



Designation: D 6301 – 98

Standard Practice for the Collection of Samples of Filterable and Nonfilterable Matter in Water¹

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1. Scope

1.1 This practice is applicable for sampling condensed steam or water, such as boiler feedwater, for the collection of filterable and (optional) nonfilterable matter using 0.45- μm membrane filter (filterable matter) and ion exchange media (nonfilterable matter).

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 1066 Practice for Sampling Steam²
- D 1129 Terminology Relating to Water²
- D 1192 Guide for Equipment for Sampling Water and Steam in Closed Conduits²
- D 1193 Specification for Reagent Water²
- D 3370 Practice for Sampling Water from Closed Conduits²
- D 3864 Guide for Continual On-Line Monitoring Systems for Water Analysis²

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology D 1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *corrosion product sampler, n*—a device used to collect integrated samples of filterable and (as an option) nonfilterable matter. It consists of a flow totalizer that accurately measures the amount of sample passing through the device and a 0.45- μm pore size membrane filter. Adding a second filter holder for ion exchange resin impregnated membranes allows for collecting nonfilterable matter.

3.2.2 *filterable matter, n*—includes all matter that is removed by a 0.45- μm pore size filter.

3.2.3 *nonfilterable matter, n*—includes all matter that will pass through a 0.45- μm pore size filter and may be captured on anion, or cation ion exchange membranes, or both.

4. Summary of Practice

4.1 A typical sampling apparatus, commonly called a corrosion product sampler, is used to obtain integrated, representative samples of filterable and nonfilterable matter using a 0.45- μm membrane filter and ion exchange membranes. The sampling is accomplished at system operating pressure and sample temperature of $\leq 50^\circ\text{C}$. The practice utilizes a modified stainless steel high pressure filter housing to accommodate a 47-mm diameter filter (for filterable matter) and if desired, ion exchange membranes (for nonfilterable matter). The sample collection system (corrosion product sampler) is designed and operated specifically for quantitative determination of filterable and nonfilterable matter. An important feature of the sampler is the flow totalizer, which accurately determines the total volume of sample water which has passed through the sampler, regardless of changes in flowrate or pressure during the collection period. Control and pressure reducing valves and metering devices are downstream of the filter housing to eliminate the possible contribution of filterable and nonfilterable matter from these components to the sample stream. Additional flow may bypass the filter housing, so that flows within the sample lines are maintained within required range (see Guide D 3864). If a single sampling point is not representative due to lack of homogeneity in the process fluid (the water being sampled), multiple point sampling may be required.

5. Significance and Use

5.1 The transport of suspended and corrosion products from the preboiler cycle has been shown to be detrimental to all types of steam generating equipment. Corrosion product transport as low as 10 ppb can have significant impact on steam generators performance.

5.2 Deposited corrosion products on PWR steam generator tubes can reduce heat transfer, and, if the deposit is sufficiently thick, can provide a local area for impurities in the bulk water to concentrate, resulting in a corrosive environment. In BWR plants, the transport of corrosion products can cause fuel

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² *Annual Book of ASTM Standards*, Vol 11.01.

