

Superabrasive  
**RESIN, HYBRID & METAL  
BOND SPECIFICATIONS**



# INTRODUCTION | SPECIFYING RESIN, HYBRID & METAL BOND WHEELS

## Why Superabrasives?

Diamond is the hardest material known to man and has unsurpassed resistance to wear. It is used to grind hard, brittle, highly abrasive materials such as glass, ceramic, quartz, carbide, cermets, ferrites, graphite, wear-resistant spray coatings, glass fiber reinforced plastics and similar hard-to-machine materials.

cBN (Cubic Boron Nitride) is the second hardest abrasive known to man. It offers many advantages when grinding ferrous materials, such as hardened steel or steel superalloys.

When compared to conventional abrasives, Diamond and cBN allow greater material removal rates, improved quality due to less damage of the workpiece, and longer wheel life, all of which will reduce overall grinding costs.

## How to Specify Resin, Hybrid and Metal Bond Superabrasive Wheels

Our Diamond and cBN grinding wheels are built to exacting standards. Maintaining these standards is your best assurance of repeatability.

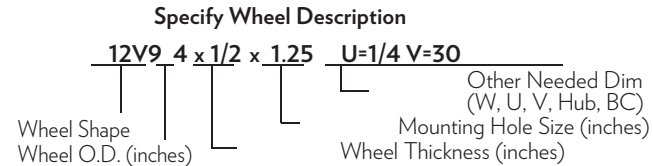
All relevant information is completely documented through unique part numbers consisting of the catalog number plus a 3 digit suffix which identifies the wheel formulation. Part numbers will be assigned by customer service associates at the time of the order and should be used when placing repeat orders.

We also identify each wheel we produce with a unique serial number. A detailed manufacturing record is kept for each wheel produced. This serial number can also be used to troubleshoot or improve product specifications to better meet the customer's performance needs. The following table explains how to completely specify a wheel for your application.

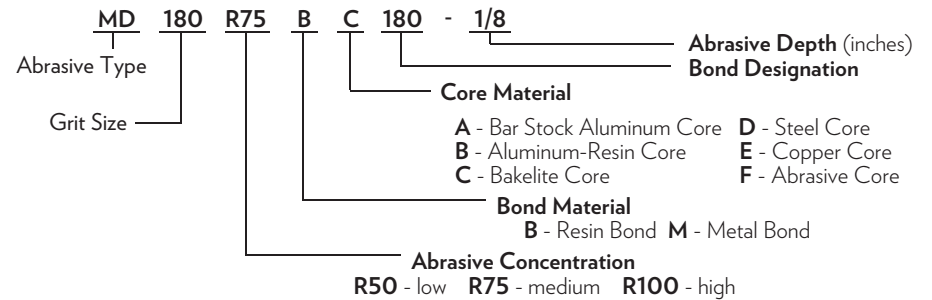
### Always Specify the Following:

1. Wheel Geometry
2. Mounting Hole Size
3. Application Number (p.6)
4. Finish Desired (Ra, RMS) or Coarse, Medium or Fine abrasive to be used
5. Quantity Desired

### Specifying Wheel Geometry and Mounting Hole Size



### Specifying Wheel Abrasive, Bond and Core Type



## Wheel Specifications/General Guidelines

When specifying Diamond or cBN wheel formulations to fit an application, four main factors are important: 1) Workpiece material, 2) Coolant application, Wet vs. Dry grinding, 3) Grinding contact area, 4) Machine condition and available power.

## Diamond Types

Diamond abrasives are used for precise grinding and finishing of tungsten carbide and carbide tipped cutting and milling tools. Diamonds are also used for grinding carbide, carbide/steel combinations, PCD/PCBN, and ceramic components. The standard diamond types offered by Abrasive Technology are listed below.

### Description

**Uncoated friable diamond.** Recommended for dry grinding applications, low power machines and grinding heat sensitive carbide and ceramic materials.

**Nickel coated, friable diamond.** The metal coating improves diamond retention in bond, extending the life of the wheel. This is the most versatile and common diamond type used for wet/dry grinding applications. Works best in wet grinding applications.

Note: Customized specifications are required when horsepower requirements are a concern, or for dry grinding applications when 15-30% steel is present.

**Copper coated, friable diamond.** Used only for dry grinding carbide when no steel is present.

**Nickel coated semi-friable diamond.** Used only when more than 30% steel is ground with carbide.

**Blocky diamond.** Ideal for grinding tools requiring optimum crystal retention for high material removal ratios.

## cBN Types

Cubic Boron Nitride (cBN) abrasives are used for precise grinding of tool and die steels, superalloys, stainless steels, and other hardened alloy steels. Abrasive Technology offers the following standard cBN types:

### Description

**Uncoated cBN.** Used for light to medium duty applications or where the application involves large grinding contact areas. Also used in vitreous bond systems.

