MNG 331: ROCK MECHANICS SPRING 2016

Experiment 2: Cutting and Grinding

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Objective of the Experiment

- Get a feel for the processes of preparing a Universal Compressive Strength (UCS), a Brazilian Tensile Strength (BTS) and a Point Load Test (PLT) test samples using cutting and grinding machines.
- Gain hands on experience on operating the cutting and grinding machines.
- Understand the standards described by ASTM.

Equipment: Cutting Machine

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Equipment: Grinding Machine

4

Equipment: Dial Gage and Ruler

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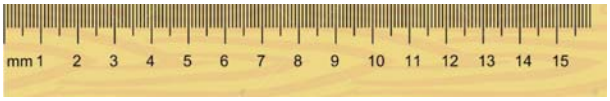
Dial Gage – To measure the tolerance level



Ruler

Personal Protective Equipment (PPE)

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- Use protective gears
  - Safety Goggles
  - Ear Plugs
  - Coverall or Apron

Sample Dimensions as per Standards

Based on the test, mark on the sample in desired length and position.

BTS

0.2 < h or L/D < 0.75

Typically 0.5 is used.

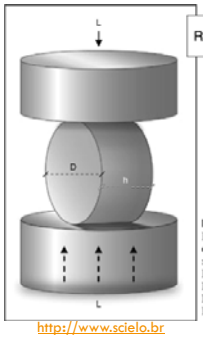


FIGURE 1 - Diagram of diametrical tensile strength test. R: resistance, L: load, D: diameter, h: height.

http://www.scielo.br

UCS

2 < h or L/D < 2.5

Typically 2.0 is used.

Preferred sample diameter is NX or 51 mm (2 inch) and above.

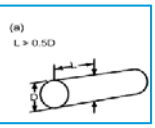
http://www.controls-group.com

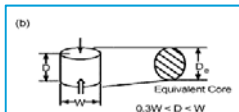
Sample Dimensions as per Standards

Diametral PLT

1 < h or L/D

Typically 1.2 is used.

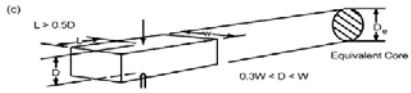


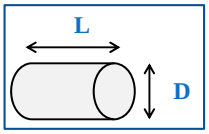


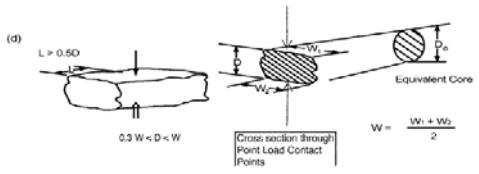
Axial PLT

0.3 < h or L/D < 1

Typically 0.5 is used.







Note 1—Legend: L = distance between contact points and nearest free face, and D_e = equivalent core diameter (see 10.1).

FIG. 3 Load Configurations and Specimen Shape Requirement for (a) the Diametral Test, (b) the Axial Test, (c) the Block Test, and (d) the Irregular Lump Test[3]

Sample Dimensions as per Standards

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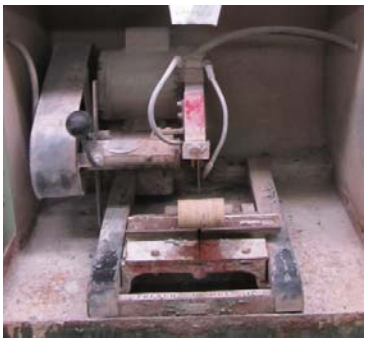
Diameter (Inch)	Test Sample Lengths (Inch)								Total Length of Sample needed
	UCS		BTS		PLT				
					Axial		Diametral		
	Real	Rounded	Real	Rounded	Real	Rounded	Real	Rounded	
1.75	3.50	3.50	0.88	0.90	0.88	0.90	2.10	2.10	7.40
2.00	4.00	4.00	1.00	1.00	1.00	1.00	2.40	2.40	8.40
2.25	4.50	4.50	1.13	1.20	1.13	1.20	2.70	2.70	9.60
2.50	5.00	5.00	1.25	1.30	1.25	1.30	3.00	3.00	10.60

Since we have cored samples having diameter of 2 inches, the size of samples to be cut and grinded for various tests are marked in red

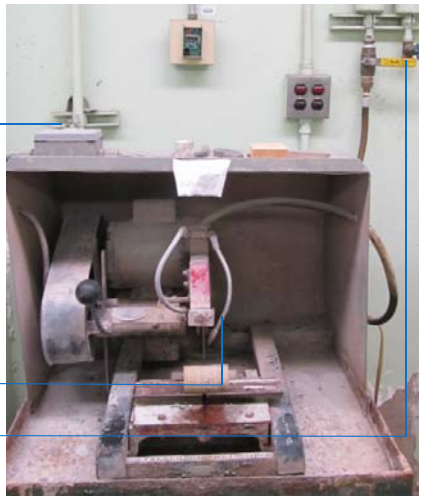
Procedure for Cutting the Samples

- Put an identification code or name on each to be cut samples.
- Place the sample on V-shape cradle securely.
- Make sure that cutter will hit the marked points of sample.



