The Grinding Doc's

Interrogation Sheet

by Dr. Jeffrey A. Badger

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page 2: Instructions

For the evaluation to be successful, I need to have as much information as possible about your processes. Please go through the following sheets and fill in the relevant details. Since each grinding process is unique, please sketch out what is happening in the process, the form on the wheel, the motions of the wheel and workpiece, etc. A picture is worth a thousand words (and far better than a part schematic). Please include photos.

Please fill out ALL the details of the process. Remember, too much information is better than too little. Good communication is vital. Please do not assume. Remember, you may have been working with this process for ten years, but it is new to me. I need good, clear, concise communication.

Once finished, email it to me at JB@TheGrindingDoc.com.

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The Grinding Doc

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page 3: Photos

Please take photos of:

1) **The part, from different angles;**
2) **The grinding machine;**
3) **The wheel contacting the part as its fixtured in the machine;**
4) **The coolant nozzles;**
5) **Anything else you feel is important;**

Email them or text them to Dr. Badger at jb@TheGrindingDoc.com / +1 512-934-1857.

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page 4: Off-site burn evaluation

If an off-site evaluation of the grinding process is being performed, it is paramount that communication is thorough and effective. This includes photos of the part, with illustrations of how the part is ground, the direction of travel, which sides are ground in which order, etc. Part schematics are not sufficient. It also includes video, uploaded to YouTube, of the grinding operation and of a person holding a non-mounted wheel next to the part and describing how the part contacts the wheel.

	Yes	No
Photo of part	☐	☐
Illustrations on photo showing grinding action	☐	☐
Video uploaded to YouTube	☐	☐

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page 5: Checklist

		Relevant	Not relevant	Completed	Not completed
Page 2:	**Wheel details**	☒	☐	☐	☐
Page 5, 6:	**Part geometry**	☒	☐	☐	☐
Page 7:	**Issues, goals**	☒	☐	☐	☐
Page 8:	**Cooling**	☒	☐	☐	☐
Page 9:	**Single-point/cluster/blade dressing**	☐	☐	☐	☐
Page 10:	**Plunge-roll dressing**	☐	☐	☐	☐
Page 11:	**Diamond disc dressing**	☐	☐	☐	☐
Page 12:	**Diamond/CBN trueing with Al_20_3/SiC**	☐	☐	☐	☐
Page 13:	**Sticking/Conditioning of Diamond/CBN**	☐	☐	☐	☐
Page 14:	**Surface and creep-feed grinding**	☐	☐	☐	☐
Page 15:	**General grinding**	☐	☐	☐	☐
Page 16:	**Plunge OD/ID cylindrical grinding**	☐	☐	☐	☐
Page 17:	**Traverse OD/ID cylindrical grinding**	☐	☐	☐	☐
Page 18:	**Centerless plunge grinding**	☐	☐	☐	☐
Page 19:	**Centerless cylindrical grinding**	☐	☐	☐	☐

*** If this evaluation is done off-site, photos of the workpiece, the coolant nozzle and the wheel and the workpiece in the actual grinding position are very helpful.`**

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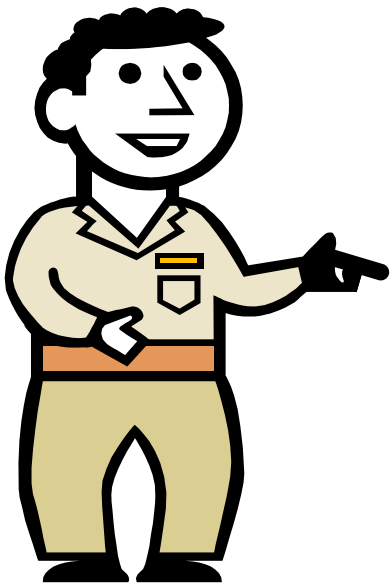
Units

ASS U ME

☺	10 inches/minute	Good	✓
☹	10	Bad	✘
☺	10 ipm	Good	✓
☺	5 mm	Good	✓
☹	5	Bad	✘
☺	5 inches	Good	✓



Dude. Always include units.

Never assume. When you assume, you me a me.. . . A assmake an ass out of you and me.