**Nickel coated cBN.** Most popular cBN abrasive used with the resin bond system. Well suited for most light to medium duty applications.

**Nickel coated semi-friable cBN.** Used for heavy-duty applications where extra long wheel life or fine surface finish is required.

## Grit Sizes

The following table lists the standard diamond and cBN sizes offered by Abrasive Technology. Other sizes are available upon request.

The general recommendation for selecting abrasive size is to use as coarse a grit size as possible which will provide the desired surface finish for the application.

The target surface finish provided in the following table serves as a guideline for selecting the appropriate grit size. However, there are other factors, such as machine condition, wheel and travel speed, workpiece material and coolant that will influence the surface finish actually achieved.

Diamond and cBN Sizing Chart				
Mesh Size	FEPA Designation	Avg. Size (Inches)	Avg. Size (Microns)	Est. Particles Per Carat
50/60	D301	0.018	455	2,660
60/80	D252	0.015	384	6,140
80/100	D181	0.011	271	13,770
100/120	D151	0.009	227	19,030
120/140	D126	0.008	197	51,490
140/170	D107	0.007	185	66,400
170/200	D91	0.006	139	111,700
200/230	D76	0.005	116	133,000
230/270	D64	0.004	97	318,000
270/325	D54	0.003	85	522,000
325/400	D46	0.003	75	890,000
400/500	XXX	0.002	45	1,483,333
500/600	XXX	0.001	33	2,022,726
600	XXX	0.001	30	2,224,999
800	XXX	0.001	25	2,669,998
1000	XXX	0.001	20	3,337,498
1200	XXX	0.001	15	4,449,997
1500	XXX	0.000	12	5,562,497
1800	XXX	0.000	9	7,416,662
2000	XXX	0.000	8	8,343,745
2400	XXX	0.000	7	9,535,708
3000	XXX	0.000	6	11,124,993

## The Importance of Abrasive Concentration in Your Application

Increasing abrasive concentration will:

1. Increase wheel life
2. Improve surface finish
3. Reduce cut rate

However, increased concentration will make the wheel act "harder" while grinding. The degree to which wheel life will be improved also depends on the mesh size of the abrasive.

In general, high concentrations are recommended when coarse grits and/or small grinding contact areas are encountered. Low concentrations are recommended when large contact areas and fine grits are used.

Higher concentrations could be used when there are high requirements for profile and edge stability, when using a hard bond and coarse grit sizes, or for creep-feed grinding applications.

Medium concentration levels are recommended for straight wheels for surface and cylindrical grinding, cup wheels, soft bonds, and finer grits. Low concentration levels are recommended for applications that use extremely fine grit sizes or have very large contact areas.

	Concentration	
	Low	High
Wheel life	Shorter	Longer
Surface	Rougher	Finer
Cut rate	Higher	Lower
Grit	Smaller	Larger
Contact area	Larger	Smaller

## Bond Systems

Abrasive Technology offers a complete range of high performance bond systems specifically designed to fit a wide variety of applications.

Abrasive Technology Diamond & cBN Resin Bonded Applications							
	Conc.	Grit	Wheel Shape	Material	Wet/Dry	Operation	
<b>General HSS &amp; carbide/brazed/steel mix grinding</b>							
1	Ni coated cBN	75-100	80-200	1A1, A2	Hard steels	Wet	General HSS grinding
2	Ni semi-friable DIA	75	100-220	1A1, A2	Carbide/steel mix	Wet	Mixed metal component grinding
<b>General HSS grinding</b>							
3	Ni coated cBN	75-100	80-200	1A1, A2	Hard steels	Dry	General HSS grinding
<b>General carbide grinding</b>							
4	Ni friable DIA	50-75	100-400	All 1A1, 6A2	Carbide	Wet	General carbide grinding
<b>Blanchard &amp; double disc grinding</b>							
5	Ni friable DIA	50-75	120-220	2A2T	Carbide	Wet	Grinding flat carbide surfaces
6	Ni coated cBN	75-100	120-280	2A2T	Steel	Wet	Grinding flat steel surfaces
<b>Centerless grinding</b>							
7	Ni friable DIA	50-100	100-180	1A1	Carbide	Wet	Thrufeed grinding of carbide rods
8	Ni coated cBN	50-100	100-180	1A1	Steel	Wet	Thrufeed grinding of HSS rods
<b>Circuit board drill fluting</b>							
9	Uncoated or Cu friable DIA	100-125	400-1200	1A1, 1V1	Carbide	Wet	Fluting less than 1/8" (3mm) drills
<b>Fluting</b>							
10	Cu friable DIA	100-125	120-180	1A1, 1V1, 1FF1	Carbide	Wet	Water coolant
11	Ni friable DIA	100-125	120-180	1A1, 1V1, 1FF1	Carbide	Wet	Oil coolant
12	Ni coated cBN	100-125	120-180	1A1, 1V1, 1FF1	Steel	Wet	Oil coolant - grinding HSS
<b>Insert grinding</b>							
13	Ni friable DIA, Co friable DIA	75-125	180-320	2A2T, 6A2, 11A2	Carbide	Wet	Production carbide insert grinding
14	Ni friable DIA	75-125	180-320	2A2T, 6A2, 11A2	Ceramic	Wet	Production ceramic insert grinding
15	Ni friable DIA	75-125	180-320	2A2T, 6A2, 11A2	Cermet	Wet	Production cermet insert grinding

