


## Comparative Marking Chart

Abrasives		SAINT-GOBAIN		TYROLIT	
		NORTON	CARBORUNDUM	CINCINNATI/ BAYSTATE	RADIAC
Regular Aluminum Oxide	<b>A</b>	<b>A, 57A</b>	<b>A</b>	<b>A</b>	<b>A</b>
Semi-Friable Aluminum Oxide	<b>94A</b>	<b>57A</b>	<b>GA</b>	<b>2A, 3A</b>	<b>JA</b>
Mixed Aluminum Oxide	<b>91A</b>	<b>19A, 23A, 53A</b>	<b>DA</b>	<b>97A, 2A</b>	<b>FA, NA</b>
Ceramic	<b>AS3</b>	<b>3SG, 5SG</b>	<b>3SG, 5SG</b>	<b>3BP, 5MSB, 3MSB, 3GA, 5GA</b>	<b>7BW, 8BW</b>
Mono-Crystalline Aluminum Oxide	<b>32A</b>	<b>32A</b>	<b>32AR</b>	<b>32A</b>	<b>32A</b>
Premium Blue Aluminum Oxide	<b>AZ</b>	<b>64A, 32A, 55A, 38A</b>	–	<b>9A, 48A, 12A, 17A, 32A</b>	<b>32A, SA WAA, WA</b>
Ruby Aluminum Oxide	<b>RA</b>	<b>48A</b>	–	–	<b>RA</b>
Pink Aluminum Oxide	<b>PA</b>	<b>55A, 32A, 25A, 64A</b>	<b>PA</b>	<b>87A, 12A, 17A</b>	<b>WAA, RAA, WRA</b>
Premium Pink Aluminum Oxide	<b>PASP</b>	<b>32A, 55A, 86A</b>	–	<b>87A, 32A, 8BP</b>	<b>RAA, WRA</b>
White Aluminum Oxide	<b>WA/83A</b>	<b>38A</b>	<b>AA</b>	<b>9A, 48A</b>	<b>SA, WA</b>
Mixed Aluminum Oxide/ Silicon Carbide	<b>CA</b>	<b>AC</b>	<b>CA</b>	<b>CA</b>	<b>CA</b>
Green Silicon Carbide	<b>GC</b>	<b>39C</b>	<b>GC</b>	<b>5C, 1C</b>	<b>GC</b>
Black Silicon Carbide	<b>C</b>	<b>37C</b>	<b>C</b>	<b>6C, C</b>	<b>C</b>

### Special engineered vitrified wheels

CGW provides wheels to industries that request “Special Engineered Vitrified Wheels”.

For example, the aerospace and gas turbine industries manufacture aircraft engine blades and vanes using CGW open structure wheels. These special engineered wheels are typically used during Creep Feed Surface Grinding applications.

Our R&D department is committed to finding solutions for the most difficult applications. Using the Technical Data Sheet provided on page 122 along with your request would ensure that CGW could provide the best choice wheel for your application.

Our success in these industries, as well as the gear and bearings industries, is attributed not only to the sophisticated wheels we are capable of manufacturing, but also to the technical and logistical support that compliments them.

## CGW Grain Types

- A – Dark Aluminum Oxide:** The most common of all grains. This grain is used for heavy-duty general purpose applications.
- 94A – Semi-Friable Aluminum Oxide:** Used mainly in cylindrical and centerless grinding wheels. This grain can be used to grind steels in either soft or hard state.
- AS3:** 20% Ceramic Aluminum Oxide, 30% Pink Grain, and 50% White Grain creates a wheel with maximum grinding performance and life. Excellent for form and corner holding and down feed of .0005-.002 per pass.
- 32A – Mono-Crystalline Aluminum Oxide:** Ideal for medium to heavy stock removal; outstanding form holding and free cutting grain. Provides maximum versatility.
- AZ – Blue Aluminum Oxide:** Excellent at grinding HSS over 55 RC. Grinds with an exceptionally cool, fast cutting action and requires minimum dressing.
- RA – Red Aluminum Oxide (Ruby):** This grain is harder and sharper than PA and AZ. Good for steels with a high level of chromium.
- PA – Pink Aluminum Oxide:** Good general purpose grain that is tough, but friable. Excellent for tool room sharpening applications.
- 83A, WA – White Aluminum Oxide:** Highly friable grain for fast, cool cutting. Good for light grinding of all kinds of steels, particularly on tool and die steels.
- 91A – White and Regular Aluminum Oxide:** Combination of 94A and WA for general purpose work and light stock removal.
- GC – Green Silicon Carbide:** More friable than C; for carbide grinding applications.
- 72C, C – Black Silicon Carbide:** Sharper than Aluminum Oxide and therefore more effective grinding low tensile materials and non-ferrous metals.
- New WAG:** Highly friable grain with special bond characteristics for fast, cool cutting action and extended life over traditional aluminum oxide wheels.
- New PASP:** Special pink formulation for precision grind applications. Tough, but very friable. Produced with new high performance VD ceramic bond for cooler cutting and longer life.