Bud the Button Pusher

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page 7: wheel details

wheel specification:

- **grit type:**
- **grit size:**
- **grade:**
- **bond:**

wheel supplier:

maximum operating speed:

new-wheel diameter:

worn-out wheel diameter:

current wheel diameter:

wheel width:

wheel RPM or wheel velocity:

surface Finish Requirement (Ra, Rz, etc.):

other relevant information:

Is there a form on the wheel? If so, sketch the form below, with dimensions.

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Bad communication.

Bad grinding advice.

Lefty The Wheel Salesman

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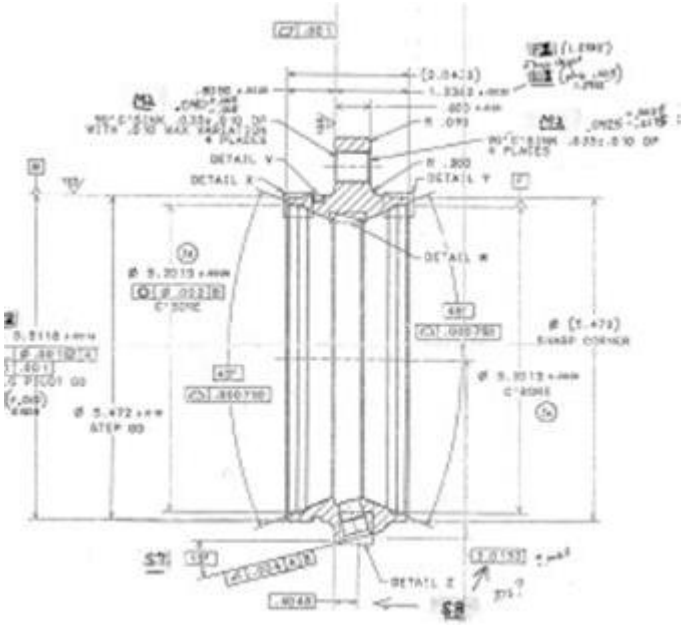
page 9: part details

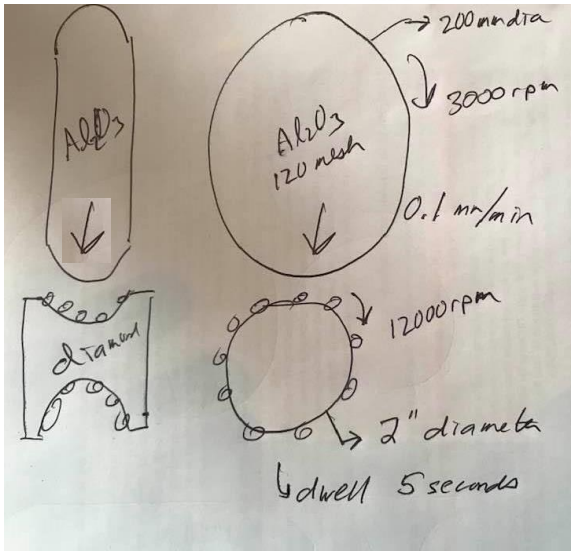
Sketch the part on the next page. Show which surface is ground, all dimension, the direction of motion and the point where the wheel usually breaks down. An example is given on the next page.

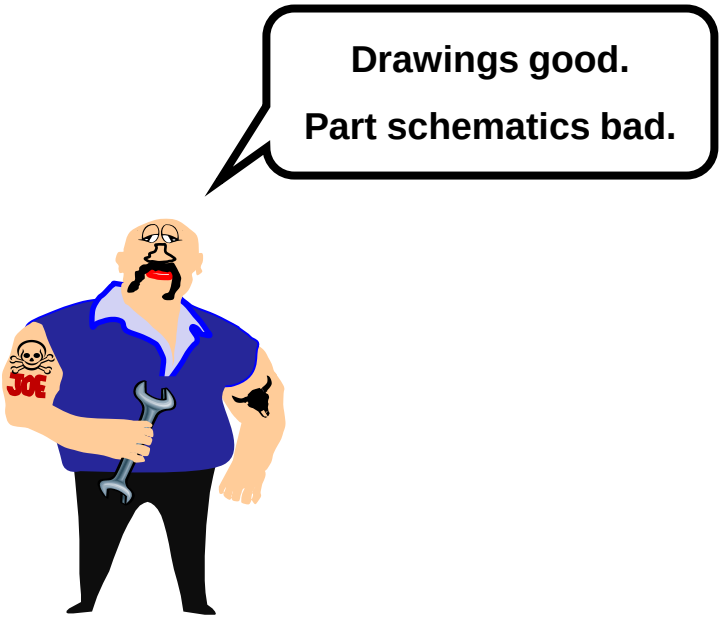
Please <u>do not send a part schematic</u>. Please sketch out the part by hand showing all the details.

