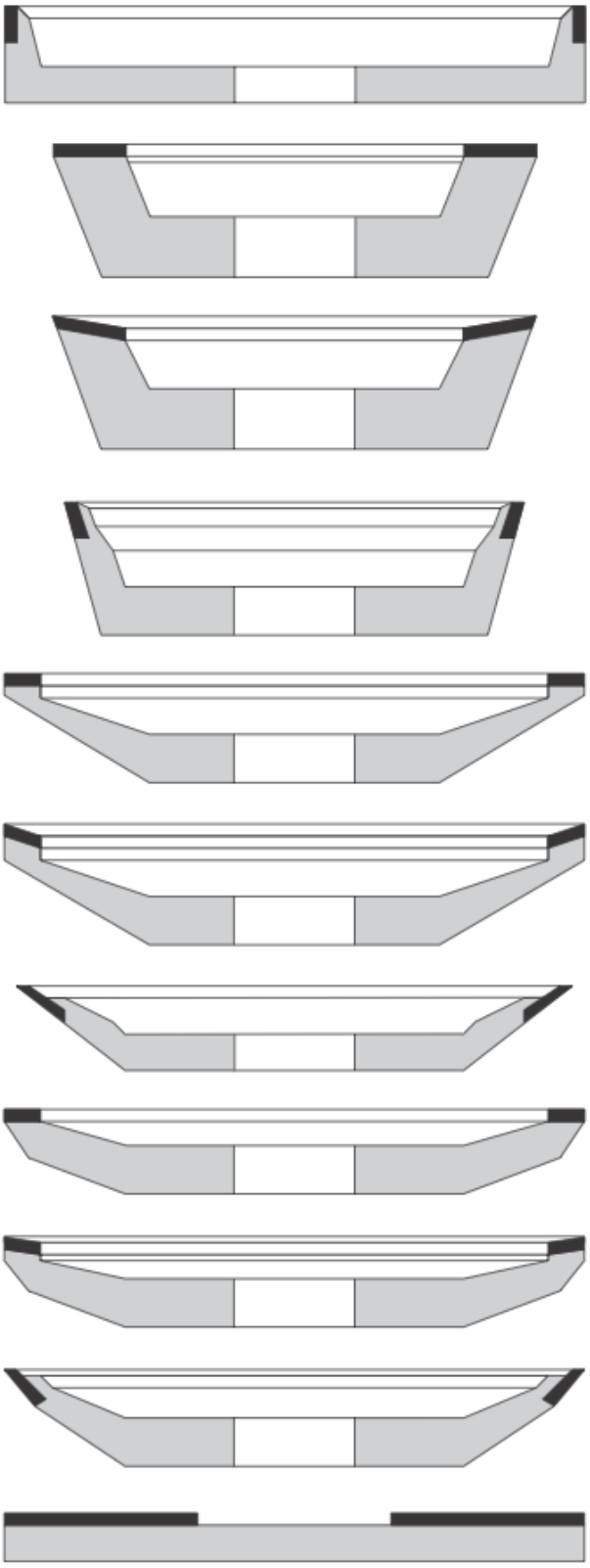






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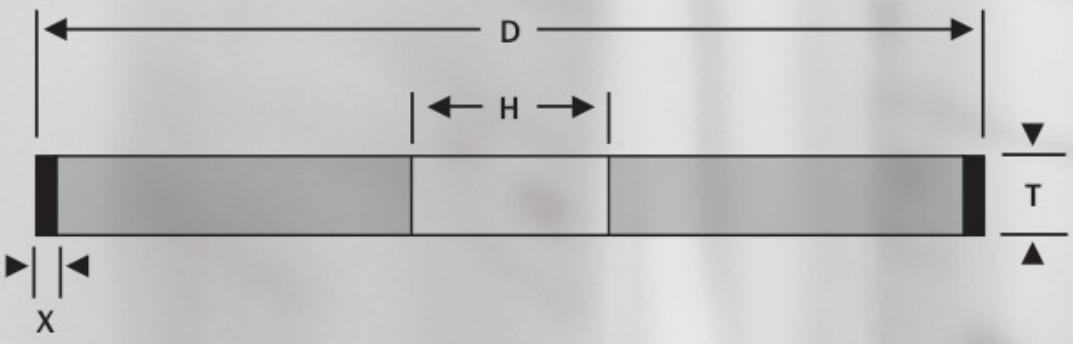
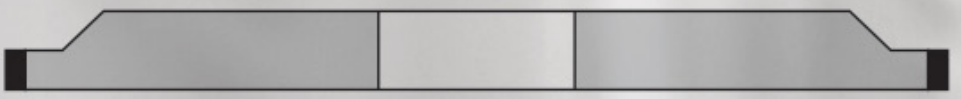
## TYPE D1A1, D3A1, D14A1 - DIAMOND

## TYPE B1A1, B3A1, B14A1 - CBN

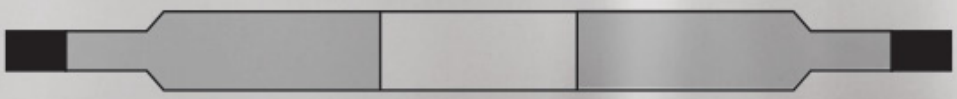
(Straight - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
X = Abrasive Depth
H = Hole Diameter



TYPE 3A1 (Hub One Side)



TYPE 14A1 (Hub Two Sides)



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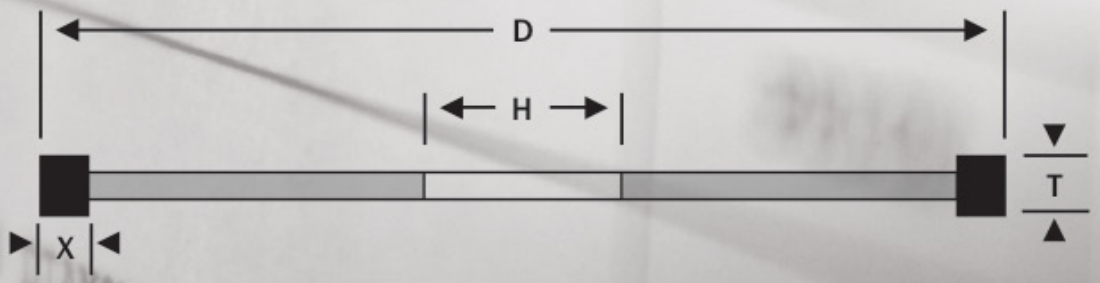
## TYPE D1A1R - DIAMOND

