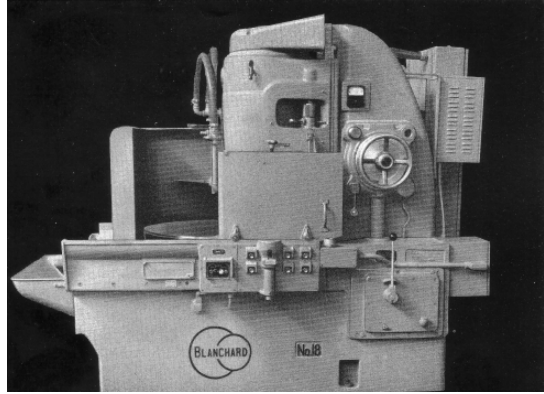


I. Overview

Blanchard grinding is the term often used to describe surface grinding using a vertical spindle, rotary table machine. The most common of such machines were made by Blanchard, though very similar machines are also available from other manufacturers.



These versatile surface grinders come in a variety sizes and capable of achieving very accurate flatness and fine finishes. Through various fixturing techniques, they are capable of grinding a wide range of shapes, sizes and materials.

This booklet is meant to provide some basic operating guidelines and tips in abrasive selection and job set-up.

II. General Considerations

A. Load Areas and Configurations

Table loads of 35% to 50% have been found to be most practical for solid parts. Load areas greater than that amount tend to make the wheel cut 'hard' or sluggish, while smaller loads tend to make the wheel cut 'soft'.

The parts are best aligned on the table in a circular band or in concentric squares or polygons near the outer 6" to 9" of the table equal in width to 1/5th the table diameter. The parts should be aligned on the table so that they pass through the center of the grinding wheel.

The following table illustrates the optimal table load for various sized machines:

Table Size	Total Table Area	Optimal Load Area	Grinding Band Width
30 in.	706 sq. in.	236-353 sq. in.	6 in.
36 in.	1018 sq. in.	339-509 sq. in.	7.25 in.
42 in.	1386 sq. in.	462-693 sq. in.	8.5 in.
48 in.	1809 sq. in.	603-905 sq. in.	9.5 in.
60 in.	2827 sq. in.	942-1414 sq. in.	12 in.
80 in.	5027 sq. in.	1676-2513 sq. in.	16 in.
100 in.	7854 sq. in.	2618-3927 sq. in.	20 in.
120 in.	11309 sq. in.	3765-5658 sq. in.	24 in.

B. Feeds & Speeds

The correct balance between table speed and downfeed rate is most important. A few general rules relative to this are:

- The fastest downfeed rate and table speed which give optimum ratios or rates of removal should be used.
- As areas become broader than 50% of the table area, feed rates generally decrease.
- As heat or burn becomes a factor, table speeds are changed.
- As areas become more 'broken' and less than 35% of the table area, feed rates should drop accordingly.

Area and configuration have a large bearing on the efficiency of a wheel and this, in turn, affects the feeds and speeds.

C. Motor Loads

These machines are normally equipped with ammeters that measure the motor load on the grinder. This measurement is a good means to monitor the work being done by the grinder. The meters normally indicate either the percentage of load or some measure the actual amperage on the motor. The meters that read the percentage of load are more common and have scales that are color coded and have a maximum reading of 150%.

Percent motor loads on Blanchard grinders can be run at 120% to 135% motor loads while Mattison grinders can be operated at 85% to 105% motor load.

The nature of the part, contact area, feeds and speeds all have a bearing on the motor load. Under normal circumstances, attempts should be made to run the grinder at the highest practical motor load.

D. Performance Ratios

The following are definitions of commonly used performance measurements:

1. **Linear Ratio** – This is the ratio of the linear abrasive wear to the linear stock removal. It is commonly used as a guide for the operator to set the amount of total downfeed required to remove a stated amount of stock. This ratio gives information that is applicable only to very similar jobs, as it does not take into consideration the total care of the parts being ground.
2. **'G' Ratio** – This is a comparison of the total volume of stock removed to the total volume of abrasive used. The higher the 'G' ratio, the more efficient the operation. However, the 'G' ratio is not the ultimate measurement of grinding efficiency as very high ratios can be obtained through the use of overly hard abrasive grades with low downfeed rates and increased grinding time.

3. **Rate of Removal** – This is a measure of the grinding time versus the volume of material ground.

Thus, 'G' Ratio can be used to measure amount of abrasive used, and the Rate of Removal can be used to measure the machine time required. Both have real costs associated with them and neither alone represents the cost of the operation. However, when combined, they give an excellent means to monitor the total cost of the grinding operation.