☹ Bad



☺ Good





Joe The Grinder

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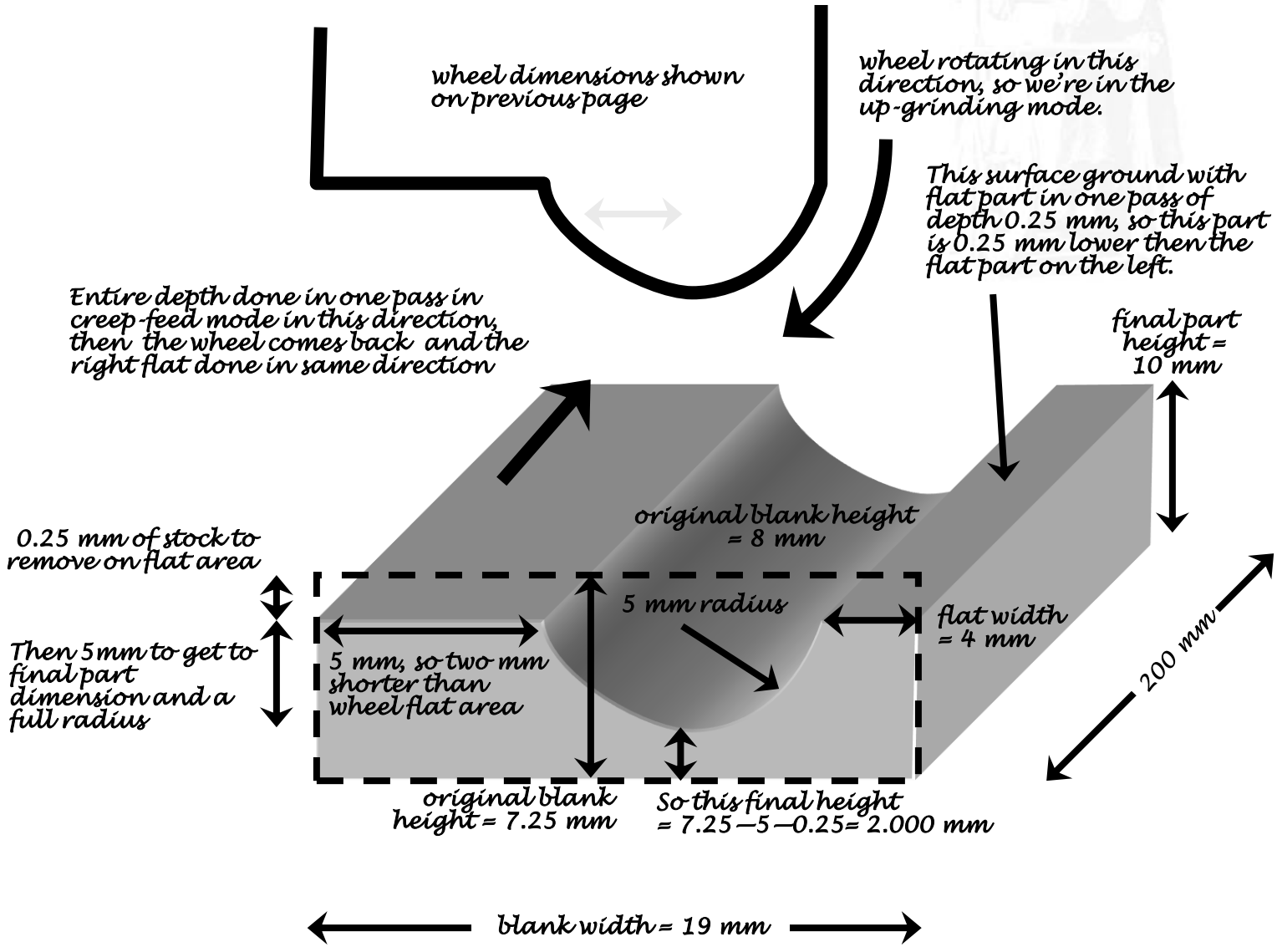
page 10: part details example

Note: A drawing is much better than a printed schematic.