## TYPE B1A1R - CBN

(Blades - Steel Center - Sides Relieved - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
X = Abrasive Depth
H = Hole Diameter



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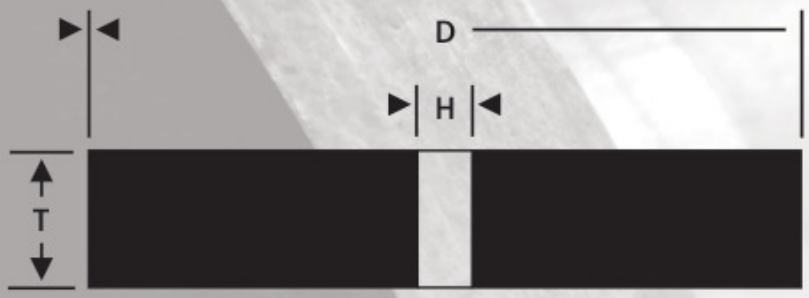
## TYPE D1A8 - DIAMOND

## TYPE B1A8 - CBN

(Straight - Solid Diamond/CBN Throughout)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
H = Hole Diameter

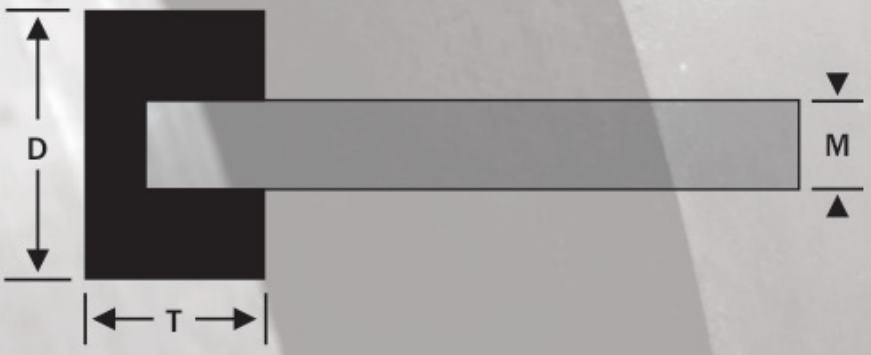



## TYPE DWS - DIAMOND

## TYPE BWS - CBN

(Solid Diamond/CBN Mounted on Mandrel)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
M = Mandrel Diameter



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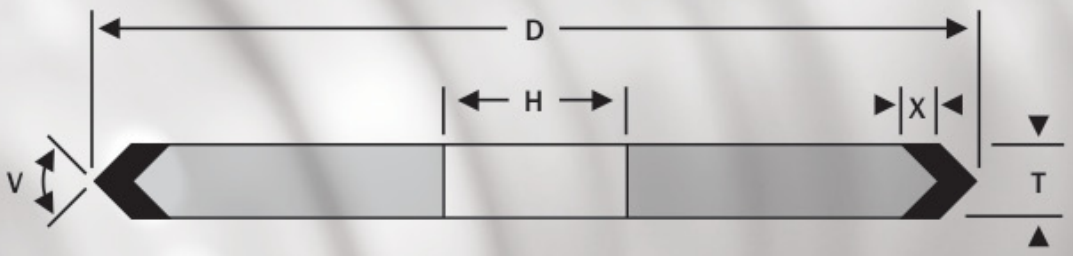
## TYPE D1EE1 - Diamond

## TYPE B1EE1 - CBN

(Straight - "EE" Face - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
V = Included Angle
X = Abrasive Depth
H = Hole Diameter

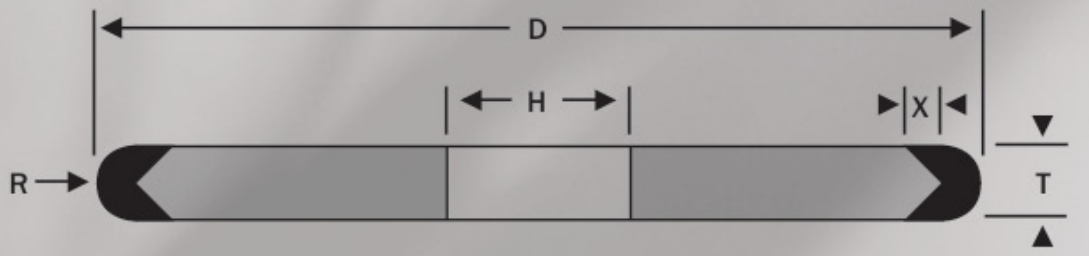



## TYPE D1FF1 - Diamond

## TYPE B1FF1 - Borazon

(Straight - "FF" Face - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
X = Abrasive Depth
H = Hole Diameter



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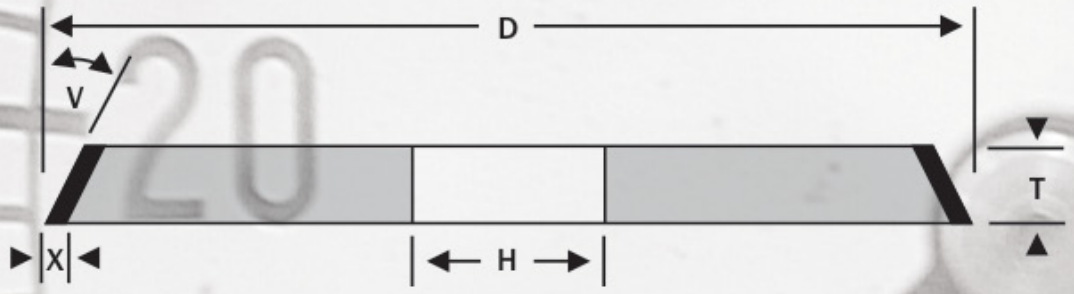
## TYPE D1V1 - DIAMOND