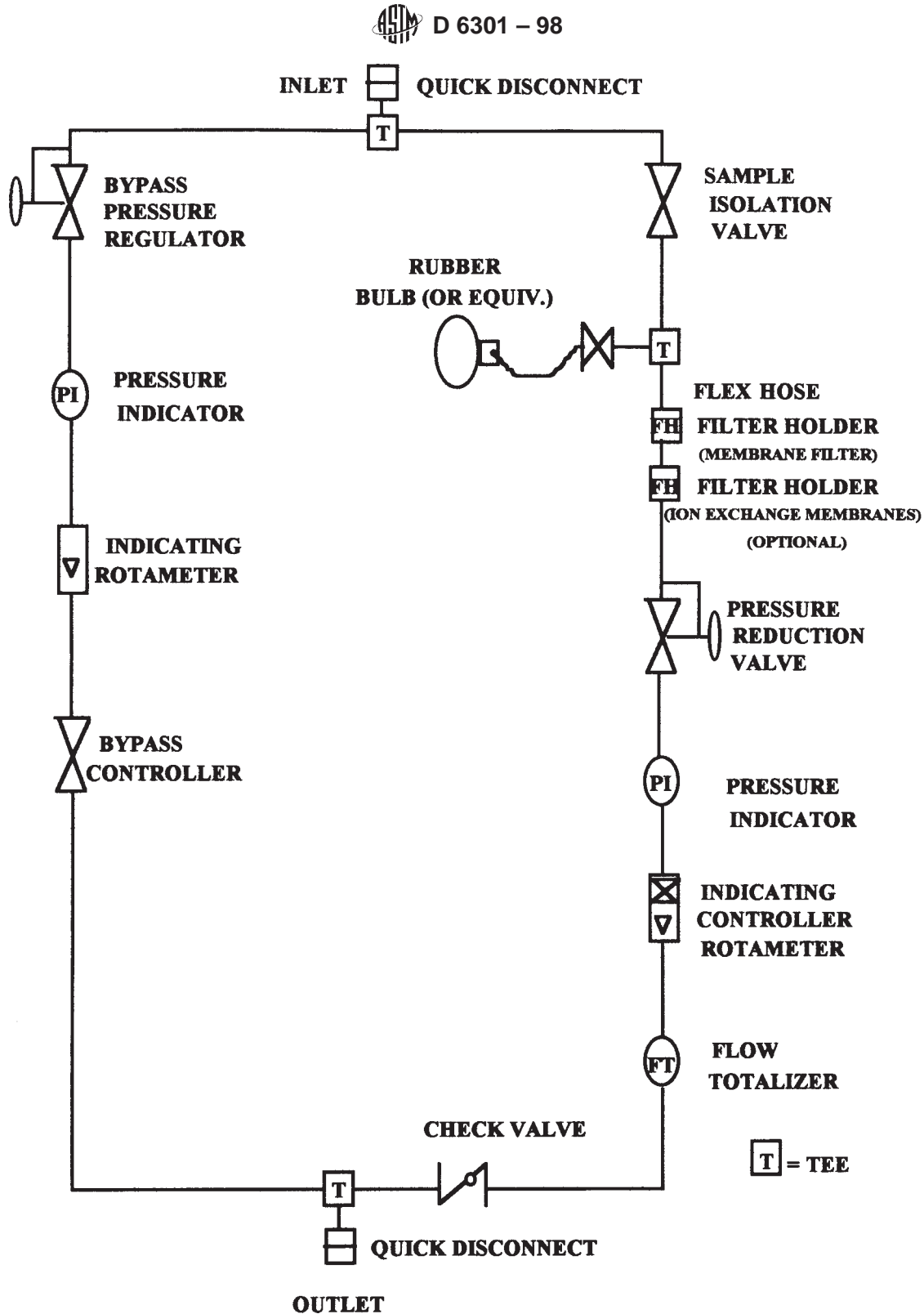


FIG. 1 Simplified Flow Diagram for Corrosion Product Sampler

failure, out of core radiation problems from activation reactions, and other material related problems.

5.3 In fossil plants, the transport of corrosion products can reduce heat transfer in the boilers leading to tube failures from overheating. The removal of these corrosion products by chemical cleaning is expensive and potentially harmful to the boiler tubes.

5.4 Normally, grab samples are not sensitive enough to detect changes in the level of corrosion product transport. Also, system transients may be missed by only taking grab samples. An integrated sample over time will increase the sensitivity for detecting the corrosion products and provide a better understanding of the total corrosion product transport to steam generators.

6. Interferences

6.1 The ion exchange capacity may be exceeded if an excessive volume of sample is passed through the ion exchange media.

6.2 The removal efficiency of the ion exchange media is flowrate and matrix dependent and could show variations from lot to lot.

6.3 Sample temperature greater than 50°C may have deleterious effects on the ion exchange media.

6.4 The corrosion products collected on the 0.45- μ m filter may be loose so care should be taken to prevent loss of sample.

6.5 Due to settling, or deposition, or both, in sampling lines with low velocity, flow in sampling lines must be turbulent and maintained at a velocity of 1.5 – 2.1 m/s (5–7 ft/s) (see also Guide D 1192).

7. Apparatus

7.1 *Sample heat exchanger*, made of such material that full system pressure can be maintained within the coil, and of such capacity that the water being sampled will be cooled to less than 50°C when the sampling flow rate is established (see Guide D 1192).

7.2 *Corrosion Product Sampler*—See Fig. 1, Simplified Flow Diagram.

7.3 *Flow Totalizer*—Water meter that will maintain $\pm 5\%$ accuracy over full range.

8. Reagents and Materials

8.1 *Reagent Water*—Reference to reagent water shall be understood to mean Type I reagent water conforming to Guide D 1193.

8.2 Anion resin impregnated membranes (47-mm diameter), optional.

8.3 Cation resin impregnated membranes (47-mm diameter), optional.

8.4 *Membrane Filters*, (47-mm diameter), 0.45- μ m pore size, without grid.

8.5 *Petri Dishes*, large enough to hold the 47-mm filters.

9. Calibration

9.1 Calibrate the flow totalizer following the manufacturer's recommendation.

10. Procedure

10.1 If subsequent chemical analysis of collected filterable/nonfilterable material is desired, record the lot numbers of the ion exchange membranes. Prepare sample blanks from same lot.

10.2 Install filter and optional ion exchange membranes in filter holder so that the sample goes through the filter first, taking care to ensure that they are centered. If necessary, use a few drops of water to wet the membranes to help hold them in place.

NOTE 1—If two filter holders are used, the filter membrane should precede the ion exchange membranes in the second holder.

10.3 Install top of the filter housing, taking care not to disturb membranes.

10.4 With the sample “indicating controller rotameter” closed, slowly open the sample isolation valve. Take the initial flow totalizer reading.

10.5 Slowly increase flow through filter holder to the desired settings. Select the flowrate not to exceed the capacity of the ion exchange papers, if used (the normal flow range is 80 to 200 mL/min).

10.6 Collect the sample using Practices D 1066 or D 3370. Maintain flow constant throughout the incoming line and through the filter holder.

10.7 Slowly isolate and depressurize the corrosion product sampler at the end of the collection period. Record the final totalizer reading.

10.8 Remove excess water from the filter housing by draining it or by purging it with a small amount of air (see Fig. 1, rubber bulb).

10.9 Remove the top of the filter housing, taking care not to disturb collected material.

10.10 Remove membranes from filter housing. Use Petri dishes to store membranes. Membrane filters, anion ion exchange membranes, and cation ion exchange membranes should be stored in separate Petri dishes.

10.11 Analyses of the membrane filters or of the ion exchange membranes may be accomplished by a variety of methods following appropriate sample preparation technique. Preparation should be consistent with the method of analysis, and is beyond the scope of this practice. Refer to the specific method of analysis for specific guidance and information on preparation, sample storage, etc.

11. Keywords

11.1 corrosion products; corrosion product sampler; filtration; integrated sample; ion exchange membranes



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