After grinding the form the wheel then lifts out, moves over, and the straight part of the wheel is used to grind this part.

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page 11: Please sketch the part here

Include the various depth of cut, feedrates, etc.

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page 12: issues, goals

Rank the in order the biggest difficulties you have with this process:

What is your main goal of this process? (reduce cycle time, reduce burn, etc.)

Do you see visible oxidation burn (brown/yellow/blue marks):

Are you testing for burn? If so, how:

- ☐ **We don't test for burn in any way**
- ☐ **We don't test for burn, but we look examine the part for oxidation burn (brown, yellow and blue marks)**
- ☐ **We boil in hot hydrochloric acid and look for "cracks" or fissures.**
- ☐ **Sectioning, mounting, etching & examining in microscope for "white layer"**
- ☐ **Dipping the entire part in nitric acid and looking for white spots.**
- ☐ **Barkhausen Noise**
- ☐ **It's a ceramic/carbide/cermet part, so we just check for cracks or hope cracks don't develop.**
- ☐ **We use a different method, described below:**

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page 13: cooling

Coolant : ☐ **Neat oil** ☐ **Water-based oil emulsion or water-based chemical synthetic**

Are you using one main tank for the entire factory or a separate tank for each machine?

If you are using a main supply tank with one pump for the entire plant or does each machine have a separate pump?

Is machine enclosed?

Maximum pump pressure:

Maximum pump flow rate:

Maximum pump power:

Have you measured the actual flow rate?

Have you measured pressure?

If so, where?

Number of nozzles:

Description of nozzles:

Other relevant information:

Sketch nozzle arrangement below with sizes.

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page 14: "single-point:" dressing

Type – single-point, blade, cluster, other:

Diamond or diamond-area width:

If single point, is diamond dull/flat:

Do you rotate the diamond?

Wheel diameter:

Wheel speed or RPM during dressing:

Diamond traverse velocity:
Or dressable wheel width:
dressed in:
for a velocity of:

Dressing depth:

Grinding wheel grit mesh size:

Number of passes or total dressing depth:

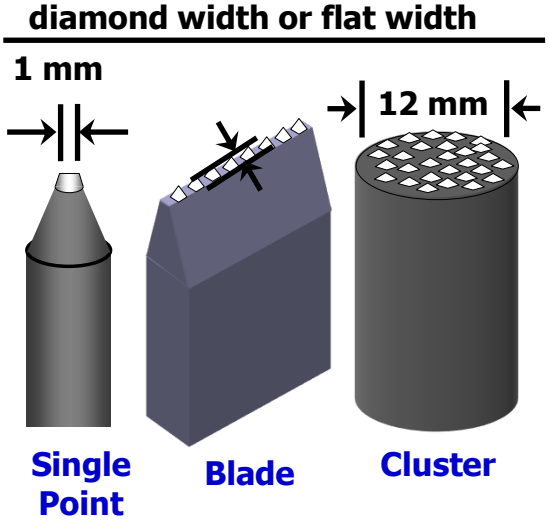
Number of sparkout passes at 0 depth:

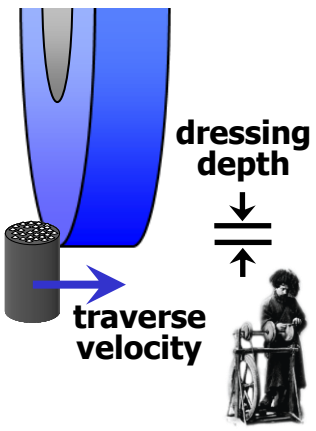
Dressing frequency:

Reason for dressing:

- ☐ to make the wheel sharp, prevent burn
- ☐ to get the wheel form back
- ☐ I don't know
- ☐ Just for the hell of it
- ☐ Other. _____

Other relevant information:





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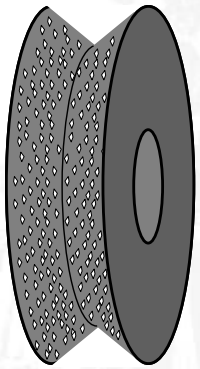
page 15: plunge-roll dressing



Wheel speed or RPM during dressing:

Wheel diameter:

Roll speed or RPM during dressing:

Roll diameter

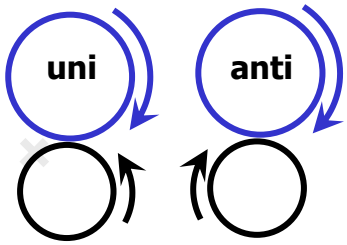
Plunge speed:

Total depth to dress:

Dwell time or # of dwell revolutions:

Dressing frequency:

Uni-directional or anti-directional: ☐ uni ☐ anti



Reason for dressing:

- ☐ to make the wheel sharp, prevent burn
- ☐ to get the wheel form back
- ☐ I don't know
- ☐ Just for the hell of it
- ☐ Other. _____

Other relevant information:

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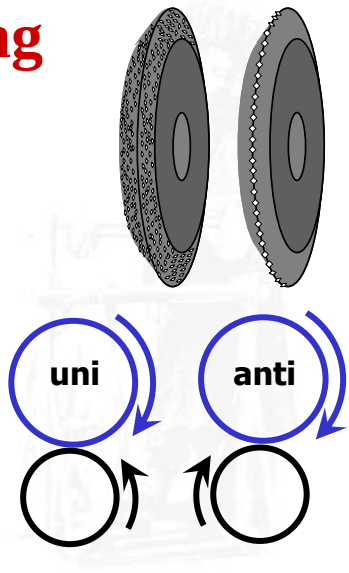
page 16: traverse diamond disc dressing



Wheel speed or RPM during dressing:

Wheel diameter:

Roll speed or RPM during dressing:

Roll diameter

Uni-directional or anti-directional: ☐ uni ☐ anti

Traverse speed:
or dressable wheel width:
dressed in:
for a velocity of:

Dressing depth:

Total depth to dress:

Number of sparkout passes at 0 depth:

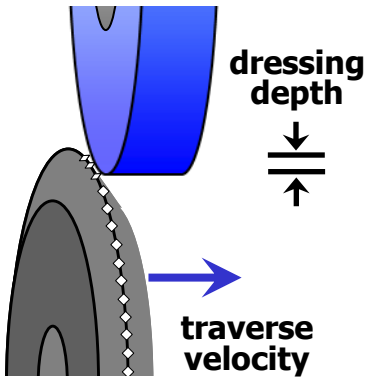
Width of diamond contact region:
(sketch below if necessary)

Dressing frequency:

Reason for dressing:

- ☐ to make the wheel sharp, prevent burn
- ☐ to get the wheel form back
- ☐ I don't know
- ☐ Just for the hell of it
- ☐ Other. _____

Other relevant information:



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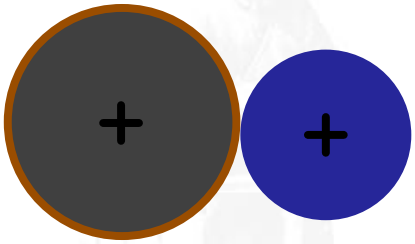
page 17: diamond/cbn trueing with Al_20_3/SiC



Superabrasive wheel speed or RPM :

Superabrasive wheel diameter:

Superabrasive wheel width:

Superabrasive wheel specification:

Superabrasive wheel grit size:

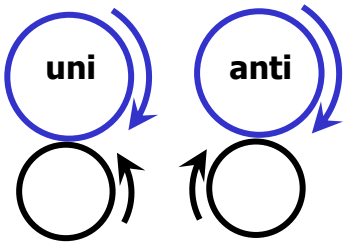
Al_20_3/SiC wheel speed or RPM during trueing:

Al_20_3/SiC wheel diameter:

Al_20_3/SiC wheel width:

Al_20_3/SiC wheel specification:

Al_20_3/SiC wheel grit size:



Uni-directional or anti-directional: ☐ **uni** ☐ **anti**

Trueing depth:

Trueing traverse speed:
or dressable wheel width:
dressed in:
for a velocity of:

Total depth to true or number of passes:

Do you take "sparkout" passes?

Do you true off machine or on machine? ☐ **on-machine** ☐ **off-machine**

Do you keep the diamond/CBN wheel on the same mandrel/adaptor for trueing AND grinding?