III. Abrasive Selection



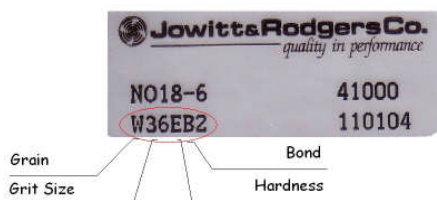
Efficient grinding requires that the proper abrasive is used that best matches the job. Abrasive wheels for these types of grinders can either be solid wheels or segmented wheels.



Abrasives are made of abrasive grain, which are the materials that do the actual cutting, and bonding materials that hold the wheel together. The abrasive materials are usually forms of either Aluminum Oxide or Silicon Carbide and the bonding materials are usually either vitrified or resin.

The choice abrasive grain is normally determined by the material being ground. The grains, through their chemistry, have varying properties of hardness, friability and sharpness. These are matched to the physical properties of the material being ground to give the most appropriate cutting action. The grain is also available in a wide range of particle sizes, referred to as grit size. This is matched as well to both the part material and tolerance of the operation to provide the optimum results, where coarser grits are used for soft materials and high stock removal.

The bond is the glue that holds the abrasive grain in the wheel. 'Harder' grades hold the grain more firmly than 'softer' grades. Vitrified bonds are glass like bonds fired at very high temperatures. Resin bonds are usually phenol/formaldehyde resins that are baked at relatively low temperatures. At Jowitt & Rodgers Co. we make only resin bonded products.



Shown here is a typical product label with our grade marking circled. Our markings are always in the format of Grain, Grit Size, Hardness, Bond. Grain types are identified in the chart below. Grit size is the size of the abrasive grain; smaller numbers for larger grain and larger numbers for smaller grain. Our bonds all start with 'B', signifying resin bonds.

Jowitt & Rodgers Co. Abrasive Grain Guide:

Type	Code	Description
Aluminum Oxides	G	This is a form of brown aluminum oxide that is blocky and not exceptionally friable. Due to its shape and lack of friability, it is a hard acting grain, good for general purpose grinding of soft steels. It also is often used in combination with more friable grains to add additional life to the wheel. It is a relatively inexpensive grain.
	A	This is a more friable version of G grain. It is still an inexpensive brown aluminum oxide, but is a little sharper and more friable. It is used on slightly harder materials than G and in combination with other grains on hard steels.
	W	A white aluminum oxide, this is a very aggressive grain. It is sharper, harder and more brittle than the brown grains. This is an expensive grain that works well on hard steels such as tool steels and stainless steel. It often is used in combination with either G or A to offset the cost.
	F	An even more friable form of white aluminum oxide. It is the sharpest, most aggressive of the aluminum oxides that we have available. F is used where W is not aggressive enough, and is often used in combination with other grains to offset the cost.
Silicon Carbide	X	This is our standard silicon carbide grain. Silicon carbide is a hard, brittle grain, more so than aluminum oxide. It is most commonly used on non-steel materials, such as cast iron and aluminum. It does not work well on steel because it is chemically reactive with the carbon in steel.
	C	A more pure form of silicon carbide, it is slightly more friable than X. This grain is not used a great deal. It is some times referred to as green silicon carbide.
Ceramic grains	R	A ceramic coated brown aluminum oxide, this grain forms stronger bonds with our resin. It is used to make very hard wheels.
	Q, L, U	These grains are polycrystalline ceramic aluminum oxides that are extremely hard and sharp, and very friable. They are either sintered grains or sol-gel grains. They retain their sharpness for an extensive period, giving good wheel life and improved grinding speed. Very aggressive grains, they are used for hard steels in combination with conventional aluminum oxide grain.

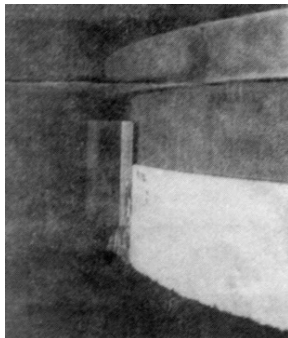
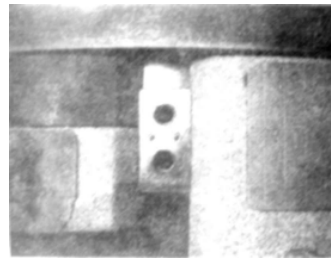
This chart gives some guidelines for which type of grain to use for various materials. These are general suggestions only. Ceramic grains may also be used as well for most of these materials, depending upon the actual requirements of the job.