## Core Materials

Abrasive Technology offers a range of core materials to fit the requirements of a wide range of applications. The core material defines the rigidity, dimensional stability and dressability of the grinding wheel. Abrasive Technology offers the following core materials:

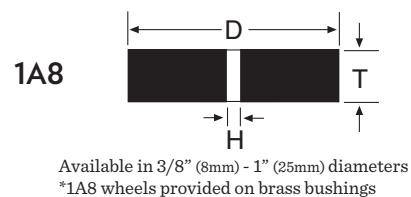
Type	Core Material	Application
A	Bar Stock Aluminum	Wet grinding periphery and form wheels up to 6" (150mm) diameter, and all face style wheels.
B	Aluminum-Resin Composite	Redressable wheels such as 11V9, 6A9, 12V9 cup style wheels. Also used for periphery and face wheels up to 12" (300mm) diameter.
C	Bakelite Resin	Wet grinding periphery wheels larger than 6" (150mm) diameter and for some redressable cup wheels.
D	Steel	Periphery and form wheels that require high degree of rigidity and dimensional stability.
E	Copper, Copper-Resin Composite	Dry grinding applications when a high degree of heat dissipation is required.
F	Abrasive-Resin Composite	Used only in dry grinding applications with 1A1, 3A1 and 14A1 style wheels.

Abrasive Technology Diamond & cBN Resin Bonded Applications - Continued							
	Conc.	Grit	Wheel Shape	Material	Wet/Dry	Operation	
<b>O.D. grinding</b>							
16	Ni friable DIA	75-100	120-180	1A1	Carbide	Wet	General carbide OD grinding
17	Ni friable cBN	75-100	120-280	1A1	Steel	Wet	General HSS OD grinding
<b>Surface &amp; face grinding</b>							
18	Ni friable DIA	75-100	120-320	1A1, 3A1, 6A2 14A1	Carbide	Wet or Dry	Size/flatness - carbide parts
19	Ni coated cBN	75	120-320	1A1, 3A1, 6A2, 14A1	Steel	Wet or Dry	Size/flatness - HSS parts
<b>Tool &amp; cutter grinding</b>							
20	Ni friable DIA	75-100	120-220	11A2, 11V9, 12A2, 12V9	Carbide	Wet or Dry	Sharpening carbide
21	Ni coated cBN	75	120-220	11A2, 11V9, 12A2, 12V9	Steel	Wet or Dry	Sharpening HSS
22	Ni semi-friable DIA	75	120-220	11A2, 11V9, 12A2, 12V9	Carbide/Steel	Wet or Dry	Sharp. carbide/steel combo tools
<b>Sprayed carbide coatings cylindrical grinding</b>							
23	Ni friable DIA	75	100-220	1A1	Sprayed carbide	Wet	Cylindrical grinding - sprayed carbide
<b>Slitting &amp; cut-off saws</b>							
24	Ni friable DIA	75-100	80-270	1A1R	Carbide	Wet	General carbide cutting
<b>Polishing &amp; surface preparation</b>							
25	Special wheels - uncoat. fria. DIA	25-50	Micron sizes	Any	Carbide	Wet or Dry	Fine polished finish
Abrasive Technology Diamond Metal Bonded Applications - WET USE ONLY!							
	Conc.	Grit	Wheel Shape	Operation			
<b>Pencil edging</b>							
1	Blocky diamond	25-75	80-250	1FF1V, 1FF6Y	Automotive, decorative and laminated glass		
<b>Arrissing</b>							
2	Blocky diamond	25-75	60-325	1EE1V	Standard 90° angle		
3	Blocky diamond	25-50	60-300	6A2*	Cupwheel arrissing		
<b>Flat grinding</b>							
4	Blocky diamond	25-75	60-325	1A1	Segmented or slotted for laminated glass		
5	Blocky diamond	25-75	60-325	1A1	Finger grips grinding		
6	Blocky diamond	25-50	60-300	6A2*	Cupwheel flat grinding		

