SUGGESTED TEST PROCEDURE FOR ULTRASONIC DISAGGREGATION OF CLAY FORMING MATERIALS -GRAIN SIZE DISTRIBUTION-

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I. Purpose

The procedure described below is applicable to clay forming materials such as hardened clay soils, hard pan, shales, etc. It presents a method of preparing a sample of the material so that the grain size distribution can be determined under the most critical conditions.

II. Equipment

1. The Westinghouse Ultrasonic cleaning system is comprised of:
   a. Solid State Magnatrak (TM) 200 Watt Generator
   b. 1.5 gallon capacity stainless steel tank with Magnapak (TM) transducers
2. Two 1000 ml. stainless steel beakers (4 inch diameter, 6 inch high)
3. Two stirrers
4. 1/2 gpm. reciprocating pump
5. 1000 ml. conical flask
6. 12" x 8" x 3/4" plexiglas plate
7. Rubber tubing
8. 500 ml. beakers

Items 3 through 7 are optional but they are recommended specifically for temperature control and greater efficiency. Figure 1 depicts the schematic diagram of the equipment and connections and Figures 2, 3, and 4 various parts of the equipment.

III. Preparation of Sample for Ultrasonic Treatment

The steps indicated below pertain to the sample preparation method for grain size distribution determination including hydrometer analysis (AASHO Designation T 88-57, ASTM D-422-63).

1. Spread the material obtained in the field in a thin layer and air dry it.

2. Using a rubber end pestle and mortar crush the material to pass the U. S. Standard Sieve No. 10.

3. Determine the moisture content of air dried material.

4. Weigh accurately 50-80 gm. of air dried material.

5. Transfer weighed material into a 250 ml. beaker.

6. Add 125 ml. of sodium hexametaphosphate solution or whatever amount and type of deflocculating agent is conventionally used in your laboratory for hydrometer analysis.

The sample now is ready for ultrasonic treatment.

IV. Ultrasonic Treatment

1. Transfer the presoaked material to the 1000 ml. stainless steel beaker, making sure that all particles are transferred. Use as little additional distilled water as possible.

2. Place beaker (or beakers) in the ultrasonic tank and place plexiglas plate on it. Use adhesive tape to hold the plate firmly down to the tank and to the beaker (or beakers).

3. Lower the stirrer along the center of the beaker until fins are about 1 inch above the bottom of the beaker.

4. Connect the stirrer to motor control and motor control to AC source.

Switch the motor on and run the stirrer at high speed. All the material should now go into suspension; if it does not, switch off the motor and lower the stirrer further in the beaker. After a few trials the desired position of stirrer can be determined in this way. Fix the stirrer in that position.

6. Run the stirrer at a medium speed which will prevent settling of suspended particles.

7. Turn on the water source and pump. Adjust the flow of water until the inflow is slightly greater than the outflow. Any excess water will be drained off through the overflow outlet of the conical flask.

8. Connect the ultrasonic generator to the proper AC source and switch on the generator. Record the time as the generator is switched on since it marks the start of ultrasonic treatment.

9. At the end of one hour ultrasonic treatment time turn off the generator and water. When no more water is reaching the pump, turn it off, too.

. Remove the stirrer, adhesive tape, plexiglas plate and the beaker, in that order, from the tank. The material in the beaker is the required ultrasonically treated material.

. Transfer the material from the stainless steel beaker to a 1000 ml. hydrometer jar for the standard hydrometer analysis as specified by AASHO Designation T 88-57, ASTM Designation D-422-63.