☐ **We just take the wheel on and off** ☐ **We keep the wheel on the same adaptor always**

Reason for trueing:
- ☐ **To make the wheel sharp, prevent burn**
- ☐ **To get the wheel form back**
- ☐ **To get a better surface finish**
- ☐ **I don't know**
- ☐ **Just for the hell of it**
- ☐ **Other. _____**

Other relevant information:

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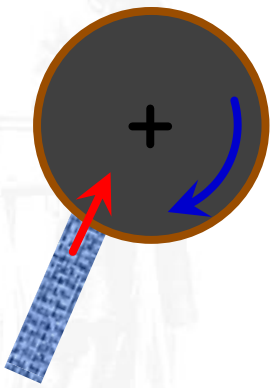
page 18: sticking/conditioning of diamond/cbn



Superabrasive wheel speed or RPM :

Superabrasive wheel diameter:

Superabrasive wheel specification:

Superabrasive wheel grit size:

Superabrasive wheel bond type:

- ☐ resin
- ☐ hybrid
- ☐ rubber
- ☐ vitrified
- ☐ metal
- ☐ electroplated

Conditioning stick abrasive type:

- ☐ Al_20_3
- ☐ SiC

Grit size in conditioning wheel:

How do you stick the wheel?

- ☐ I stick it hard!
- ☐ I stick it gently, just to sharpen things up a little
- ☐ I turn the wheel off and stick it until it stops
- ☐ I don't know, but it takes around _____ seconds to stick around one inch or 25 mm of stick.

Reason for sticking:

- ☐ To make the wheel sharp, prevent burn
- ☐ To reduce loading
- ☐ To reduce chatter
- ☐ I don't know
- ☐ Just for the hell of it
- ☐ Other. _____

Other relevant information:

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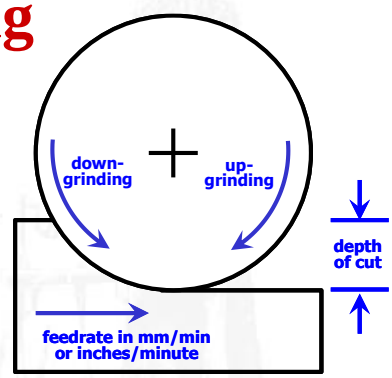
page 19: surface and creep-feed grinding



Wheel speed or RPM:

Wheel diameter:

Depth of cut:

Width of cut:

Total depth to remove

Feedrate:

Up-grinding or Down-grinding: ☐ Up ☐ Down ☐ Both

Number of sparkout passes at 0 depth:

Required surface finish:

Other relevant information:

Map out below the entire cycle in terms of depths of cut, feedrate, wheel speeds, etc.

	% of total	actual depth of cut	feedrate	wheel speed
Pass 1	60% of total	2.700 mm	10 mm/s	60 m/s
Pass 2	20% of total	0.900 mm	20 mm/s	50 m/s
Pass 3	15% of total	0.675 mm	25 mm/s	50 m/s
Pass 4	4% of total	0.180 mm	100 mm/s	40 m/s
Pass 5	1% of total	0.045 mm	150 mm/s	30 m/s
	100%	4.500 mm		
Pass 6	+one sparkout pass with no in-feed		300 mm/s	30 m/s

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page 20: general grinding

(for odd processes and odd geometries that don't really fit into the category of surface/cylindrical;/etc.)

Wheel speed or RPM:

Wheel diameter:

Depth of cut:

Width of cut:

Total depth to remove

Feedrate:

Up-grinding or Down-grinding: ☐ **Up** ☐ **Down** ☐ **Both**

Number of sparkout passes at 0 depth:

Required surface finish:

Other relevant information:

Sketch out the entire cycle below, with the depth of cut in each pass, the feedrate in each pass, the wheel speed in each pass, along with any other information to help in describing the understand the process.

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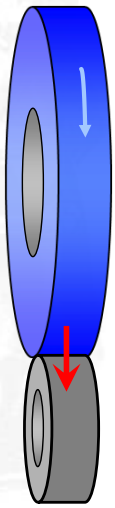
page 21: plunge cylindrical grinding



Wheel speed or RPM:

Wheel diameter:

Inner diameter or Outer diameter: ☐ **OD** ☐ **ID**

Plunge speed:

Sparkout time:

Width of cut:

Total depth to remove

Workpiece speed or RPM:

Workpiece diameter:

Workpiece material:

Required surface finish:

Is this a combo plunge & wipe operation?