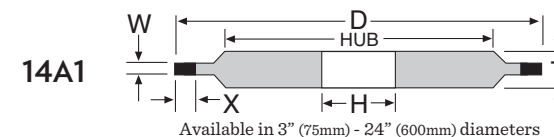
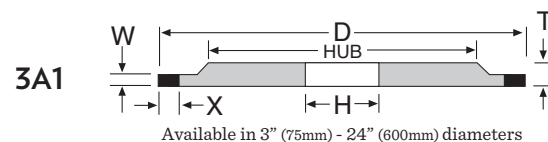
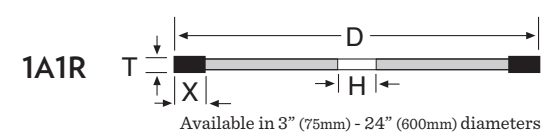
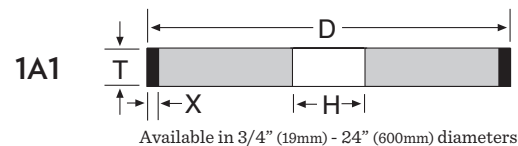
Abrasive Technology Diamond Metal Bonded Applications - WET USE ONLY! - Continued					
	Conc.	Grit	Wheel Shape	Operation	
<b>Beveling</b>					
7	Blocky diamond	25-50	60-300	6A2*	Grinding and polishing positions
<b>Radius and brilliant cuts</b>					
8	Blocky diamond	25-75	60-300	1E1	Manual or CNC decorative cutting
<b>Miter wheels</b>					
9	Blocky diamond	25-75	60-325	1E1, 1F1, 1V1	Standard 30°, 45°, 60°, 90-140° angles, slotted for laminated glass
<b>Form wheels</b>					
10	Blocky diamond	25-75	60-325	1AH1	OG and other forms
<b>Trapezoidal grind (flat &amp; arsis, flat &amp; chamfer)</b>					
11	Blocky diamond	25-50	100-270	1D6Y, 1DD6Y	2mm chamfers, 45° or 30° angles
<b>Drilling</b>					
12	Blocky diamond	25-75	100	6A8PW	6-150mm dia., thick/thin wall, 35mm drill length, matched set available
<b>Countersinks</b>					
13	Blocky diamond	25-75	100-270	1EAW	6-100mm dia., 90° angles, adjustable models
<b>Routers</b>					
14	Blocky diamond	50	100-200	1A2S	10-50mm diameter, straight or fluted segmented

