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Scientific Notebook #110

TRAINING

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Scientific Notebook #110

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Contents

Contents Page

Pages 36-110 are reserved for further descriptions of activities and to record any changes

Pages ~~110~~ KM 12/16/94 111-160 are reserved for documentation of training

Pages 1 through 35 of this Scientific Notebook were reviewed for compliance with QAP-001 in response to Corrective Action Request 94-02. Corrections and clarifications were made as appropriate. In some cases, the date of a change will reflect the date of this review rather than the date of the original Scientific Notebook entry.

Randy Folck
SwRI-Q4

K Meyer 12/16/94

Training Notebook
Hydraulic Characterization Lab

Investigators: RT. Green, Kristi Meyer

Objective: The intent of this notebook is twofold.

1) To describe the ~~activities and experiments~~ KM 12-16-94 lab techniques conducted in the hydraulic characterization lab and,

2) To maintain a record of personnel trained in these activities.

All personnel currently employed including RT Green, KAMeyer, and G James are considered proficient in all tasks.

The Chemistry Test

The Southwest Research Institute provides a general chemistry ~~test~~ 12/16/94 test for those employees who work in laboratories. This test is an assessment of very basic skills. It focuses mainly on the fundamentals of math, such as addition, subtraction, multiplication and division, along with simple readings of gauges and menesicus. Because of its simplicity, those who take this test are required to obtain a perfect score of one hundred.

12/16/94 KM All personell who come to this lab should take the above test, and/or demonstrate those skills tested.

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6/6/94
G.W.

The Aqualab

The Aqualab measures the Water Activity of different samples, which is the ratio of water vapor pressure above a particular sample to that of pure water. The greater the ratio, the more loose the water is inside that sample.

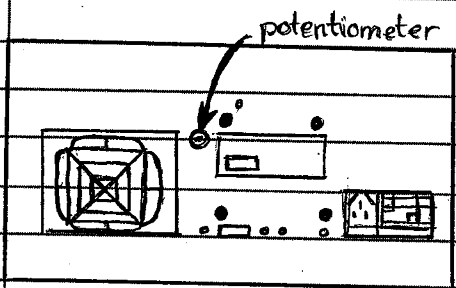
Sample Preparation

Before ready for use in the Aqualab, samples must be first dried and saturated. Then they are left to dry until a certain desired saturation level is reached

Calibration

Once samples are ready for use in the Aqualab, the machine must be calibrated to assure accuracy. Samples of deionized water and NaCl are used for this process. A sample of deionized water should give a read out of 1.000 at any temperature while NaCl should give .775 at 20°C and .773 at 25°C. These will be the reference points. If the readings come out both high or both low, the potentiometer on the back of the machine can be adjusted to correct the linear offset that has probably occurred.

5/8 0.755 @ 20°C
Km 5/28/96

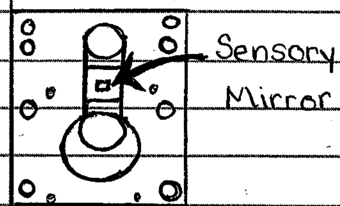


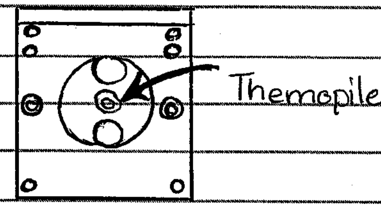
If the readings are completely unstable, the aqualab will need to be taken apart and cleaned.

