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Standard Specification for Sampling Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis¹

This standard is issued under the fixed designation E 947; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

^{ε1} NOTE—Keywords were added editorially in April 1996.

1. Scope

1.1 This specification covers the basic requirements for equipment to be used for the collection of uncontaminated and representative samples from single-phase geothermal liquid or steam. Geopressured liquids are included. Fig. 1

2. Application

2.1 This specification covers only that equipment which is commonly used for the sampling of single-phase geothermal liquid or steam. It does not cover specialized equipment required for, and unique to, a specific test or method of analysis. The specification covers items such as valves, fittings, tubing, cooling coils and condensers, pumps, degassers, sample containers, sample probes, and packaging materials, but excludes equipment used in specific testing and analysis.

2.2 This procedure applies to single-phase steam or liquid streams prior to separation and to separated single-phase steam or liquid streams.

2.3 For most geothermal and geopressured fluids tested by the procedures outlined in this specification, both liquid and gas samples may be collected.

3. Sample Probes

3.1 Sample probes shall be used to extract liquid or steam from the main part of the geothermal flow rather than using a wall-accessing valve and pipe arrangement.

3.1.1 The probe permits the sampling of various positions within the flow to determine whether stratified or annular two-phase flow is present which would bias a single-point sample.

3.2 Sample probes shall be designed to extract representative samples from flowing systems. Special attention during construction of the probe shall be given to the stresses that the probe will later be subjected to during insertion into, and operation in, a pressurized flowing system.

3.3 The sampling probe (Fig. 2) passes through the sliding seal and access valve in order that liquid or steam can be

sampled from the mainstream of the flow line. Thereafter, the sample contacts only surfaces that the operator can verify are noncontaminating and nonabsorbing.

3.3.1 Moving the probe tip across the diameter of the pipe may allow the operator to determine the existence of stratification or multiphase sampling problems.

3.3.2 Flow regulation is accomplished downstream of the cooling coils in order to avoid residual flashing into steam at the point of pressure reduction. Flashing may cause scale deposition which would preclude the accurate determination of certain constituents.

4. Sampling Lines

4.1 *Safety*—Sampling lines shall be as short as practical and of sufficient strength to prevent structural failure.

4.2 *Construction*—All sample lines shall be constructed to eliminate traps in which condensate, entrained particulates, or scale precipitates might settle since they may be partially emptied with changes in flow conditions and may result in sample contamination. Allow for thermal expansion.

5. Valves, Fittings, and Gages

5.1 Valves which control access to the sampling point shall have straight throats (frequently designated as ball, plug, and gate valves). For flexibility of sampling, a minimum of

$\frac{1}{n\#}$ -in. diameter throat is recommended. This permits a probe to be inserted directly into the flow.

5.2 It is recommended that at least one full-port shut-off valve be placed on the downstream end of the sample probe so that the sampling line may be isolated when desired.

5.3 Throttling devices such as valves, capillary tubes, or orifices, if used, shall be placed at the sample outlet of the cooler or condenser. This practice will ensure cooling at the highest pressure and will minimize the possibility of fluid flashing or scale forming in the cooling coil. A head column such as that recommended for normal water and steam sampling (Specification D 1192, for Equipment for Sampling