\*INCLUDES 6V4, 6V5, 11A2 & 12A2

## Internal Wheels



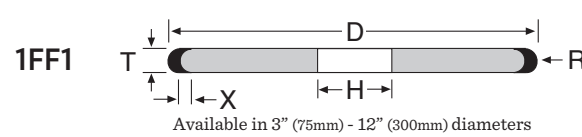
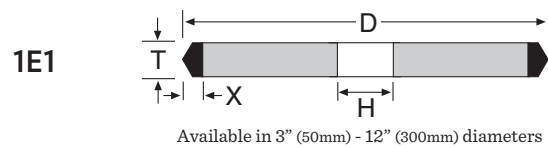
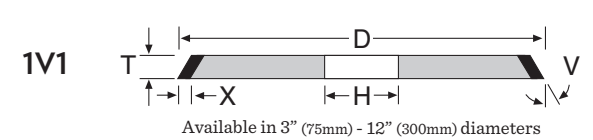
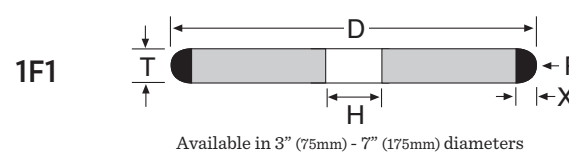
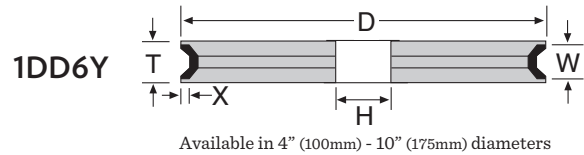
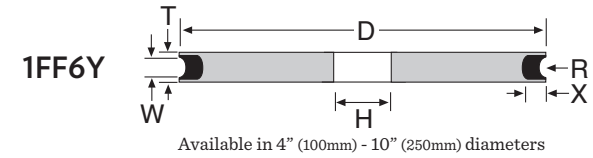
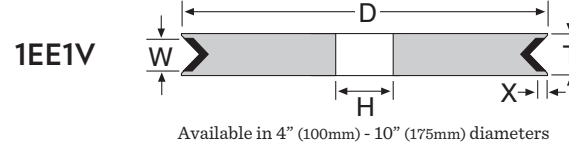
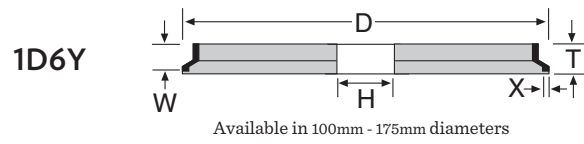
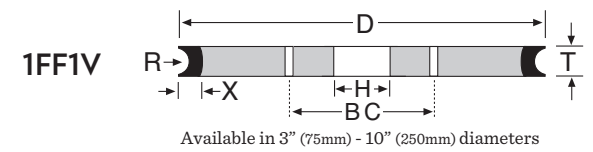
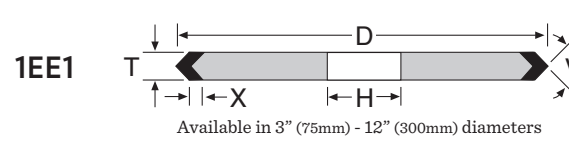
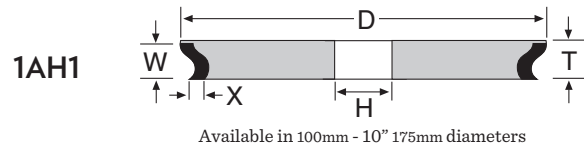
## Straight Wheels



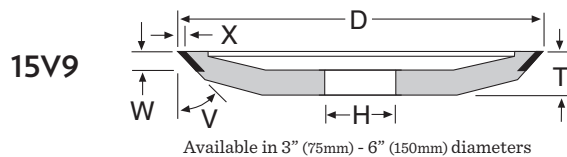
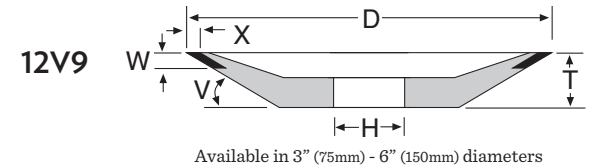
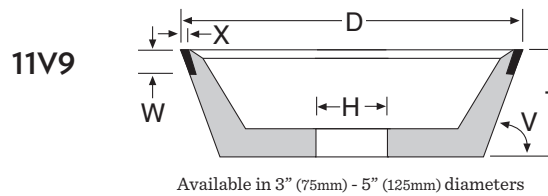
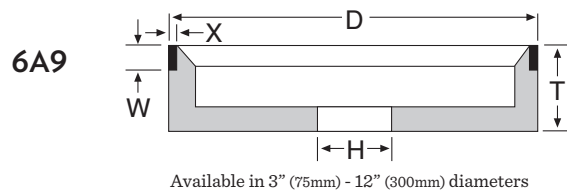
Note: Special sizes available upon request.

BC = bolt circle, D = diameter, H = hole size, R = radius, T = thickness, W = abrasive width, X = abrasive thickness