Procedure for Cutting the Samples

- Open the "Water Valve" and push the "Start" switch.
  - If sample is fragile and weak, you should not use the water.
- Monitor the amount of water and adjust it to allow you cutting
- Gently Approach the cutter to the sample.



Procedure for Cutting the Samples

- Do not push hard cutter on the sample. Cut the sample in circumferential line in shallow depth. Gently establish a full footprint for cutter.
- Continue cutting till the sample thoroughly cut
- Trim ends of the sample with sliding cutter at the same position.
- Push "Stop" Button and close "Water Valve"

Warning: If you are careless, you might cut your finger.
You need to protect your hand wearing the gloves.

Grinding

- This step is just for UCS samples
- The smoother is the sample surface after cutting, the easier and faster it is to grind it.
- Be careful while handling the soft samples as they might chip or break during the operation.

Procedure for Grinding the Samples

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- Place the sample in the V-Block and tighten the sample securely
  - Make sure that grinder will not hit V-Block.
- Adjust height of grinder abrasion wheel (GAW)

Procedure for Grinding the Samples

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Place V-block setting on the magnetic base on the grinder. Turn on the magnetic base

Adjust height of grinder abrasion wheel (GAW)

Warning: If grinder hit the V-block, impact on grinder will damage or destroy machine and it could hurt you.

Procedure for Grinding the Samples

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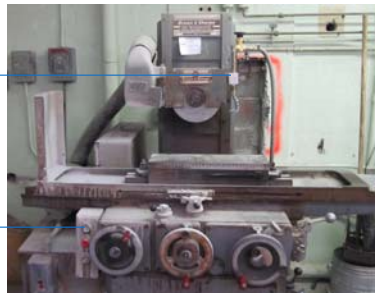
- Plug in the plug of motor which is back of the grinder.
- Push "Start" Button" which is the black button in lower left side of the grinding machine
- Turn on the valve on the pipe and adjust the fluid pressure.
  - Note: If sample is fragile and weak, you need to use only air suction system instead of mentioned water base dust suppression system



Procedure for Grinding the Samples

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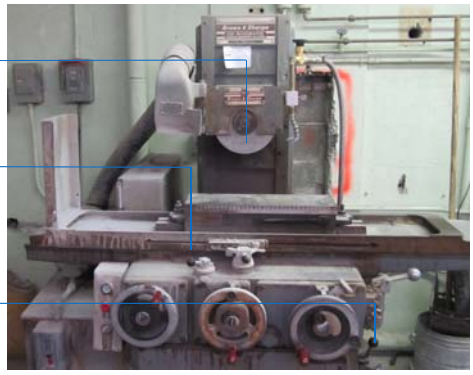
- Adjust proper range of grinder abrasion wheel and make sure that the GAW can reach over whole sample surface.

  Note: You can adjust two magnetic knobs in the bottom of magnetic base

Grinding Abrasion Wheel

Magnetic Knob to move the base left and right while in operation

Magnetic Knob to move the base forward and backward while in operation



Procedure for Grinding the Samples

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- Gently Approach GWA to the sample and start to grind
  - Use the big scale on the circumference of the wheel located in far right hand side.
  - Use maximum 3 small scales as grinding interval lapse.
  - Try to hear grinding sound. If grinder push too hard on the sample, you will hear loud sound and see the spark between sample and grinder.
- When you are done on one side, and Stop the machine (push the Red button in lower left side of you and close the value)

Stop Button

Procedure for Grinding the Samples

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- Flip the V-Block set and start grinding
- When you are done, stop the machine (push the Red button in lower left side of you and close the value and plug off pump).
- Take off the V-block from the sample
- Check tolerance of sample.

Warning: If grinder hit the V-block, impact on grinder will damage or destroy machine and it could hurt you.

Procedure for checking Tolerances

Smoothness of sample surface is important. Vertical tolerance will be checked by the dial gage.

1. Put the dial gage on flat metal place (or grinder magnetic base) and turn on magnetic of dial gage stand.
2. Put the sample under dial gage.
3. Adjust the height of dial gage with knob.
4. Move sample under dial gage in the two arbitrary diagonal directions and a circumferential direction,
5. Tolerance should be less than 0.001".
6. Double check the sample condition whether it is suitable to ASTM and ISRM standard.

If sample does not meet the standard, you may re-do sample preparation process such as cutting or coring.

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