☐ **No, this totally a traverse operation**

☐ **Yes, and I have given the plunge details on the plunge page and the traverse details on this page**

Other details given below:

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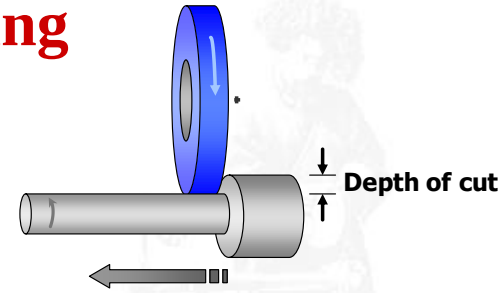
page 22: traverse cylindrical grinding



Wheel speed or RPM:

Wheel diameter:

depth of cut:

Traverse velocity:

Wheel width:

Total depth to remove or # of passes:

Workpiece speed or RPM:

Workpiece diameter:

Workpiece length:

Workpiece material:

Required surface finish:

Is this a combo plunge & wipe operation?

- ☐ **No, this totally a traverse operation**
- ☐ **Yes, and I have given the plunge details on the plunge page and the traverse details on this page**

Other details given below:

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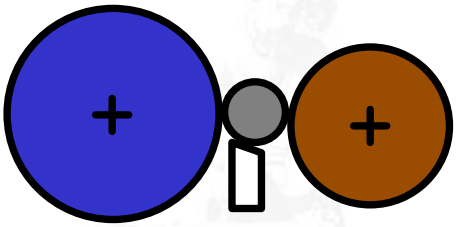
page 23: centerless plunge grinding



Grinding wheel speed or RPM:

Grinding wheel diameter:

Grinding wheel width:

Grinding wheel specification:

Regulating wheel speed or RPM:

Regulating wheel diameter:

Regulating wheel width:

Regulating wheel specification:

depth of to remove: ☐ **Off the radius** ☐ **Off the diameter**

Plunge speed:

Blade material:

Blade angle:

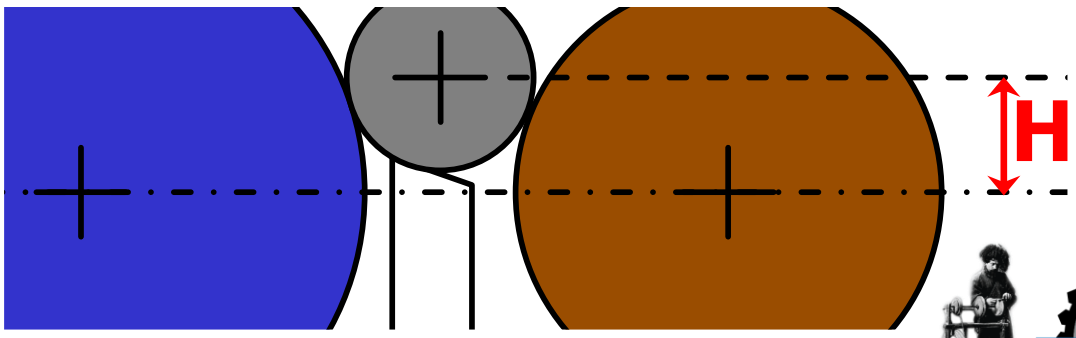
Gamma tangent angle, if known, δ:

Workpiece diameter:

Workpiece height (H, below):

Workpiece material:

Required surface finish:



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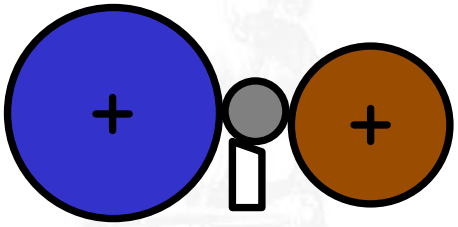
page 24: centerless thru-feed grinding



Grinding wheel speed or RPM:

Grinding wheel diameter:

Grinding wheel width:

Grinding wheel specification:

Regulating wheel speed or RPM:

Regulating wheel diameter:

Regulating wheel width:

Regulating wheel specification:

depth of cut: ☐ **Off the radius** ☐ **Off the diameter**

Is there a taper dressed into the wheel? ☐ **No** ☐ **Yes, and I have sketched it below.**

Blade material:

Blade angle:

Regulating wheel tilt angle, α:

Regulating wheel dressing angle, α':

Gamma tangent angle, if known, δ:

Workpiece diameter:

Workpiece height (H, below):

Workpiece material:

Required surface finish:

Regulating wheel dressing offset (h):