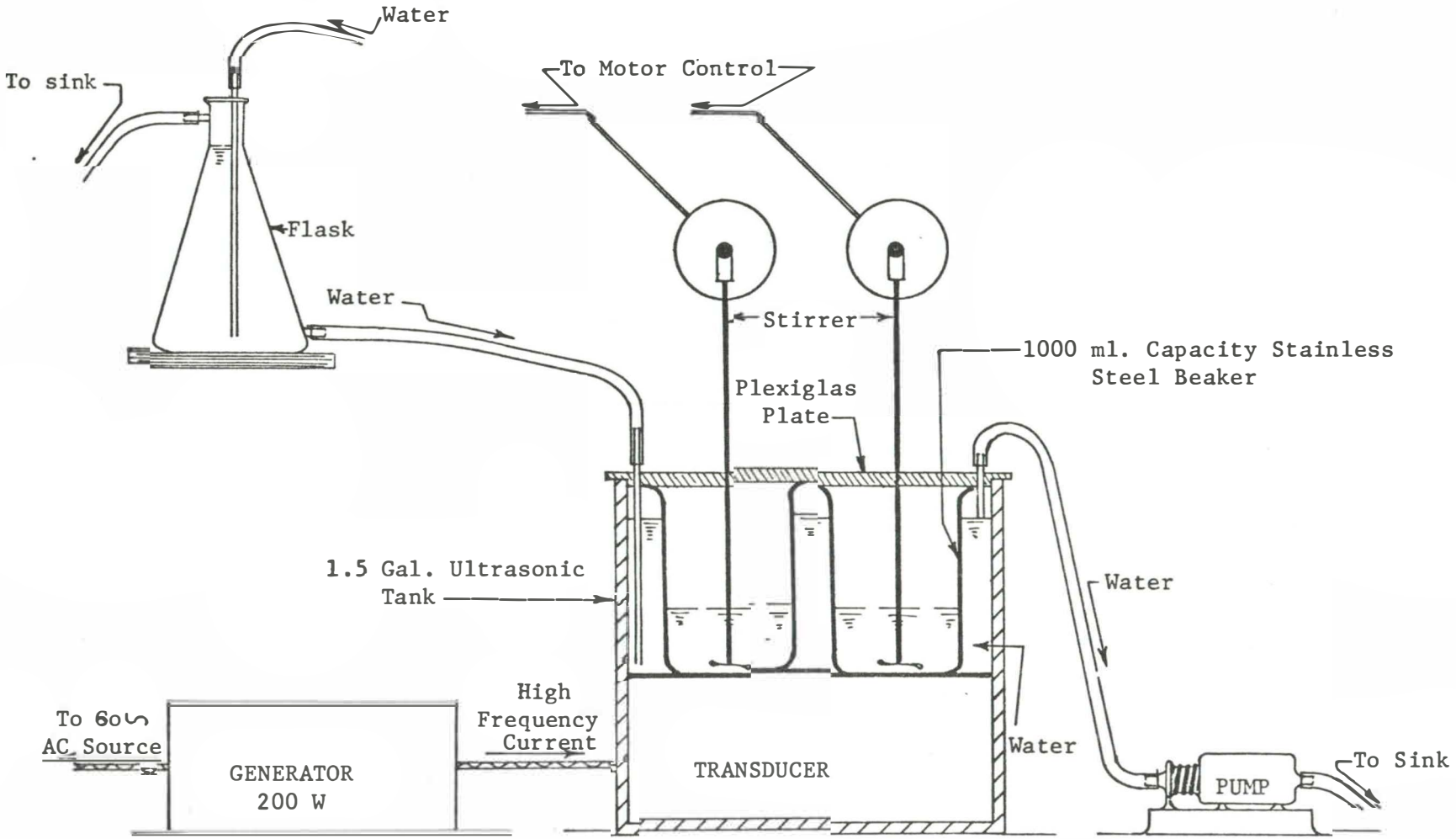


FIG. 1: SCHEMATIC DIAGRAM OF ULTRASONIC EQUIPMENT AND WATER CIRCULATION SYSTEM