## TYPE B1V1 - CBN

(Straight - "V" Face - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
V = Bevel Angle
X = Abrasive Depth
H = Hole Diameter

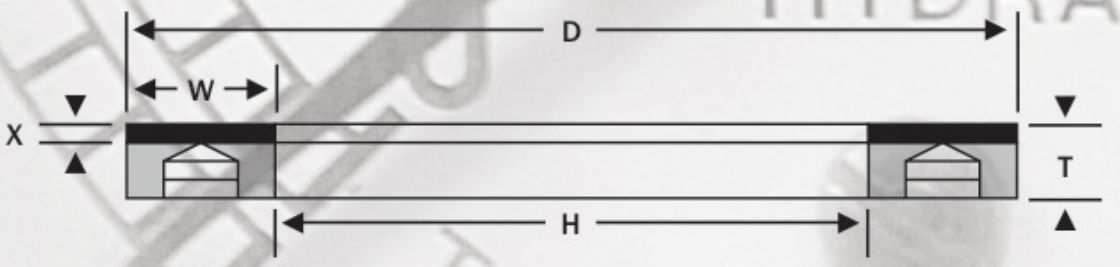



## TYPE D2A2T - DIAMOND

## TYPE B2A2T - CBN

(Cylinder - Threaded Holes - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
W = Rim Width
X = Abrasive Depth
H = Hole Diameter



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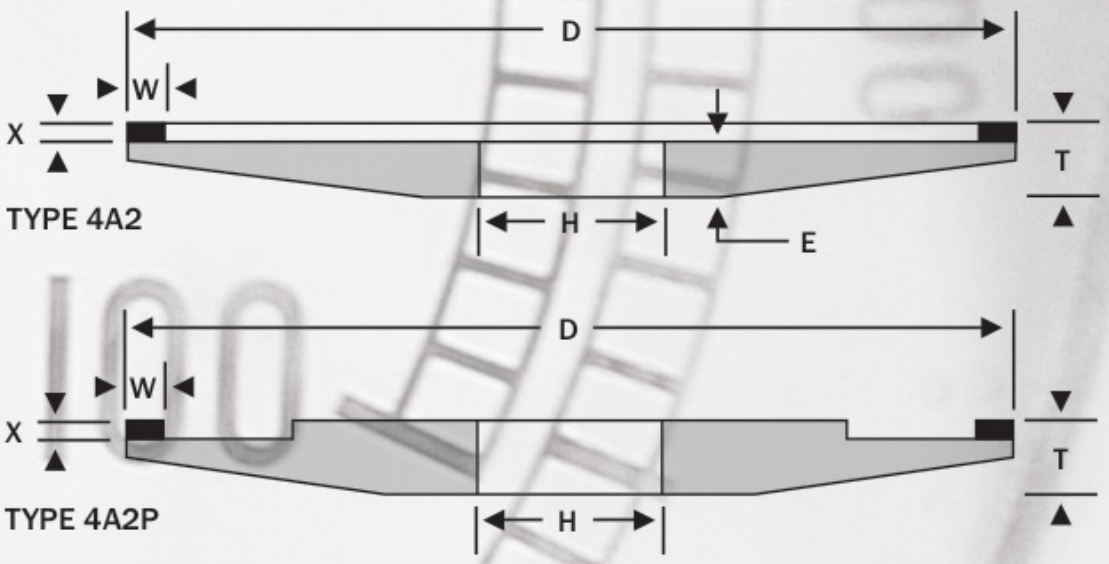
## TYPE D4A2, D4A2P - DIAMOND

## TYPE B4A2, B4A2P - CBN

(Flat Dish - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
X = Abrasive Depth
H = Hole Diameter




TYPE 4A2




TYPE 4A2P



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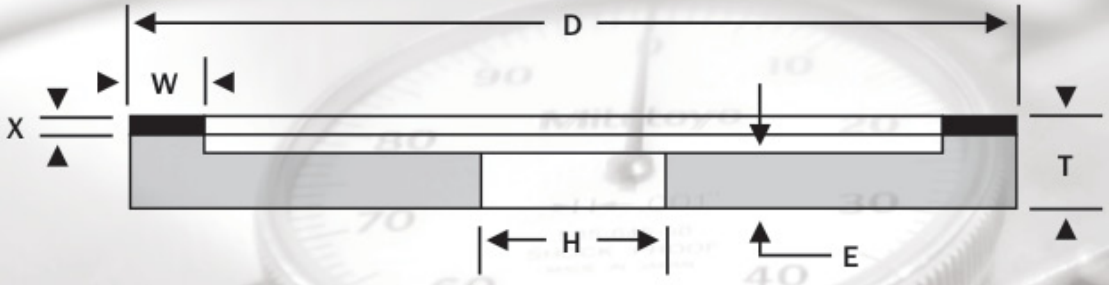
## TYPE D6A2 - DIAMOND

## TYPE B6A2 - CBN

(Plain Cup - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
W = Rim Width
X = Abrasive Depth
H = Hole Diameter

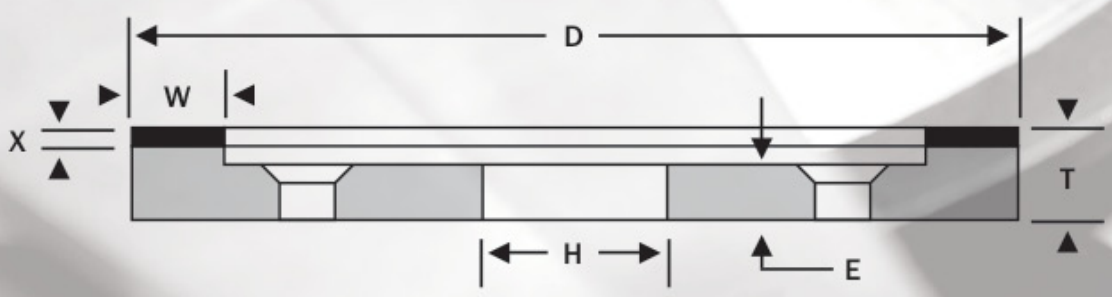



## TYPE D6A2C - DIAMOND

## TYPE B6A2C - CBN

(Plain Cup - With Countersunk Bolt Holes - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
W = Rim Width
X = Abrasive Depth
H = Hole Diameter