6/6/94
G.W. ~~If the~~ Cleaning the Aqualab

If the Aqualab does need to be cleaned, it should first be unplugged. Then the cover should be removed by unscrewing the side screws. On the inside, a

fan assembly is attached to the sliding block with four screws. This must be removed and all surfaces cleaned with distilled water. Important areas to make sure are clean are the sensor mirror on top of the block between two round ports and the thermopile on the bottom of the block. Alcohol can also be used for this cleaning process





Procedure

Once calibrated, the machine is ready for the sample. First, each individual sample should be weighed and placed in a clean sample cup

Cautions:

- Never leave a sample in AquaLab after a reading has been taken. If left too long, the sample may contaminate the instrument's chamber.
- Never leave a sample in AquaLab overnight. Samples left too long may contaminate the chamber.
- Never try to move AquaLab after a samplehas been loaded. Be especially careful when loading liquid samples. Movement may cause the sample to spill and could contaminate the chamber.
- If a sample has a temperature four degrees higher than AquaLab's chamber, the instrument will beep to alert the operator to cool the sample. Although the instrument will measure warmer samples, the readings may be inaccurate. The physical temperature of the instrument should be between 5° and 43°C.
- If a sample has an a_w lower than .03, AquaLab's display will read "LO." If the instrument gives a "LO" reading for samples with an a_w that is higher than .03, the instrument's sensors have most probably been contaminated and it will need to be cleaned or serviced. Please refer to chapter ten for more information.

7. Taking A Reading

Taking a reading with AquaLab is very simple.

- Turn the sample drawer knob to the "Open/Load" position and open the sample drawer.
- Place a sample cup half filled with the prepared sample in the drawer and slide it carefully closed.
- Turn the knob to the "Read" position to seal the sample cup with the chamber. AquaLab will beep once to let you know the sample has been properly loaded.
- AquaLab will begin to take readings. In 30 - 45 seconds, the first measurement of a_w and the temperature will appear on the display. (Times may vary with each sample).

AquaLab will repeat readings for about five minutes. This indicates that the instrument is crossing the dew threshold numerous times to insure the accuracy of readings. When the instrument begins to beep continuously and the decimal points blink, the reading is complete. The display will show a final a_w and temperature measurement.

- **Note:** Water is difficult to read and may require a longer reading time.

After the machine obtains a reading, the sample should be weighed once again.

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7/22/94 g.w. The Centrifuge

By spinning samples at excessive speeds, the centrifuge has the ability to create a centrifugal force many times greater than that of gravity which drives water outward through a saturated soil or rock. This simple concept is instrumental in ~~a~~ 7/22/94 g.w. the study of moisture holding properties, such as water retention and ~~hydrolic~~ hydraulic 7/29/94 g.w. conductivity.

Sample Preparation

For unconsolidated media:

Before use in the centrifuge, samples should be prepared in the appropriate manner. First, small pin-sized holes are made in the bottom, pointed end of a centrifuge tube to allow water to escape. Then filter paper is cut down to a suitable size, formed into a cone shape, and placed over the holes to prevent any of the sample from exiting the tube during centrifugation. These empty tubes with filter paper are now weighed and this data recorded.

Next, the saturation process begins. An eyedropper is used to wet the filter paper with deionized water so that it clings to the walls of the centrifuge tube. Now, small amounts of samples are placed 7/29/94 g.w. into the tubes, always followed by drops of water making sure complete saturation is being obtained. This alternating of sample and deionized water is continued until a desired volume is reached. (NOTE: In order for successful centrifugation, tubes must be prepared in pairs with approximately the same volume). This is done for all eight tubes. If unsure as to whether a sample is fully saturated, a few ml. of water can be added to the tube at the end of the packing process. From there, tubes can either sit with the pointed ends emersed in water for an extended period of time 7/29/94 g.w. or be centrifuged at a low speed (ex. 150 RPM). Either tactic is complete when no excess water is present.

NOTE: Samples may also be saturated in a separated beaker before deposited into tubes.

