Atmospheric Foam Slurry Preparation

Procedure No.: WM-GL-HES-QM-433.030

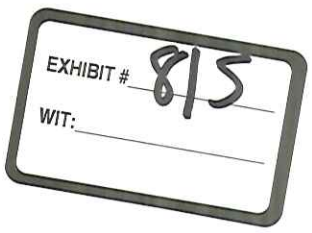
Description

This procedure contains instructions for preparing atmospheric foam slurries for testing.

Equipment

Item	Specifications	Quantity
Variable speed mixer	a constant-speed mixer with variable speed capability as specified by API or a variable speed adapter used with a mixer without speed control	1
Waring blender (2-qt.)[a]	Part No. 100021755 (115-volt) Part No. 70.08550 (230-volt)	1
Sealable mixing container	(Eberbach Catalog No. 8520, VWR Scientific Catalog No. 58984-030 or equivalent); Fann No. E4013, SAP # 204429 see Figure 3.11, Page 3-56.	1
Multiple blade kit for the sealable mixing container	Part No.100072106; see Figure 3.11, Page 3-56.	1
Container of known volume	for determining density of foamed slurry	1 per mix
Scale	with accuracy to at least 0.1 g	1
Spatula	with a blade that is 4 in. or larger	1

[a]In most cases, a 2-quart (2L) mixer is required to contain the volume of unfoamed slurry.



Atmospheric Foam Slurry Testing

Procedure No.: WM-GL-HES-QM-433.040

Description

This procedure provides instructions for testing foam cement specimens for foam stability, compressive strength, fluid loss, thickening time, and permeability at temperatures below 194°F (90°C).Testing of foam slurry above 194°F (90°C) should be performed with the MACS analyzer according to Procedure 433.080. Some of these procedures are now included in the current edition of API RP 10B-4/ISO 10426-4.

Equipment

Item	Specifications	Quantity
Sealable mold	2-in. cube mold with a cover clamped to the top OR plastic cylinder mold with sealable top	1
Graduated cylinder (glass)	250 mL, 100 mL TC, 50 mL TC, or widemouth 100 mL TC	1
Stability test device	See Figure 3.12, Page 3-62	1-2

Procedure

Foam Stability Test for Slurry at Ambient Conditions

To check the foam stability at ambient conditions using the preferred stability curing methods, perform the following steps:

1. Pour the foamed slurry into the standard 250-mL graduated glass cylinder that is used for free fluid testing.
2. Cover the cylinder to prevent drying or dehydration of the sample.
3. Place the cylinder on a countertop and check the slurry periodically over a 2-hour period for changes in appearance, noting such changes as free fluid, streaking, solids settling, bubbles concentrated in specific area, thixotropic properties, etc.

If the 250-mL cylinder is not available, use one of the following stability curing methods:

- Perform the above test in a smaller graduated glass cylinder. Standard 50-mL to contain (TC), standard 100-mL TC, or widemouth 100-mL TC cylinders will suffice.
- Perform the above test in an open-top sample container or in a plastic container with a lid. Inspect the top surface at the end of the 2-hour test period. If the open-top container is not covered, some drying may occur, resulting in a small decrease in height.

4. After 2 hours, perform the following density measurements:
   a. Remove small portions from the top, middle, and bottom of the sample with a large syringe with a Tygon tube attached.
   b. Transfer the slurry to a smaller graduated cylinder to determine the weight of a known volume.
   c. Calculate the density using the equation on Page 3-57.

Table 3.1—Signs of Foam Instability When Prepared at Various Temperatures

Appearance	Unset Slurry at Ambient Temperature	Set Specimens
More than a trace of free fluid	X	—
Bubbles on surface or bubble coalescing (breaking, enlargement, merging	X	X
Excessive column-height reduction	X	X
Signs of density segregation (streaking or dark coloration from top to bottom)	X	X
Large variations in density between top and bottom of sample	X	X

Set Foam Stability Tests

The temperature increase during cement curing causes expansion of the gas phase. To prevent this expansion, a cell with a clampable lid is required for curing foam at elevated temperatures. The following sections describe two curing methods. Method 1 is sufficient for curing foam slurry at temperatures below 150°F (65°C). Method 2 is specially designed to prevent excessive foam expansion at temperatures up to 194°F (90°C). Method 2 can be used at any temperature less than 194°F (90°C).

Method 1 for Test Temperatures < 150°F (65°C)

Check the foam stability of set foamed cement by performing the following steps:

1. Cure samples until they are set for density gradient measurement throughout the sample.
2. Use a nongreased, covered, 2-in.-diameter × 4-in.-tall cylinder or any appropriate covered container.
3. Cure samples at ambient conditions or in a heated waterbath (maximum temperature of 150°F) by clamping the lids of the curing container to prevent foam expansion.
4. Cut or break the samples into sections, mark each section's location within the sample, from the top to the bottom, and measure the specific gravity of each section.

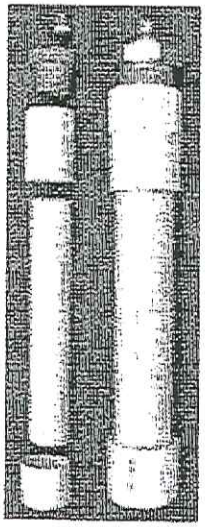


Figure 3.12—Foam stability test device showing individual components, left, and sealed, right

8. Place the samples vertically into a heated waterbath or oven and cure until they are set.
9. Cut the curing device into multiple sections (3 sections are recommended). Carefully cut PVC longitudinally along each segment and remove the sample from the PVC.
10. Inspect the sample for signs of instability.
11. Mark the sections from the top to the bottom. If the samples are to be used for compressive-strength determination, ASTM recommends that the samples be cut with a 2:1 length-to-diameter ratio.
12. Determine the specific gravity of each section by the Archimedes principle, as described in the previous test.

Caution—DO NOT cut the specimen with a saw that uses water. The specimen could absorb water, changing the density of the specimen. Large variations in density from sample top to bottom indicate instability (see Table 3.1, Page 3-60).

Compressive Strength Tests

The compressive strength of foam slurry created in the multiblade foam blender may be tested with the following procedure:

1. Pour the atmospherically prepared foam cement into a sealable mold.
   - For curing foam samples at low temperatures [<150°F (65°C)], cells such as nongreased 2-in. by 4-in. plastic cylinders or standard 2-in. cube molds (with lids or covers clamped in place) may be used.