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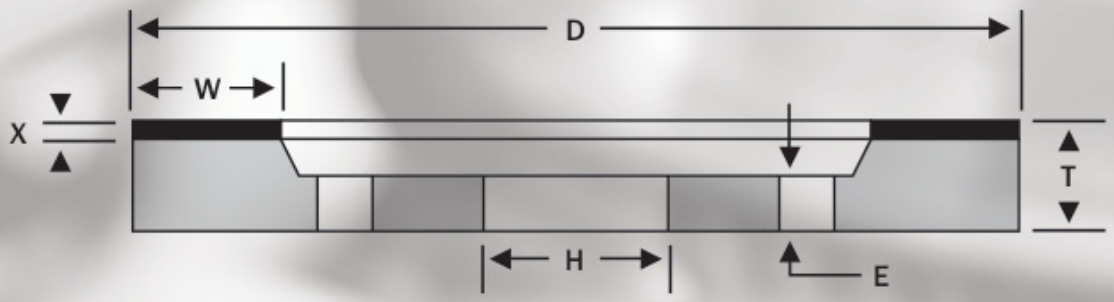
## TYPE D6A2H - DIAMOND

## TYPE B6A2H - CBN

(Plain Cup - With Thru Bolt Holes - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
W = Rim Width
X = Abrasive Depth
H = Hole Diameter

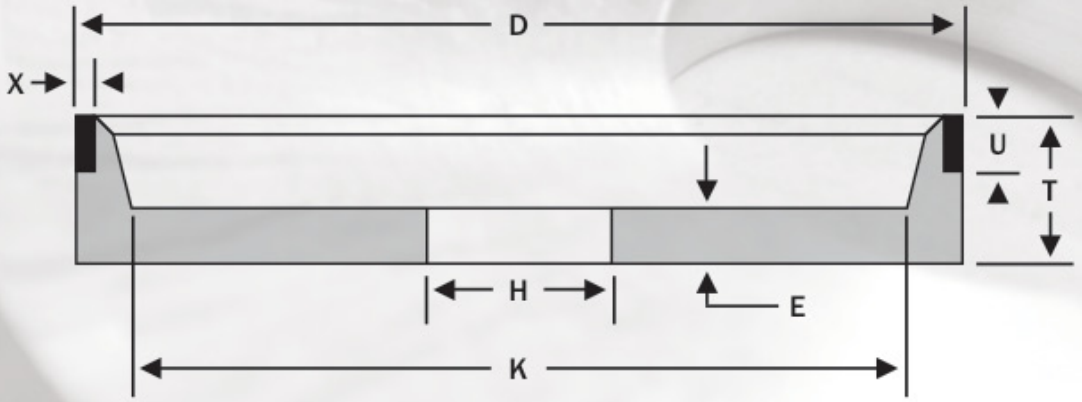



## TYPE D6A9 - DIAMOND

## TYPE B6A9 - CBN

(Plain Cup - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
U = Insert Length
X = Abrasive Depth
H = Hole Diameter



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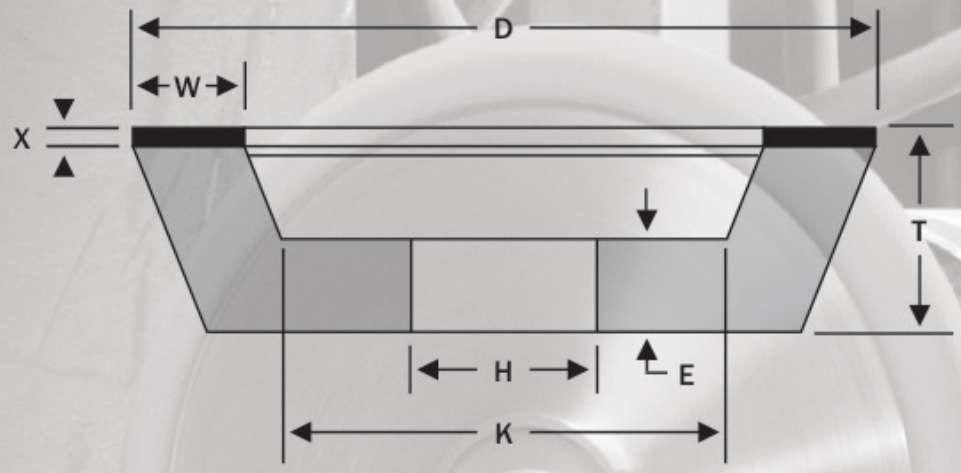
# DIAMOND & CBN WHEELS

## TYPE D11A2 - DIAMOND

## TYPE B11A2 - CBN

(Flaring Cup - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
W = Rim Width
X = Abrasive Depth
H = Hole Diameter

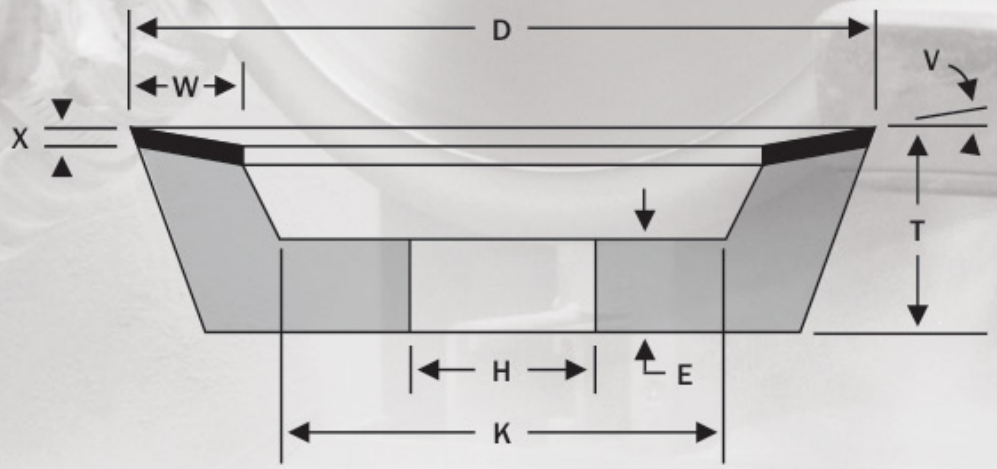



## TYPE D11V4 - DIAMOND

## TYPE B11V4 - CBN

(Flaring Cup - Rim Beveled Inside - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
V = Rim Bevel
W = Rim Width
X = Abrasive Depth
H = Hole Diameter