## Form Wheels



## Cup Wheels

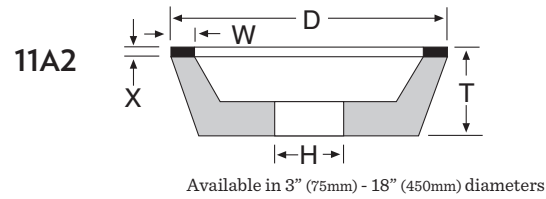
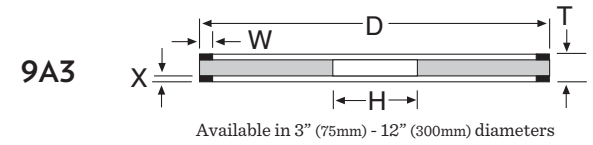
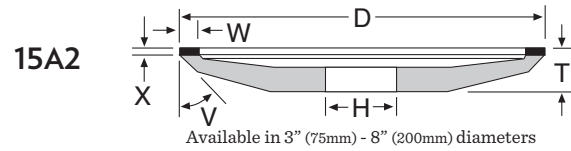
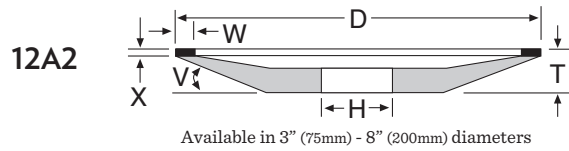
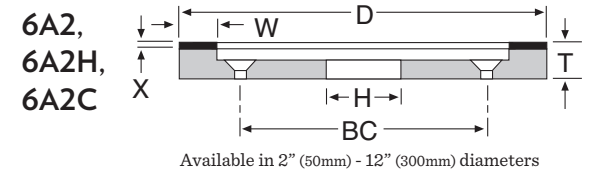
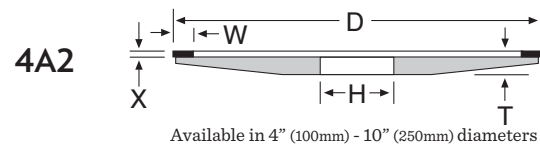
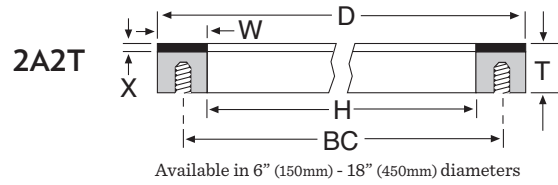


Note: Special sizes available upon request.

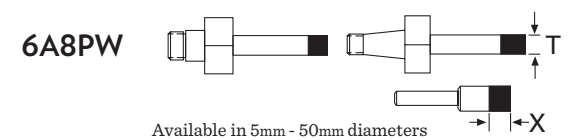
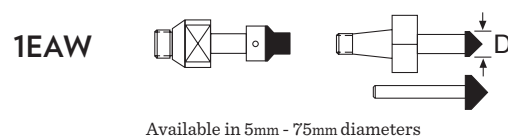
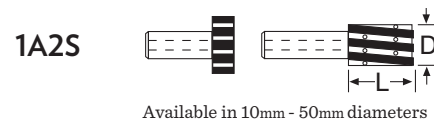
BC = bolt circle, D = diameter, H = hole size, R = radius, T = thickness, W = abrasive width, X = abrasive thickness

# WHEELS

## Face Wheels



## Specialty Tools



Note: Special sizes available upon request.

BC = bolt circle, D = diameter, H = hole size, R = radius, T = thickness, W = abrasive width, X = abrasive thickness



## Truing, Dressing and Mounting Procedures

Cost effective use of diamond and cBN wheels requires operators to check:

- 1. Machine Spindle.** Any end or side play in the spindle will considerably reduce the life of the wheel.
- 2. Mounting Flanges.** Back plates and spacers should be clean and free from nicks and burrs.

Truing and Dressing are two distinct and necessary functions.

- Truing restores the shape of the diamond or cBN wheel.
- Dressing prepares the wheel for aggressive action. This function is necessary after a wheel is trued.

**AT offers specialized metal bond redressing services.**

## Dressing

When a wheel is trued, the abrasive surface should be dressed to condition it for aggressive stock removal. The bond material should be eroded to expose the grit.

Dressing Sticks: Aluminum oxide dressing sticks are hand held on the surface of the grinding wheel until the wheel consumes the dressing stick rapidly. The wheel is now ready for aggressive stock removal.

## Truing periphery and Form wheels

True wheels to .001" (.025mm) T.I.R. maximum. Hold a colored pencil against the rotating wheel until the surface is totally covered. Then true the wheel. When the color is gone the wheel is trued. Use coolant if the wheel is used with coolant. True dry if you grind dry.

## Truing Straight Wheels

There are six methods to consider:

- 1. Truing Devices.** The truing wheel should be coarse grit in the J to M hardness range. Use a series of rapid passes at .002" (.05mm) infeed.
- 2. Diamond Truing Tool.** Mount the impregnated dresser and use as you would dress an abrasive wheel. In this instance only infeed .0005" (.012mm). Use rapid strokes leaving the wheel surface in both directions.
- 3. Molybdenum Rods 1/4" (6.35mm)- 3/8" (9.52mm).** Mount the rod in the dressing fixture normally used for the diamond dressing tool. Downfeed .004" (.1mm) on coarse wheels, .002" (.05mm) on fine wheels. Table speed should be moderate to fast.
- 4. Steel Block.** This method is recommended for large wheels. A soft steel block with a surface area of 10 in<sup>2</sup> (250mm<sup>2</sup>) is ground using flood coolant. Downfeed .001" (.025mm) to .002" (.051mm) per pass. Crossfeed at least 1/2 the width of the wheel.
- 5. Tool and Cutter Grinding.** Mount the aluminum oxide or silicon carbide wheel on the grinding spindle. The diamond wheel is mounted on the rotary head. Turn at 100 to 200 RPM. Infeed .001" (.025mm). Take quick passes, leaving the abrasive surface on both ends of the stroke.
- 6. Tool Post Grinder.** The wheel is mounted on an arbor in between centers on a lathe. Use a coarse mesh silicon carbide wheel. The diamond or cBN wheel should turn at 200 RPM rotating against the silicon carbide wheel running at normal grinding speed. Use .001" (.025mm) infeed and take rapid passes leaving the abrasive area in both directions.