## Analysis of Typical Vitrified Wheel Specifications

### Grain Size

- Coarse: 8, 10, 12, 14, 18, 20, 24
- Med: 30, 36, 46, 54, 60
- Fine: 80, 100, 120, 150, 180
- Very-Fine: 220, 240, 280, 320, 400, 600

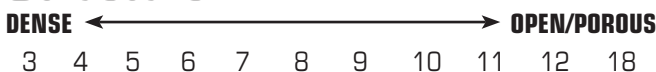
### Grade

- Soft: B, D, E, F, G, H
- Med: I, J, K, L, M, N
- Hard: O, P, Q, R, S, T

### Bond

- V, V18, V32A: Vitrified
- VP, V18P, VPB, VCERP: Vitrified Porous
- B: Resin
- B2: Resin Bonded
- BF: Reinforced Resin
- RX: Natural Rubber
- CDR: Calendered Rubber

### Structure



**MAXIMUM OPERATING SPEED**

**7 x 1/2 x 1 1/4 RA 46H 8V**

WHEEL SIZE

ABRASIVE

GRAIN SIZE

GRADE

STRUCTURE BOND

## Basic Characteristics of a CGW Wheel

The CGW grinding wheel consists of abrasive grains held together by a bond. By varying the properties of the abrasives, the type of bond and the structure of the wheel, it is possible to produce innumerable grinding characteristics.

**The Abrasive:** There are two main categories of grain:

**Aluminum Oxide** – For grinding high tensile steel (i.e. hardened or high speed steels)

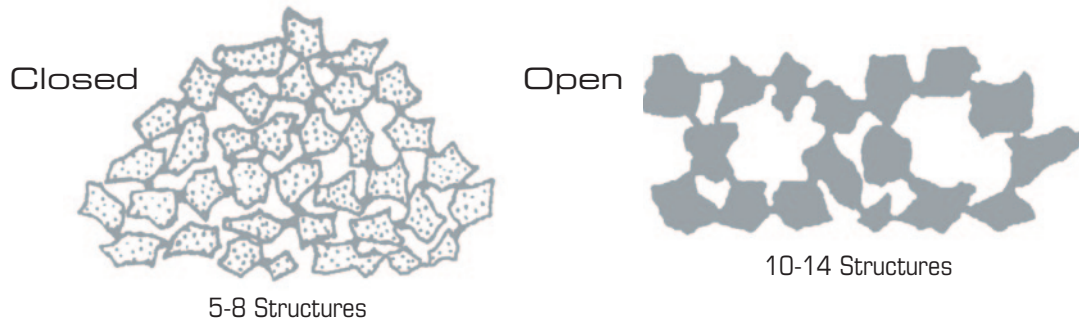
**Silicon Carbide** – Low tensile steels (i.e. cast iron and non-ferrous metals)

**Bond:** The function of the bond is to hold the abrasive grains in a definite spacing to form a product of defined size and shape. The most commonly used bonds are:

**Vitrified** – This bond gives rich stock removal and its rigidity is excellent for precision grinding.

**Resin** – An organic bond which makes the wheel tougher; suited for heavy-duty operations, high operating speeds, rough grinding and cut-off applications (i.e. 1-1/2 – 20" Cutoff Wheels, 3 – 9" Depressed Center Wheels).

**Structure:** Wheel structure is the spacing of the grain in the wheel. The grain is held in position by the bond, the closer the grains (the smaller the pores), the lower the structure. The further apart the grains (the larger the pores), the higher the structure.



## Standard Wheel Shapes

### Type 1

Straight



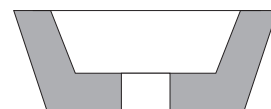
### Type 6

Straight Cup



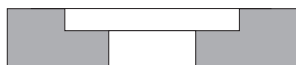
### Type 11

Flaring Cup



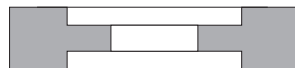
### Type 5

Recessed 1 Side



### Type 7

Recessed 2 Sides



### Type 12

Dish



### Type 50

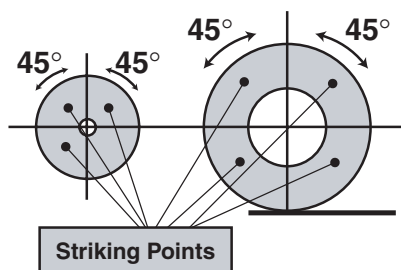
Plate Wheels



## Surface Grinding Wheel Safety

### Ring Test

- Always perform a ring test on a grinding wheel before mounting it. The ring test will locate an invisible crack.
- If a sharp distinct ring is heard the wheel is safe.
- If the wheel is cracked the ring will be dull. DO NOT USE DAMAGED WHEELS.