<u>Material</u>	<u>Grain Selection</u>
Cast iron	X
Carbon/low alloy steel	G, A
Stainless Steel	W, GW
Tool Steel	W, GW, AW
Super alloys	W, F, AF
Aluminum	X

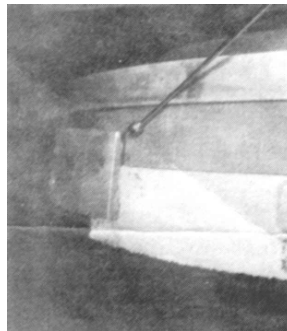
IV. Abrasive Mounting Instructions

A. Cortland Shaped Segments:

1. Position the segments between the locator guide bars of the segment holder and against the underside of the segment holder clamp. (See the photo opposite with clamp removed.)
2. Securely tighten the two socket head cap screws at each clamp with a hexagon key or a ratchet wrench having an 8" arm (for 2 1/4" wide segments) or a 10" arm (for 3" wide segments). Do not use auxiliary means of gaining leverage, or broken segments may result.
3. When segments are worn to approximately 1/4" distance from the segment clamp, make a segment drop using appropriate riser blocks. Align both the segment and riser block between the locator guide bars and against the underside of the segment holder flange. (See photo above.) When using the riser blocks, tighten only the bottom screw securely and snug the upper screw lightly. Do not clamp against the riser block. At this point the clamp should be parallel to the face of the segment and not tilted inward or outward.



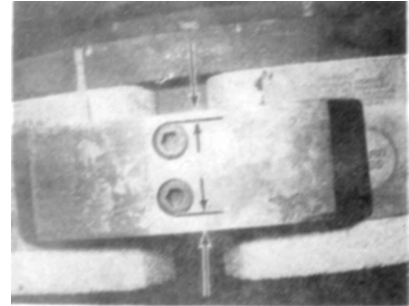
Correct



Incorrect

4. Note: If segments tend to flare outward or loosen during the grinding operation, tighten the bottom socket screw more securely when making the segment drops.

5. For 2 ¼" wide segments, it is recommended that two segment drops be utilized with the appropriate size riser blocks and that the final thickness of a worn segment should not be less than 1" thick. For 3" wide segments, it is recommended that only one segment drop be utilized and that the final thickness of a worn segment should not be less than 1 ¼".
6. Note: The wall thickness between the two bolt holes and the top and bottom side of a segment clamp may vary. The side with the greater wall thickness should be in the bottom position to assure maximum clamping. (See photo.)



B. Cylinder Wheels:

1. Adjust or remove wheel guard as necessary to clear clamp screws.
2. With the table moved under the head, place the mounting board on the table under the wheel and lower the head until the wheel is about ⅛" above the board.
3. Loosen the clamp set screws, fully retracting the clamps. The wheel will drop to the board.
4. Raise the head until the wheel is free of the holder and remove the wheel.
5. Run hand around the inside of the holder and make certain that no clamp projects beyond its slot and check any sludge accumulation which should be removed.
6. Place the new wheel on the board and slide it under the holder, raising the head as necessary.
7. Lower the head, moving the wheel, as necessary, to guide it into the holder. Continue lowering until the wheel is against the face of the holder and the board has been slightly depressed so that holder, wheel and board turn together.
8. Tighten the set screws turning them equally and hand tight. It is easy to tell when the center of the clamp comes against the wheel by the sharp increase in force required to turn the screws. The set screws should be turned only slightly beyond this point.
9. Raise the head and remove the board.
10. Adjust the wheel guard.

Maintenance: As is the case with every piece of machinery, the holder should be cleaned and lubricated occasionally, frequency depending on use. If difficulty is experienced retracting clamps, it is an indication that the holder needs cleaning. The clamps should be removed from the holder and cleaned. The slots and holder face should also be cleaned. Put a small amount of Lubriplate 130A lubricant on the set screws and the sliding faces of the clamps.

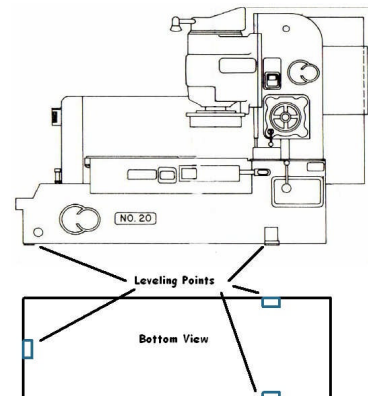
Precautions:

1. Use care in handling and sorting wheels as they are brittle.
2. Use only the recommended standard short arm hexagon key wrench with a 3 1/4" arm.
3. Use care in getting the wheel started into the holder.
4. Always run hand around inside of the holder to make sure that the clamps are fully retracted into slots, and check for sludge accumulation.
5. Clean and lubricate holder as required.