For consolidated media:

PROCEDURE:

Once samples are completely saturated with no excess water, their weights and volumes are recorded. Then the tubes are placed in the centrifuge in pairs. That is, those tubes with corresponding volumes are placed directly across from one another. Once in place, the lid of the centrifuge is closed and locked by moving the handle on top as far as possible in the clockwise direction. Then, by turning the knob on the side of the machine, the speed is adjusted to a chosen level. To monitor the speed, a separate tachnometer is utilized which is directed at a peice of tape located toward the center of the centrifuge head. This speed is kept steady for a predetermined period of time. (NOTE: The centrifuge WILL NOT stay at a given speed on its own so it will need to be monitored and adjusted continuously throughout each run) Once the time has expired, turn the knob to zero and allow the centrifuge to come to a complete stop. Now the tubes are weighed again. (NOTE: If at any time throughout these observations, the weight of a sample increases, there is most likely too much water in the centrifuge tube holder.
7/22/99 gw ~~They~~ It should be emptied immediately.) Repeat this procedure at the same speed, but not necessarily the same time periods, until a constant weight is obtained. At this time, the volume is recorded. Once this process is completed for one speed, increase the speed by whatever number and repeat.

After the completion of the entire centrifugation process, the sample is emptied from the tube into a beaker, weighed, and then dried. Finally, a dry weight is obtained and the process complete.

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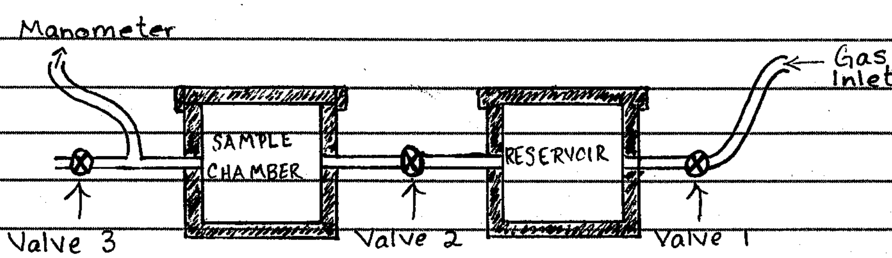
J.W.

The Pycnometer

From Boyle's Law, it is known that the product of the volume and pressure of a gas is a constant. The pycnometer applies this concept to soil and rock samples in order to find their corresponding bulk volumes and porosities. The bulk volume refers to the volume of the sample's solid and liquid content. This does not include its pores. From this information, the porosity, or percentage of pore space in a sample, can be determined.

Sample Preparation

Before observed in the pycnometer, samples must be oven-dried to assure that no water within the rock interferes with the results.



Procedure

Before starting with the samples, the pressure of the gas entering the system should be adjusted to a certain specified level. Do this by sealing valve 1 and allowing gas to enter the gas inlet until the gauge reads the correct pressure. Once this is completed, procedures may begin. The first step in testing a sample is to do a run through without the sample in the sample chamber. However, one should be aware of what sample will be being observed so that as much space as possible in the chamber can be occupied. This will assure the greatest accuracy. Leaving open only what air is necessary for the sample, seal the sample chamber tightly and verify that the reservoir is sealed as well. With valve 3 closed and valve 2 open, open valve 1 and allow gas to fill the entire system until a chosen pressure is reached. This pressure can be adjusted by either opening valve 1 or valve 3 depending on whether an increase or decrease is needed. Record this pressure

as it will be the pressure of the reservoir (P_r) in calculations. Valve 1 and valve 3 should now be sealed. Close valve 2 and release the pressure through valve 3 until the manometer reads 0.00. Close it again and open valve 2. The pressure reading obtained from this is the final pressure of the combined system (P). Record this pressure. Next, with valve 1 closed, release all the pressure from the system, and remove the lid from the sample chamber. Now, insert the rock sample into the chamber and repeat the process. In doing so, it should be noted that, for each individual sample, the pressure of the reservoir for procedures with and without the sample must be adjusted to the same level.

Calculations

Once ~~all the information~~ gas pycnometer testing is complete, the information collected for each sample should consist of the pressure of the reservoir, pressure of the combined system with and without the sample, and a volume of the sample which should have been found previous to testing. From this data, porosity can be found using the following equations.