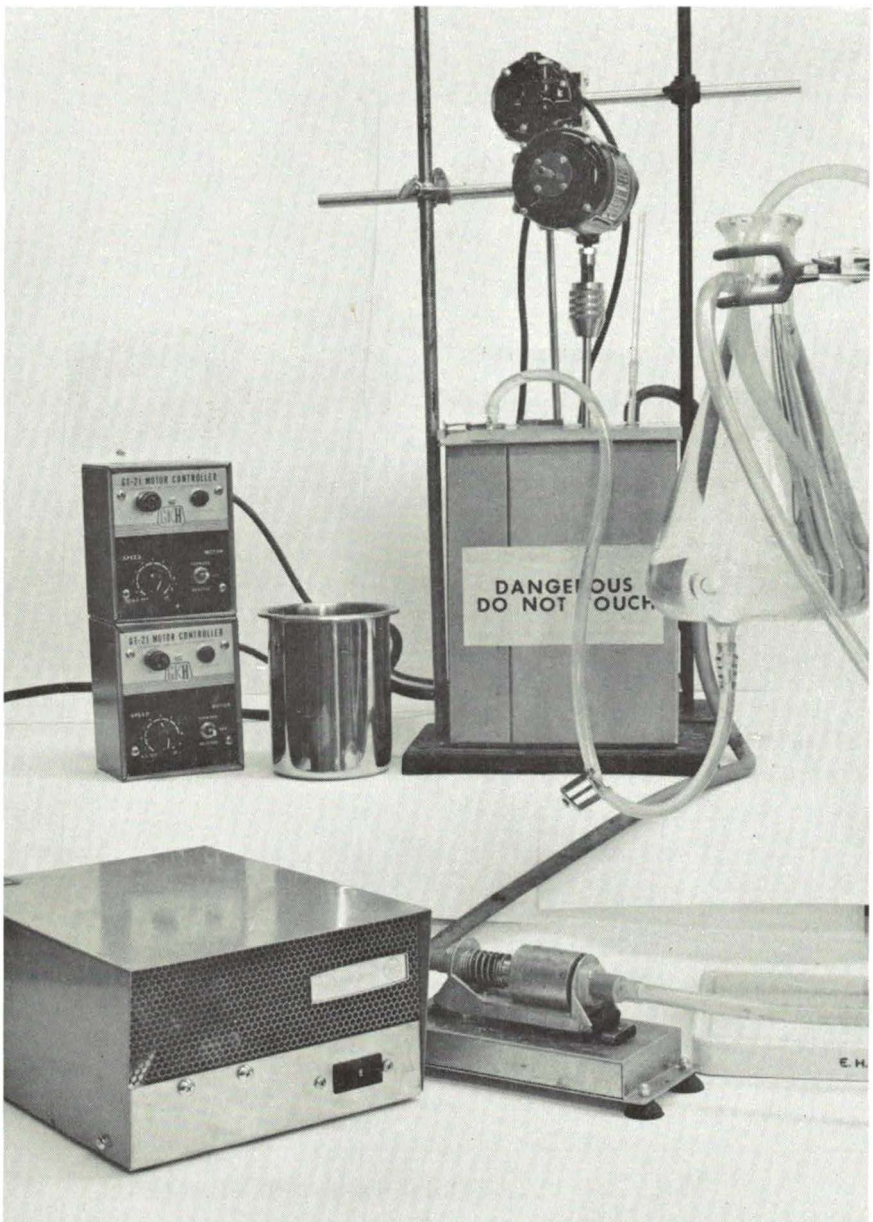


FIG. 2: GENERAL VIEW OF ULTRASONIC EQUIPMENT
AND WATER CIRCULATION SYSTEM