V. Trouble Shooting Guide

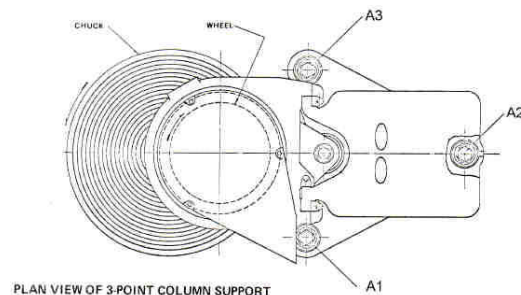
1. Vibration Problem: Check Base Rigidity at the Floor Level

Most standard Blanchards in the field were made with three point leveling of the base. Cast Iron base grinders are strengthened by ribs at these points. Steel base grinders made about 1960 are leveled at three pads. However, additional supports are necessary with wedges to eliminate vibration. Blanchard grinder bases do not have to be bolted down but grouting is recommended for the larger machines (60" table and over) after they are run for a few weeks.



2. Work Not Parallel: Check Column and Head Adjustments:

The 3 point column adjustment is used to grind the magnetic chuck flat and work parallel. To grind magnetic chuck flat, use a soft wheel or segment



PLAN VIEW OF 3-POINT COLUMN SUPPORT

Place piece of soft steel on magnetic chuck towards outside diameter. Lower head and touch lightly, watch for spark. If one side only grinds, turn side adjustment washer (A1) until both sides spark lightly and evenly. Look for cross grind. This means wheel is level side to side.

Next, remove the block, mark up magnetic chuck with copper sulphate, dyecom, or Marcal paint stick. Lower head until see very light spark. See if this point is high by using good straight edge

across center of magnetic chuck. If it is – continue grinding while dressing frequently with very little motor load. If magnetic chuck is concave or convex, re-adjust rear adjusting bushing (A2). Move bushing counterclockwise if magnetic chuck is concave and clockwise if it is convex.

When the magnetic chucks surface is flat to .001” feeler gage then use 6 to 8 one inch strips of good magazine paper with hard surface to it. This paper should be torn from one sheet with the grain so edge will feather out.

When these 6 to 8 papers are tight under straight edge (which should be tested with these strips on good surface plate first), the magnetic chuck will be flat to a few tenths of a thousand of an inch. Do not use indicator to check chuck!! It is important to finish the last grind with very little power work from sliding as magnet only holds work down but does not prevent pieces from sliding except by the friction between the pieces and magnetic chuck surface. If work is ground and finished this way, very close tolerances can be had.

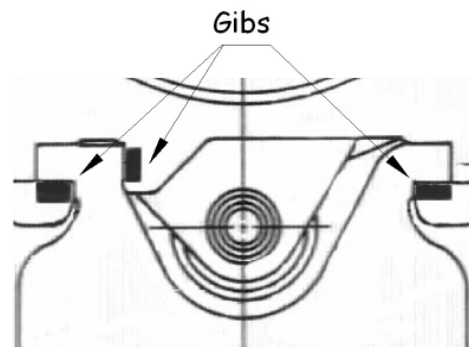
3. Work Not Parallel: Consider Temperature Change:

To grind to light wave bands for flatness in the grinding of optical flats, gage blocks, surface plates and tool makers flats the rear locking bolt (A2) of the adjustment bushing is used by slightly loosening or tightening with a long wrench that can be used as a vernier. As temperature of the day increases or temperature rises from grinding heat, this lock down bolt is tightened a little at a time until at the end of the day it is up tight. The next morning this excessive pressure is released and adjusted to secure the flatness wanted to start the day. Direct sunlight on column will cause deflection.

4. Size Hard to Hold: Check For Head Hang-up:

Spindle head motor should always be free traveling up and down on column. To check this, hand feed upper gear box down until feed dial is at zero and back off to see how much backlash is present. If only ¾ to 1½ thousandth backlash is had, this is normal and is only in the gearing. If more than this is had, the head is hanging up. Also, if hand wheel spins down freely, the head is hanging up on gibs and may be due to the following:

- a. Gibs adjusted too tight
- b. Dirt worked way in due to lack of proper lubrication
- c. Grease dried out and cake up
- d. Painted Ways often found to be cause of hang-up
- e. Worn and glazed gibs due to lack of lubrication



The full weight of the head should always be down on the feed screw. If head hangs, it will not feed down, but will drop. After backlash is overcome, head will be pulled down to feed screw and spark-out can be indefinite and size hard to hold.