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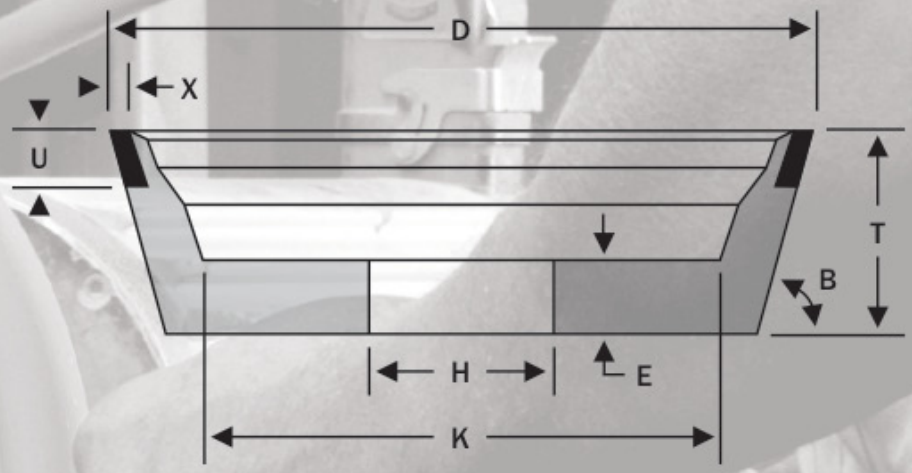
# DIAMOND & CBN WHEELS

## TYPE D11V9 - DIAMOND

## TYPE B11V9 - CBN

(Flaring Cup - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Back Angle
U = Insert Length
X = Abrasive Depth
H = Hole Diameter

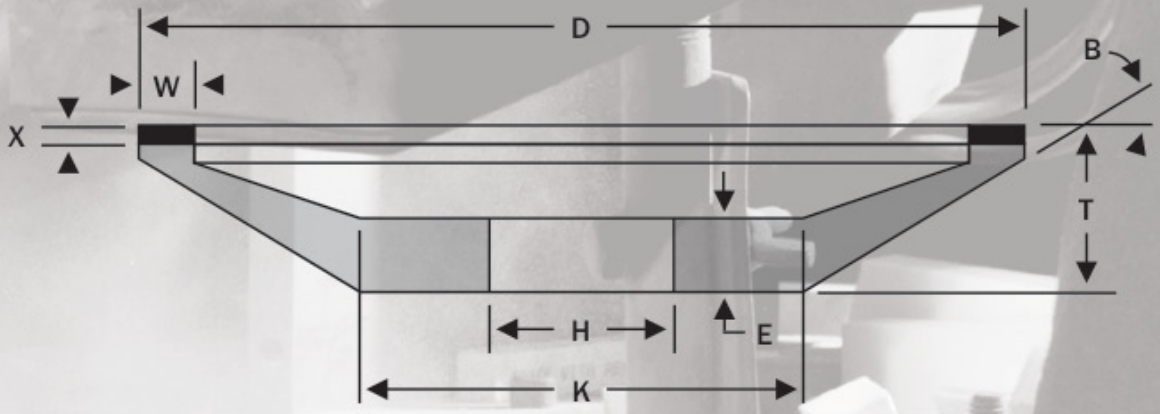



## TYPE D12A2 - DIAMOND

## TYPE B12A2 - CBN

(Dish - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Dish Angle
W = Rim Width
X = Abrasive Depth
H = Hole Diameter



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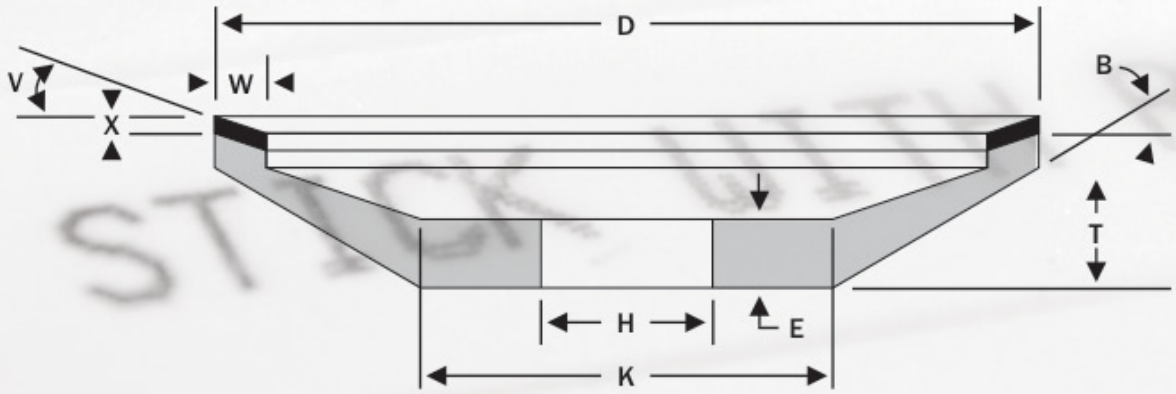
## TYPE D12V4 - DIAMOND

## TYPE B12V4 - CBN

(Dish - Rim Beveled Inside - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Back Angle
V = Rim Bevel
W = Rim Width
X = Abrasive Depth
H = Hole Diameter