## Warning! Grinding Wheels Improperly Used Are Dangerous

Grinding is a safe operation if the few basic rules listed below are followed. These rules are based on material contained in the ANSI B7.1 Safety Requirements for "Use, Care and Protection of Abrasive Wheels." For your safety, we suggest you benefit from the experience of others and carefully follow these rules.

## Safe Operating Instructions

### ALWAYS USE A GUARD

### WEAR EYE PROTECTION

### COMPLY WITH ANSI CODE B7.1 AND OSHA REGULATIONS

### DO NOT EXCEED MAXIMUM SAFE SPEED MARKED ON WHEEL

1. DO always HANDLE AND STORE wheels in a CAREFUL manner.
2. DO VISUALLY INSPECT and ring test all wheels before mounting for possible damage.
3. DO CHECK MACHINE SPEED against the established maximum safe operating speed marked on the wheel.
4. DO CHECK MOUNTING FLANGES for equal and correct diameter.
5. DO USE MOUNTING BLOTTERS when supplied with wheels.
6. DO be sure WORK REST is properly adjusted. (Center of wheel or above; no more than 1/8" away from wheel.)
7. DO always USE A SAFETY GUARD covering at least one-half of the grinding wheel.
8. DO allow NEWLY MOUNTED WHEELS to run at operating speed, with a guard in place, for at least one minute before grinding.
9. DO always WEAR SAFETY GLASSES or some type of eye protection when grinding.
10. DO TURN OFF COOLANT before stopping wheel to avoid creating an out-of-balance condition.
1. DON'T use a cracked wheel or one that HAS BEEN DROPPED or has become damaged.
2. DON'T FORCE a wheel onto the machine OR ALTER the size of the mounting hole—if wheel won't fit the machine, get one that will.
3. DON'T ever EXCEED MAXIMUM OPERATING SPEED established for the wheel.
4. DON'T use mounting flanges on which the bearing surfaces ARE NOT CLEAN, FLAT AND FREE OF BURRS.
5. DON'T OVERTIGHTEN the mounting nut EXCESSIVELY.
6. DON'T grind the SIDE OF THE WHEEL (see Safety Code for B7.1 for exception).
7. DON'T start the machine until the WHEEL GUARD IS IN PLACE.
8. DON'T JAM work into the wheel.
9. DON'T STAND DIRECTLY IN FRONT of a grinding wheel whenever a grinder is started.
10. DON'T FORCE GRINDING so that motor slows noticeably or work gets hot.

# SURFACE GRINDING WHEELS



## AS3 - Ceramic Aluminum Oxide

- Engineered for fast metal removal with reduced dressing frequency.
- Excels at grinding 50 Rockwell C and harder.
- Submicron crystal structure continually fractures to produce sharp new grinding points.
- Designed for heavier downfeeds and faster traverse rates with excellent form holding capabilities.

## 32A

- Mono-crystalline aluminum oxide grain offers excellent versatility and performance on a wide range of applications and materials.
- Outstanding form holding wheels with free cutting grain.
- Ideal for medium to heavy stock removal.

## AZ - Premium Blue Aluminum Oxide

- Sharp aluminum oxide grain with premium CGW bond offers excellent versatility and performance.
- Exceptionally fast and cool cutting characteristics suitable for grinding heat sensitive, alloy steels and mold steels (high speed steels over 55RC).
- Free cutting design pulls the heat away from the part.
- Friable grain for cooler grinding. Requires minimal dressing and holds its form well.

## RA - Ruby Aluminum Oxide

- Ideal for rough grinding of all tool steels including steel with high levels of chromium.
- A tough, sharp, yet friable abrasive with high material removal rate and strong form holding capabilities.
- Grain is tougher than White, AZ or Pink grain wheels.