Corrective action: Remove one gib at a time, clean gib, ways and way cover using flat rod with swab soaked in a chemical cleaner. Reflake or frost gibs to produce lubrication pockets. Replace in same position. Check for .002”-.003” clearance using feeler gage between gibs and ways. It is better to have these slightly loose than a little too tight. On older grinders it may be hard to use feelers. Recommend that three gibs be tightened down solidly and then back off five turns of nut on stud that holds these gibs in place. This will give ample clearance from the tightest spot on worn ways. If excessive backlash is still had after doing above, loosen one gib at a time until minimum backlash is secured. Keep well lubricated to keep dirt out of ways and wipe off surplus grease.

5. Bouncing Wheel and Blotchy Finish: Check “Preload” of Spindle:
Blanchards up to 1935 had spring pre-loaded at top of spindle. A large nut held down eight springs. This nut was adjusted by using a spanner wrench. Springs were collapsed solid and then nut backed off one full turn. To check preload, place a bar between face plate and the head. Movement should be had when prying down and then spindle should snap up solidly.

The next 10,000 standard grinders have fixed spring preloads built into lower end of spindle and are not adjustable. When face plate is uptight, check with bar between face plate and head. Pull down with bar and when released, spindle will snap back solid. On these models, twenty springs were used and preload is approximately 1200 lbs.

The latest standard grinders (about Serial#10,000 and up) have a Timken Bearing at lower end and an adjustable spring preload at top. The ten springs each have adjustable screws. To set preload, take up on each one until they are all solid. Back off one-half to one turn each and 1200 – 1400 lbs. preload will be had. Make test as above with bar.

6. No Accuracy at Different Head Heights From Table:
To check column and head ways, use indicator clamped to segment or wheel chuck. Swing this through center of magnetic chuck and record reading at center, left and right sides of magnetic chuck with head as low as possible. Repeat this at different heights of head. Instead of lowering this indicator use a block left, center and right. Repeat using blocks of different heights. Correct by rescraping ways to remove concave or convex ways.
7. Parts Not Parallel: Check Base and Table Ways:
After magnetic chuck is ground flat at full “in” position, put two pieces on magnetic chuck, one on outside and the other about 6 inches from the center. Clean grind these pieces with table all the way in. Check both pieces for height. They should be the same. Replace in same position as before. Mark up both pieces and run table all the way in and then back out again about 5 inches. Grind blocks to clean and check for height. If different, the base and table ways are worn concave or convex. To overcome error – rescrrape ways. If you do not want to rescrape ways, then I recommend that only roughing be done with table out – so wheel can be dressed while grinding. Finish grind with table all the way in

since this is position where table was ground. (If larger diameter wheel or segment chuck can be used, this will overhang magnetic chuck and table will be ground flat. Dressing can then be done at all times while grinding and accuracy maintained.)

8. Wheel Too Hard For Large Work Areas:

- a. Tilt head so wheel will cut on back side away from operator. This reduces area of wheel in contact and puts double pressure on one side of wheel.
- b. Step grind large pieces. Bring table in approximately one-third of the way to grind about 50% of the area. Recommended over tilting head. Our rule of thumb for best efficiency when grinding: load area should not exceed 100 square inch per 10 horsepower of motor. When it does – step grind.
- c. Positioning of table affects power even when medium areas are ground. Move table out as far as possible while still covering the work. Amps can drop as much as 10%.

9. Feeds, Speeds and General Information Affecting Wheel Performance:

- a. Increase downfeed to force wheel to break down.
- b. Adjust table speed when roughing. Average table speed should be 100 ft./minute. This depends on area and where parts are placed on table. Near the edge of 36” diameter table – run at 9 or 12 rpms. Nearer center, increase table speed.
- c. Dress slowly when finishing to “clean” all grains. Dressing quickly roughs part of wheel face but causes blotchy finish.
- d. Mounting Cortland type segments always tighten bottom screw first – especially when using lowering blocks. Recommend loosen all top screws first before lowering. Then loosen bottom screws on 2 clamps and remove and replace one segment at a time, snugging up bottom screw. Avoid cracking segment by strong clamp pressure.
- e. Vary magnetic power of table through DC power source. Machines are set for full holding power. Lower holding power is used when grinding bow out of pieces. Use just enough power to keep parts from moving.
- f. Problem of squealing wheels – May times squealing is caused by overtightening clamps in wheel holds. Use normal hand pressure with standard 5 inch Allen wrench. This will generally stop the squeal and improve performance.