6/23/94

$V_c = (P_r - P)V_r / (P - P_c)$ Note: P_c drops out of the equation

$$\eta_{eff} = \frac{V_s - [V_{c\ w/o\ sample} - V_{c\ w/sample}]}{V_s}$$

Note: $V_{c\ w/o\ sample} - V_{c\ w/sample} =$ Bulk volume

P_r = absolute air pressure of reservoir
P_c = atmospheric pressure
P = absolute pressure of combined system
V_r = volume of reservoir
V_c = volume of air in sample chamber
V_s = volume of sample
η_{eff} = effective porosity

Pages 31 and 32 Are Intentionally Left Blank

7/27/94 # The Grinder

Balancing:

For accurate results, the grinding wheel must be symmetrical and balanced. If not, grinding accuracy and the surface finish of the specimen will be affected along with the life of the grinding wheel, wheel spindle and bearings.

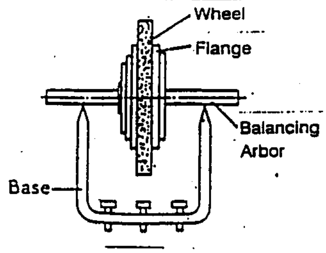
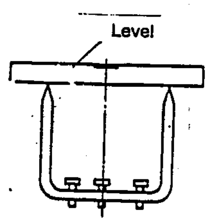


Fig 2

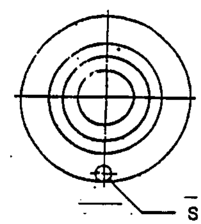
J.W. 7/27/94

Procedure-

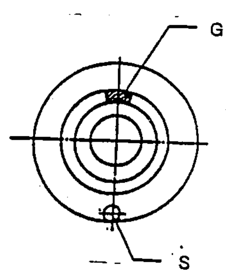
1. Level the wheel balancing base.



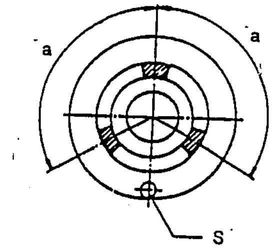
2. Allow the wheel to oscillate so as to locate the center of gravity which should then be marked.



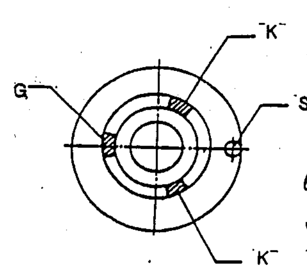
3. Apply the first balancing weight opposite to this mark and screw it up.



4. Add the two correction weights anywhere around the periphery but making sure they are an equal distance away from the first.



5. Turn the wheel through an angle of 90 degrees a number of times to see if it is balanced. If not, the correction weight should be adjusted until the whell is balanced at any position.



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6. Once the balancing is complete, the wheel must be given a test run of at least five minutes at working speed before being used or rebalanced.

Note: If the grinding wheel is not properly balanced, it could explode.

Sounding:

This procedure should be done prior to the initial installation and once a week from then on. J.W. 7/27/94

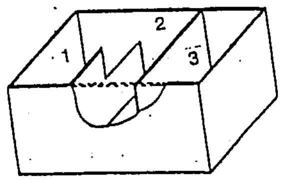
Procedure-

The wheel is first placed on a mandrel and struck lightly with a wooden hammer. If the wheel is in good condition, a clear tone will be heard. If it is not, the wheel should not be used because internal cracks are present which could cause the machine to explode. This process will detect~~ed~~ even the smallest hair cracks not visible to the naked eye. 7/27/94 J.W.

Coolant:

Operating the coolant system-

To begin, the power source plug is inserted into the socket at the rear side of the control box. The coolant pump is then started up by pressing the appropriate pushbutton switch. Rotation should occur in the clockwise direction. If it does not, any two cords of the three cord cable can be interchanged. The coolant flow is adjusted by turning the ball valve to a suitable rate. The cooling water collected from the table should return to the coolant tank through a hose to be filtered by turns of its three cabinets.