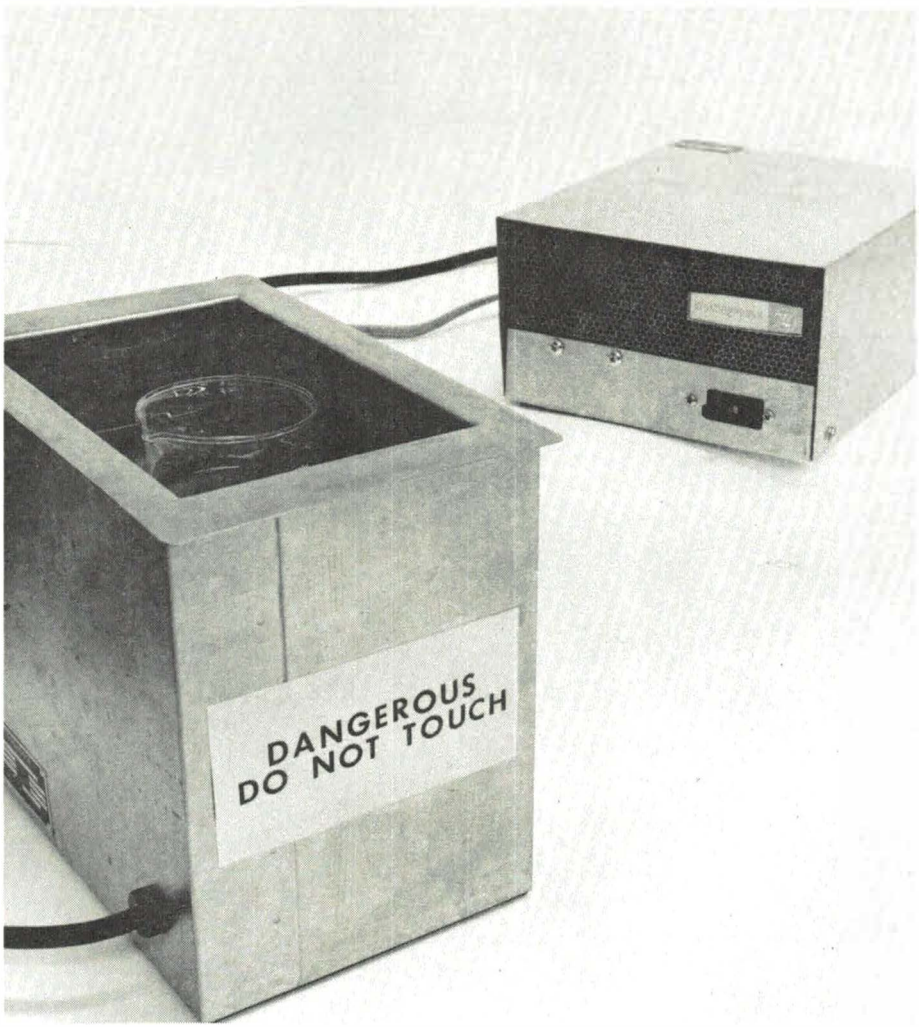
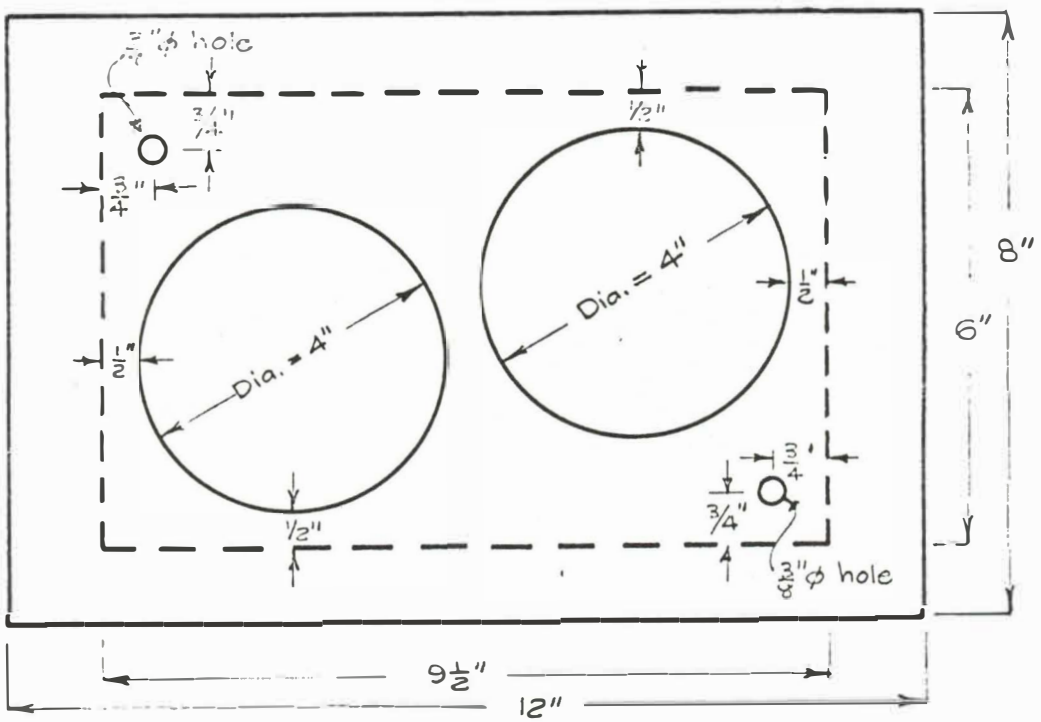
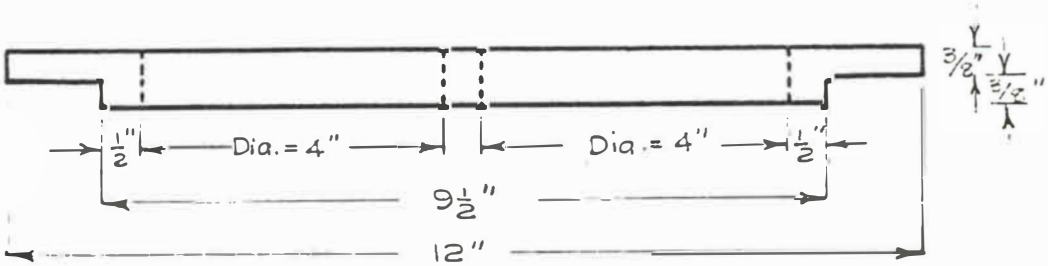