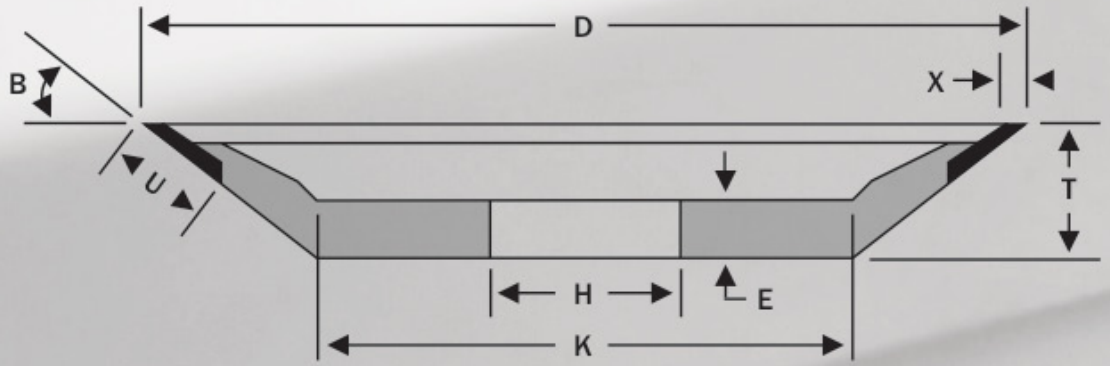



## TYPE D12V9 - DIAMOND

## TYPE B12V9 - CBN

(Dish - Diamond/CBN In Periphery)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Dish Angle
U = Insert Length
X = Abrasive Depth
H = Hole Diameter



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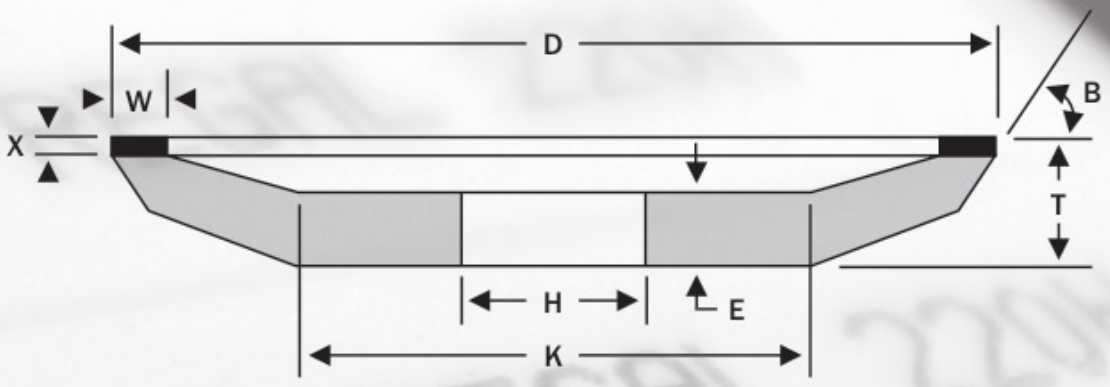
## TYPE D15A2 - DIAMOND

## TYPE B15A2 - CBN

(Dish - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Back Angle
W = Rim Width
X = Abrasive Depth
H = Hole Diameter

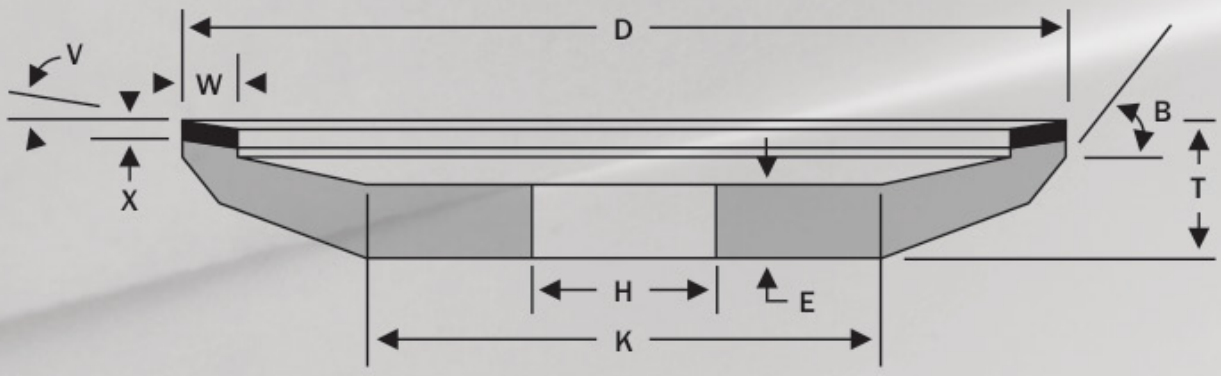



## TYPE D15V4 - DIAMOND

## TYPE B15V4 - CBN

(Dish - Rim Beveled Inside - Diamond/CBN In Rim)

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Back Angle
V = Rim Bevel
W = Rim Width
X = Abrasive Depth
H = Hole Diameter



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## TYPE D15V9 - DIAMOND

## TYPE B15V9 - CBN

(Dish - Diamond/CBN In Periphery)

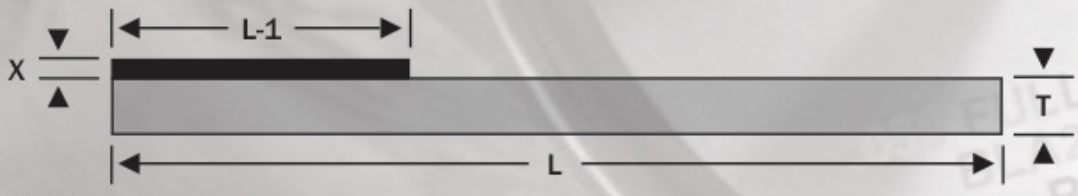
To order, specify:
D = Wheel Diameter
T = Wheel Thickness
E = Back Thickness
K = Inside Flat
B = Back Angle
U = Dish Angle
X = Abrasive Depth
H = Hole Diameter


## TYPE DHH1, DHH2 - DIAMOND

## TYPE BHH1, BHH2 - CBN

(Hand Hone - Diamond/CBN - HH1 One End, HH2 Both Ends )