## PA/PASP - Pink Aluminum Oxide/Premium Pink Aluminum Oxide

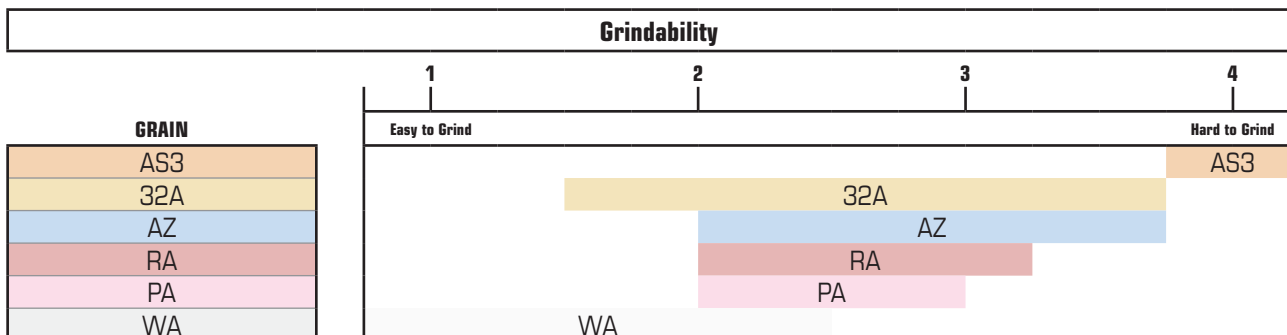
- Engineered for grinding high speed steels over 55C and general purpose tool steels.
- Best choice for fast & cool cutting of heat sensitive & hard alloys. 55RC and general purpose tool steels.
- Excellent tool sharpening wheel.
- Best value for performance & tooling costs.

## WA - White Aluminum Oxide

- Used when easy cutting action is needed on all surfaces.
- Ideal for grinding heat-sensitive steels, as well as easy and medium to grind high speed steels.
- The most friable grain choice.

## Surface Grinding Wheels

### Tool Steel Classifications



Steel Type	Classification of Grindability	Steel Type	Classification of Grindability	Steel Type	Classification of Grindability	Steel Type	Classification of Grindability	Steel Type	Classification of Grindability	Steel Type	Classification of Grindability
<b>Air-Hardening Medium Alloy Cold Work Tool Steels</b>		<b>Carbon-Tungsten Tool Steels</b>		<b>Molybdenum Hot Work Tool Steels</b>		<b>Molybdenum High-Speed Tool Steels (cont.)</b>		<b>Oil-Hardened Cold Work Tool Steels</b>		<b>Tungsten High-Speed Tool Steels</b>	
A2	1	F1	2	H41	2	M6	3	O1	1	T1	2
A3	1	F2	2	H42	2	M7	3	O2	1	T2	2
A4	1	F3	2	H43	2	M8	2	O6	1	T3	3
A5	1	<b>Chromium Hot Work Tool Steels</b>		<b>Low-Alloy Special Purpose Tool Steels</b>		M10	2	O7	1	T4	2
A6	1					M15	4			T5	3
A7	1	H10	1	L1	1	M20	2	<b>Mold Steels</b>		T6	3
A8	1	H11	1	L2	1	M25	2	P1	1	T7	2
A9	1	H12	1	L3	1	M30	2	P2	1	T8	2
A10	1	H13	1	L4	1	M33	3	P3	1	T9	4
		H14	1	L5	1	M34	3	P4	1	T15	4
<b>Air-Hardening Medium Alloy Cold Work Tool Steels</b>		H16	1	L6	1	M35	3	P5	1	T20	4
D1	2	H17	1	L7	1	M40	3	P6	1		
D2	3	<b>Tungsten Hot Work Tool Steels</b>		<b>Molybdenum High-Speed Tool Steels</b>		M41	3	P20	1	<b>Water-Hardening Tool Steels</b>	
D3	2			M1	2	M42	3	P21	1	W1	1
D4	2	H20	1	M2	2	M43	3			W2	1
D5	2	H21	1	M3	3	M44	3	<b>Shock-Resisting Tool Steels</b>		W3	1
D6	2	H22	1	M4	4	M45	3	S1	1	W4	1
D7	4	H23	1			M50	3	S2	1	W5	1
		H24	1			M52	3	S3	1	W7	1
		H25	1					S4	1		
		H26	1					S5	1		
								S6	1		
								S7	1		

### Surface Grinding Tips

There are many applications in surface grinding, from heavy stock removal to a very precise finish and size requirements. Matching the right wheel with the application is very important to achieve the needs of the grinder. There are many ways to meet these needs. If a fine finish is required a finer wheel may be used. Many times an operator may use one wheel to do the job of many changing the speed and feed of the wheel.

### Grit Size / Grain Size Combinations

**Grit Size:** All abrasives are sized to a national standard and are assigned a numerical designation. The higher the number, the finer the grit size. When selecting grit size, the following should be considered:

- Use Coarse Grit:**
- For rapid stock removal
  - For large areas of contact
  - When finish is not important
  - For softer materials

- Use Fine Grit:**
- For form holding
  - For small areas of contact
  - For fine finishes
  - For hard, brittle materials

#### General Grain Size Selections

Grain	Finish (Rms)	Grain	Finish (Rms)	Grain	Finish (Rms)
46	Over 32	80	12 - 18	120	8 - 12
54	20 - 32	100	10 - 15	150	6 - 10
60	15 - 20				