FIG. 3: ULTRASONIC TANK AND GENERATOR



A. PLAN VIEW



B. SIDE ELEVATION

FIG. 4: PLEXIGLAS PLATE DETAILS

Method of Test for
Preparation of Shales for Analysis - Atterberg Limits

OHD-L-30

SCOPE: The procedure described below is applicable to clay forming materials such as hardened clay soils, hard pan, shales, etc. It presents a method of preparing a sample of the material so that its index properties (plasticity and shrinkage) can be determined under the most critical conditions.

APPARATUS:

1. The Westinghouse Ultrasonic cleaning system is comprised of:
   a. Solid State Magnatrak (TM) 200 Watt generator
   b. 1.5 gallon capacity stainless steel tank with Magnapak (TM) transducers
2. Two 1000 ml. stainless steel beakers (4 inch diameter, 6 inch high)
3. Two stirrers
4. 1/2 gpm. reciprocating pump
5. 1000 ml. conical flask
6. 12" x 8" x 3/4" plexiglas plate
7. Rubber tubing
8. 500 ml. beakers

Items 3 through 7 are optional but they are recommended specifically for temperature control and greater efficiency.

PROCEDURE: The steps indicated below pertain to the sample preparation method for Atterberg limit tests (AASHO T 89-60, T 90-61, and T 92-60, ASTM Designation D-423-66, D-424-65, and D-427-67).

1. Spread the material obtained in the field in a thin layer and air dry it.
2. Using a rubber end pestle and mortar crush the material to pass the U.S. Standard Sieve No. 10.
3. Take approximately 250 gm. of material and separate into two near equal portions.
4. Transfer one portion into one 500 ml. beaker and the other portion into the other 500 ml. beaker.
5. Add 125 ml. of distilled water to each beaker containing the same and soak for 12 to 18 hours.

The samples are now ready for ultrasonic treatment.

6. Transfer the presoaked material to the 1000 ml. stainless steel beaker, making sure that all particles are transferred. Use as little additional distilled water as possible.
7. Place beaker (or beakers) in the ultrasonic tank and place plexiglas plate on it. Use adhesive tape to hold the plate firmly down to the tank and the the beaker (beakers).
8. Lower the stirrer along the center of the beaker until fins are about one inch above the bottom of the beaker.
9. Connect the stirrer to motor control and motor control to AC source.
10. Switch the motor on and run the stirrer at high speed. All the material should go into suspension; if it does not,

switch off the motor and lower the stirrer further in the beaker. After a few trials the desired position of stirrer can be determined in this way. Fix the stirrer in that position.

11. Run the stirrer at a medium speed which will prevent settling of the suspended particles.

12. Turn on the water source and pump. Adjust the flow of water until the inflow is slightly greater than the outflow. Any excess water will be drained off through the overflow outlet of the conical flask.

13. Connect the ultrasonic generator to the proper AC source and switch on the generator. Record the time as the generator is switched on since it marks the start of ultrasonic treatment.

14. At the end of one hour ultrasonic treatment time turn off the generator and water. When no more water is reaching the pump turn it off, too.

15. Remove the stirrer, adhesive tape, plexiglas plate and the beaker, in that order, from the tank. The material in the beaker is the required ultrasonically treated material.

16. Pour the treated material over a U.S. Standard Sieve No. 40.

17. Wash the material on the sieve with distilled wate and collect the filtrate.

18. Dry the filtrate in an oven at 200^{o} - 212^{o}F.

19. Crush the dried material to pass the U.S. Standard Sieve No. 40. Determine the Atterberg limits as specified by AASHO Designations T 89-60, T 90-61, and T 92-60, ASTM Designations D 423-66, D 424-65, and D 427-67.