To order, specify:
T = Hone Thickness
W = Rim Width
L = Length
L-1 = Abrasive Length
X = Abrasive Depth
H = Hole Diameter




TYPE HH1


TYPE HH2



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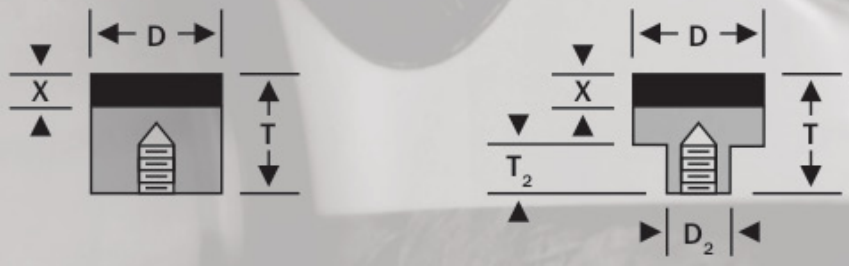
# BUTTONS – RESIN & METAL BOND

To order, specify:
D = Wheel Diameter
T = Wheel Thickness
X = Abrasive Depth



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# GENERAL CARE AND USE INSTRUCTIONS

## TRUING

When a diamond or CBN wheel is first mounted or worn to the point where it has lost its required shape, the abrasive section needs to be trued concentric or reshaped to original form via a truing process. Some newer CNC grinding machines have truing attachments for this purpose. For other machine types the following general procedures can be applied:

**DIAMOND WHEELS:** The best method for truing periphery type wheels (Type D1A1, D3A1, D14A1) is with a brake controlled truing device. The truing wheel should be a J to M hardness silicon carbide vitrified wheel in 60 or 80 grit. Use a series of rapid passes at .001" infeed until .0005" TIR or less is achieved.

**CBN WHEELS:** Use Regal CBN Truing Nibs for this purpose. They are available from stock in 3/8 & 7/16 shanks to fit in many single point tool holders. Infeed CBN wheel at .0005" or less per pass while traversing slowly until truing nib is in contact with entire wheel.

Use flood coolant when using the above methods.

Another option that can be used on both diamond and CBN wheels is the Regal Solid Metal truing nib available in 1/4, 3/8, 1/2 and 5/8 diameter. Use instructions for these are included with the nibs.

After proper truing of diamond and CBN wheels, the wheel surface will be very smooth (glazed) so it is very important to dress the wheel (see below) after truing to expose the superabrasive grit and allow the wheel to grind freely.

> **(Note: Never use a single point diamond tool or cluster diamond to true or dress diamond and CBN wheels. You will seriously damage both the wheel and the tool.)**

For a minimal charge, any diamond or CBN wheel can be shipped to Regal for truing. Our normal turnaround time is held to 1 - 3 days for customer convenience.

## DRESSING

If a wheel has become smooth from truing or glazed from the loading of work piece material, it has lost grit projection and needs to be dressed. Dressing erodes the bond material around the abrasive grit to expose cutting points and cleans out any foreign material that interferes with your grinding process. Regal generally recommends using the soft 220 grit white aluminum oxide stick supplied with each wheel for this purpose.



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Aggressively push the stick into the wheel until the stick begins to wear rapidly and the surface of the wheel has a gritty texture. Dress the wheel whenever amp load readings begin to increase or if the sound starts to change. The dressing stick that comes with most Regal diamond or CBN wheels is NOT meant to last the entire life of the wheel. Additional sticks can be purchased from Regal.

## RELIEVING CORE MATERIAL

This is necessary on Type 6A9, 11V9, 12V9, and 15V9 type wheels to fully utilized the superabrasive section. Whenever the core material begins to rub the work piece, it must be relieved to minimize heat, pressure and loading of the abrasive section. Core relieving can be done with a lathe type carbide or HSS tool bit. It is recommended to relieve the hub 1/32" below the abrasive surface, leaving a thin layer of core material next to the abrasive section. This will wear away during grinding and prevents chipping the abrasive section with the tool.

## SAFETY

Comply with American National Standards Institute Safety Code B7.1 and Occupational Safety and Health Act covering maximum speeds, safety guards, flanges, mounting procedures and general operation rules. It is recommended that you always wear safety glasses.

## MOUNTING

**MACHINE CONDITIONS:** Before mounting wheel, check flanges, back plates, spacers and spindle — they should be free of any burrs or debris and run true.

**MOUNTING PROCEDURE:** Mount the wheel with the "REGAL" name straight up and loosely tighten wheel mount. Check wheel for runout with the aid of a dial indicator. If wheel runout exceeds .005", it can be trued by centering the wheel on the spindle. Hold a wooden block against the periphery of the wheel at the point which runs out and gently tap the wheel into the most accurately centered position as shown by the dial indicator. Tighten up the wheel after the wheel has been centered.

**REMOVING WHEEL:** If a partially used wheel has to be removed from the machine, it is best to leave it mounted on the wheel mount so that best TIR is maintained when the wheel is put back on the machine. Regal stocks standard Sopko wheel mounts if you need extras for this purpose.

Regal can also mount and finish grind wheels on standard Sopko wheel mounts to give you the best possible TIR by mounting a completely trued assembly on your machine.