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Warnings:

(1) Coolant flow should never be started when grinding wheel is not in motion because it will absorb the coolant as it does humidity and, as a result, become unbalanced.
(2) A specimen should only be ground when the coolant is flowing so as to minimize thermal stresses on the wheel and control flying particles.
(3) Once grinding is complete, the coolant should be allowed to flow in order to cool the specimen and the wheel.
(4) After each use, the wheel should be allowed to idle preventing the wheel from becoming unbalanced due to a collection of coolant.

Grinding:

The actual grinding process can only begin after the specimen has been secured using a V-block and magnet. Then the machine is to be operating using the electric control panel located to the right side of the machine. This allows for the operator to be out of the path of flying particles.

General Comments Of Grinding

The grinding results depend to a very degree on the choice of the correct grinding wheel and suitable operation. J.W. 7/27/94

(1)Stock removal efficiency
For intensive stock removal a coarse grain (about 30-36)should be used. The wheel is dressed by passing the diamond over quickly so that the surface of the wheel is roughened and bites well.

(2)Surface finish required
If fine finish is to be produced, a finer grain wheel is required (40-80). The diamond in this case is passed slowlyover the wheel so as to break up the grain.

(3)Distortion of the workpiece
If the workpiece shows too much distortion when being ground, this means that the stock removal was too great and the longitudinal and cross movements of the table was too slow, or the grinding wheel in "clogged".

(4)Undesirable burns and grinding cracks
If burn marks and grinding cracks appear, this means that the wheel is too hard, or the wheel "clogged"

Dressing The Wheel And Correct Treatment Of Dressing Diamond

The diamond is inserted in the dressing device. The sleeve of the dressing device is arranged at an angle of about 5° , so that, when the diamond loses its keenness, it can be turned in the sleeve, along with its holder, thus ensuring that there is always a sharp diamond edge available.

Various degrees of roughness can be produced in the ground component by varying the speed at which the diamond is passed over the grinding wheel.

If there is only about 0.2mm to 0.3mm stock removal, it is advisable to roughen the grinding wheel. This is done by feeding the diamond in about 0.03mm and turning the handwheel rapidly, so that the dressing diamond moves quickly over the wheel. This makes the wheel bite well and the stock removal is good.

If the component is finishedly ground to size with the same grinding wheel, the wheel must be dressed again, this time slowly, in two or three passes, with the diamond fed in only about 0.01mm.

Frequent light dressing is better for the life of the grinding wheel and the diamond than a heavy cut.

When dressing, the diamond should always be cooled, if possible. Sudden cooling dangerous, as it can lead the diamond to be split.

The diamond is very brittle because of its extraordinary hardness thus it's sensitive to even the slightest knock, and naturally cracks easily.

When dressing, please begin in the center, as the edges are usually worn down further. If dressing is begun at the worn edges, there is dangerous of the higher pressure in the center overstressing the diamond and shattering it.

Experience has shown that, with highly accurate grinding, dressing with the hand-operated dressing device on the spindle carrier is inadequate. The hand operation might necessarily causes slight undulations on the surface of the wheel.

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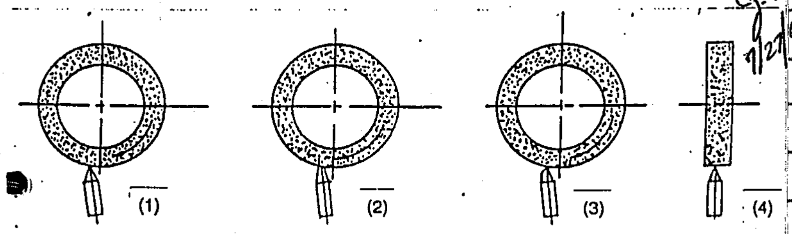

(1)The new diamond is inclined at the correct angle to the wheel.
(2)As a face has formed on the diamond, it must be turned about its axis.
(3)The new point acts like a new diamond again.
(4)Begin in the middle of the width.

The project has been discontinued

I have reviewed this Scientific Notebook and find it in compliance with QAP-001.

[signature] Manager, RD 2/7/97