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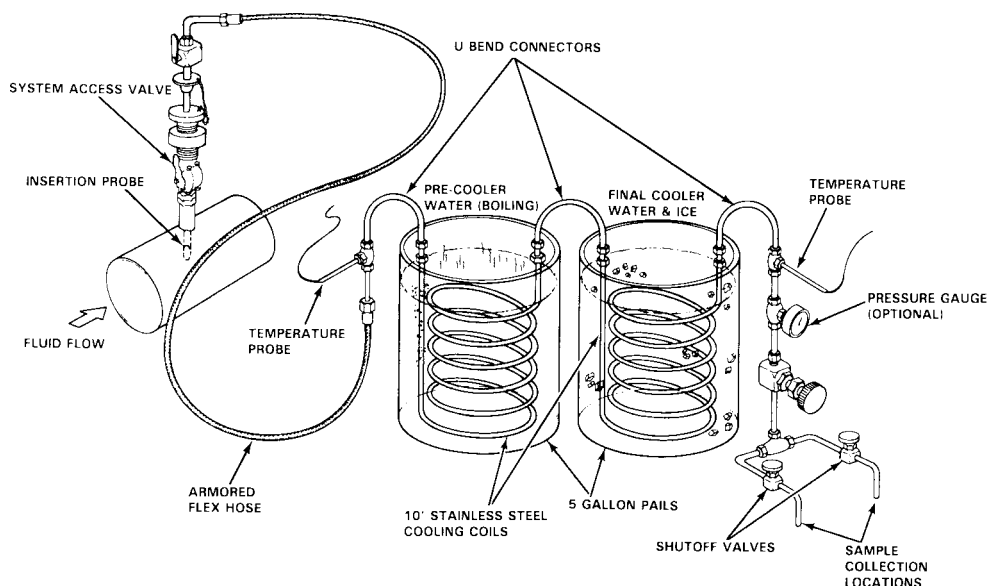


FIG. 1 Example Assembly (Particularly Suited for Liquid Flows)

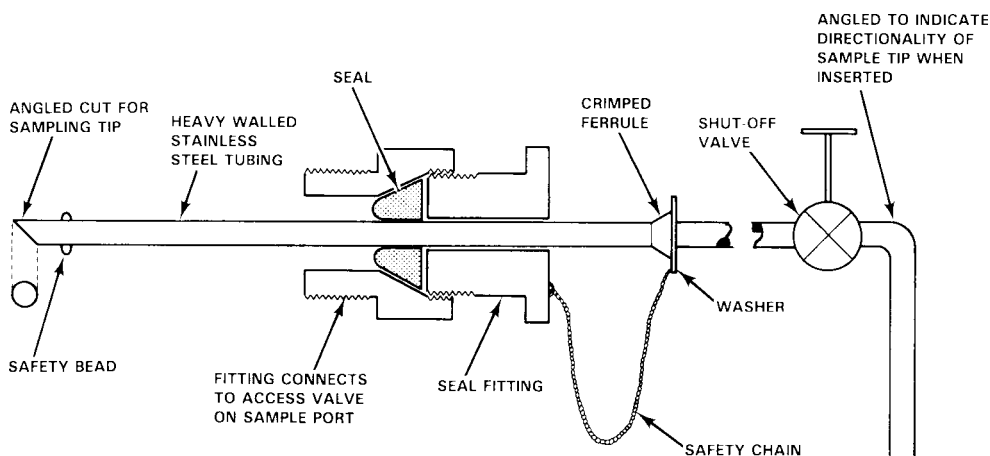


FIG. 2 Sample Probe

Water and Steam²) shall not be used because it provides a mechanism for gas separation and escape prior to sample collection.

5.4 Equipment adequate to determine the pressure and temperature of the mainstream liquid or steam flow shall be utilized.

6. Sample Cooler

6.1 The tube through which the sample flows shall be continuous through the cooling location so there will be no possibility of sample contamination or dilution from the cooling water. The internal diameter of the tube is suggested to be no larger than that of the sample probe so that storage within the coil is low and the time lag of sample through the cooling phase will be a minimum.

6.2 When the temperature of the sample is above the boiling point of water, it may be advantageous, in order to conserve

ice, to use a precooler containing water to lower the temperature of the sample before it enters the cooler. The temperature of the sample can then be controlled by the flow rate and the temperature of the final cooling bath (frequently an ice water bath).

7. Materials and Lubricants

7.1 Lubricants:

7.1.1 No lubricant shall be used in the collection containers, or their valves and seals, where it could contact the sample and bias the components of interest. This is particularly important if minor constituents are to be measured.

7.1.2 Other valves and moving parts in the sampling equipment that contact the sample should be lubricated to the minimum extent consistent with service life.

7.2 Materials:

7.2.1 In all cases, the sampling equipment shall be made of materials resistant to corrosion by the sample and that will not bias the results. Stainless steel, glass, and polymers are examples of materials that are generally satisfactory.

² Annual Book of ASTM Standards, Vol 11.01.