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# WHEEL SURFACE SPEED CONVERSION CHART

| Wheel Diameter | | WHEEL SPEED - SURFACE METERS PER SECOND | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 23 | 25 | 28 | 30 | 33 | 36 | 38 | 41 | 43 | 46 | 48 | 51 | 61 | 71 | 81 |
| | | WHEEL SPEED - SURFACE FEET PER MINUTE | | | | | | | | | | | | | | | |
| Inches | mm | 3,000 | 3,500 | 4,000 | 4,500 | 5,000 | 5,500 | 6,000 | 6,500 | 7,000 | 7,500 | 8,000 | 8,500 | 9,000 | 9,500 | 10,000 | 12,000 |
| | | REVOLUTIONS PER MINUTE | | | | | | | | | | | | | | | |
| 1 | 25 | 11,000 | 12,500 | 15,279 | 17,198 | 19,908 | 21,008 | 22,918 | 24,828 | 26,737 | 28,847 | 30,558 | 32,467 | 34,377 | 36,287 | 38,196 | 45,836 |
| 2 | 50 | 5,800 | 7,000 | 7,639 | 8,594 | 9,549 | 10,504 | 11,459 | 12,414 | 13,368 | 14,328 | 15,278 | 16,238 | 17,188 | 18,143 | 19,096 | 22,918 |
| 3 | 80 | 3,800 | 4,500 | 5,093 | 5,729 | 6,366 | 7,033 | 7,639 | 8,276 | 8,913 | 9,549 | 10,186 | 10,822 | 11,459 | 12,096 | 12,732 | 15,278 |
| 4 | 100 | 2,800 | 3,500 | 3,820 | 4,297 | 4,775 | 5,252 | 5,729 | 6,207 | 6,685 | 7,162 | 7,640 | 8,116 | 8,595 | 9,072 | 9,549 | 11,459 |
| 5 | 125 | 2,400 | 2,500 | 3,056 | 3,436 | 3,820 | 4,202 | 4,584 | 4,966 | 5,348 | 5,730 | 6,112 | 6,494 | 6,876 | 7,258 | 7,640 | 9,168 |
| 6 | 150 | 2,000 | 2,250 | 2,546 | 2,865 | 3,183 | 3,501 | 3,820 | 4,138 | 4,456 | 4,775 | 5,092 | 5,411 | 5,729 | 6,048 | 6,366 | 7,639 |
| 7 | 180 | 1,700 | 2,000 | 2,183 | 2,455 | 2,728 | 3,001 | 3,274 | 3,547 | 3,820 | 4,092 | 4,366 | 4,638 | 4,911 | 5,183 | 5,456 | 6,548 |
| 8 | 200 | 1,500 | 1,750 | 1,910 | 2,148 | 2,387 | 2,626 | 2,865 | 3,103 | 3,342 | 3,580 | 3,820 | 4,058 | 4,297 | 4,535 | 4,775 | 5,729 |
| 9 | 230 | 1,300 | 1,500 | 1,698 | 1,910 | 2,122 | 2,334 | 2,546 | 2,758 | 2,970 | 3,182 | 3,396 | 3,606 | 3,820 | 4,032 | 4,244 | 5,092 |
| 10 | 250 | 1,200 | 1,250 | 1,528 | 1,719 | 1,910 | 2,101 | 2,292 | 2,483 | 2,674 | 2,865 | 3,056 | 3,247 | 3,438 | 3,629 | 3,820 | 4,584 |
| 12 | 300 | 1,000 | 1,200 | 1,273 | 1,432 | 1,591 | 1,751 | 1,910 | 2,069 | 2,228 | 2,386 | 2,546 | 2,705 | 2,864 | 3,023 | 3,183 | 3,820 |
| 14 | 350 | 900 | 1,000 | 1,091 | 1,228 | 1,364 | 1,500 | 1,637 | 1,773 | 1,910 | 2,046 | 2,182 | 2,319 | 2,455 | 2,592 | 2,728 | 3,274 |
| 16 | 400 | 700 | 900 | 995 | 1,074 | 1,194 | 1,313 | 1,432 | 1,552 | 1,672 | 1,791 | 1,910 | 2,029 | 2,149 | 2,268 | 2,387 | 2,885 |
| 18 | 450 | 650 | 780 | 849 | 995 | 1,061 | 1,167 | 1,273 | 1,379 | 1,485 | 1,591 | 1,698 | 1,803 | 1,910 | 2,016 | 2,122 | 2,546 |
| 20 | 500 | 580 | 700 | 764 | 859 | 955 | 1,050 | 1,146 | 1,241 | 1,337 | 1,432 | 1,528 | 1,623 | 1,719 | 1,814 | 1,910 | 2,292 |

### ABRASIVE CROSS REFERENCE

| F.E.P.A. | British Standard | US Standard |
|---|---|---|
| 1181 | ~ | 16/18 |
| 1001 | ~ | 18/20 |
| 851 | 18/22 | 20/25 |
| 711 - 853 | 22/25 | 25/30 |
| 601 | 25/30 | 30/35 |
| 501 | 30/36 | 35/40 |
| 426 - 502 | 36/44 | 40/45 |
| 356 | 44/52 | 45/50 |
| 301 - 357 | 52/60 | 50/60 |
| 251 | 60/72 | 60/70 |
| 213 - 252 | 72/85 | 70/80 |
| 181 | 85/100 | 80/100 |
| 151 | 100/120 | 100/120 |
| 126 - 152 | 120/150 | 120/140 |
| 107 | 150/170 | 140/170 |
| 91 - 108 | 170/200 | 170/200 |
| 76 | 200/240 | 200/230 |
| 64 - 77 | 240/300 | 230/270 |
| 54 | 300/350 | 270/325 |
| 46 - 55 | 350/400 | 325/400 |

### ABRASIVE SIZES

| Micron Size | Size in Inches | Grit Equivalent |
|---|---|---|
| ~ | 0.007 | 80 |
| ~ | 0.006 | 100 |
| ~ | 0.005 | 120 |
| ~ | 0.004 | 140 |
| ~ | 0.0035 | 170 |
| ~ | 0.003 | 200 |
| 60 | 0.0024 | 230 |
| 45 | 0.0018 | 325 |
| 30 | 0.0012 | 600 |
| 15 | 0.0006 | 1200 |
| 9 | 0.00035 | 1800 |
| 6 | 0.00024 | 3000 |
| 3 | 0.00012 | 6000 |
| 1 | 0.00004 | 14000 |

### GRIT SIZE - RADIUS SIZE CHART

| Grit Size | Minimum Radius |
|---|---|
| 120 | 0.012 |
| 150 | 0.01 |
| 180 | 0.008 |
| 220 | 0.007 |
| 240 | 0.006 |
| 280 | 0.005 |
| 325 | 0.004 |
| 400 | 0.0035 |
| 600 | 0.003 |



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