# PSI CONVERSION CHART

PSI	BAR	PSI	BAR	PSI	BAR	PSI	BAR	PSI	BAR		
1	0.07	41	2.83	81	5.59	205	14.13	510	35.17	910	62.76
2	0.14	42	2.9	82	5.65	210	14.48	520	35.86	920	63.45
3	0.21	43	2.97	83	5.72	215	14.82	530	36.55	930	64.14
4	0.28	44	3.03	84	5.79	220	15.17	540	37.24	940	64.83
5	0.34	45	3.1	85	5.86	225	15.51	550	37.92	950	65.52
6	0.41	46	3.17	86	5.93	230	15.86	560	38.62	960	66.21
7	0.48	47	3.24	87	6	235	16.2	570	39.31	970	66.9
8	0.55	48	3.31	88	6.07	240	16.55	580	40	980	67.59
9	0.62	49	3.38	89	6.14	245	16.89	590	40.69	990	68.28
10	0.69	50	3.45	90	6.21	250	17.24	600	41.37	1000	68.95
11	0.76	51	3.52	91	6.27	255	17.58	610	42.07	1010	69.66
12	0.83	52	3.59	92	6.34	260	17.93	620	42.76	1020	70.34
13	0.9	53	3.65	93	6.41	265	18.27	630	43.45	1030	71.03
14	0.97	54	3.72	94	6.48	270	18.62	640	44.14	1040	71.72
15	1.03	55	3.79	95	6.55	275	18.96	650	44.82	1050	72.41
16	1.1	56	3.86	96	6.62	280	19.31	660	45.52	1060	73.1
17	1.17	57	3.93	97	6.69	285	19.65	670	46.21	1070	73.79
18	1.24	58	4	98	6.76	290	20.2	680	43.9	1080	74.48
19	1.31	59	4.07	99	6.83	295	20.34	690	47.59	1090	75.17
20	1.38	60	4.14	100	6.9	300	20.69	700	48.27	1100	75.86
21	1.45	61	4.21	105	7.24	310	21.37	710	48.97	1120	77.24
22	1.52	62	4.28	110	7.58	320	22.06	720	49.66	1140	78.62
23	1.59	63	4.34	115	7.93	330	22.75	730	50.34	1160	80

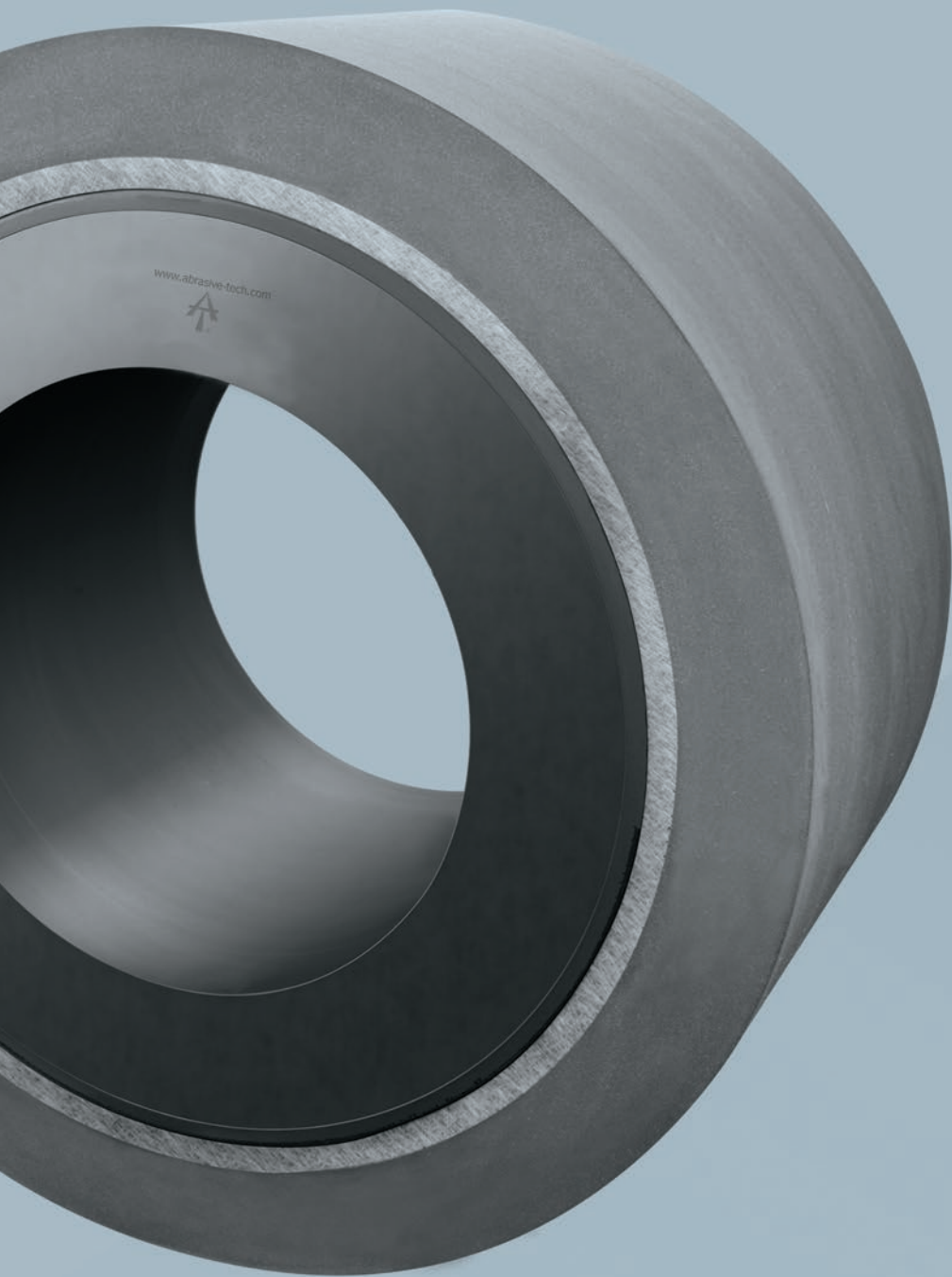
PSI	BAR	PSI	BAR	PSI	BAR	PSI	BAR	PSI	BAR		
24	1.65	64	4.41	120	8.27	340	23.44	740	51.03	1180	81.38
25	1.72	65	4.48	125	8.62	350	24.13	750	51.71	1200	82.76
26	1.79	66	4.55	130	8.89	360	24.82	760	52.41	1220	84.14
27	1.86	67	4.62	135	9.31	370	25.51	770	53.1	1240	85.52
28	1.93	68	4.69	140	9.65	380	26.21	780	53.79	1260	86.9
29	2	69	4.76	145	10.1	390	26.89	790	54.48	1280	88.28
30	2.07	70	4.83	150	10.34	400	27.85	800	55.16	1300	89.66
31	2.14	71	4.9	155	10.69	410	28.27	810	55.86	1320	91.03
32	2.21	72	4.97	160	11.03	420	28.96	820	56.55	1340	92.41
33	2.28	73	5.03	165	11.38	430	29.65	830	57.24	1360	93.79
34	2.34	74	5.1	170	11.72	440	30.34	840	57.93	1380	95.17
35	2.41	75	5.17	175	12.07	450	31.03	850	58.61	1400	96.55
36	2.48	76	5.24	180	12.41	460	31.72	860	59.31	1420	97.93
37	2.55	77	5.31	185	12.76	470	32.41	870	60	1440	99.31
38	2.62	78	5.38	190	13.1	480	33.1	880	60.69	1460	100.69
39	2.69	79	5.45	195	13.45	490	33.79	890	61.38	1480	102.07
40	2.76	80	5.52	200	13.79	500	34.48	900	62.06	1500	103.45

## Kilowatt to Horsepower Conversion

kW	hp
0.5	0.67
0.6	0.80
0.7	0.93
0.8	1.07
0.9	1.21
1.0	1.34
1.2	1.61
1.4	1.88
1.8	2.41
2.0	2.68
2.2	2.95
2.5	3.35
2.7	3.62
3.0	4.02
3.2	4.29
4.0	5.36
4.5	6.03
5.0	6.70
5.5	7.37
7.5	10.05
8.0	10.72

1 kW = 1.34 hp    1 hp = .75 kW

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