Evaluation of Wildland Fire Chemicals

STANDARD TEST PROCEDURES

STP 4.6 Marsh Funnel

Summary: The Marsh Funnel was developed to provide a field measurement of the apparent viscosity of clay-thickened drilling mud.

Provided that a conversion table has been developed, a modified Marsh Funnel can be used to provide a measure of apparent viscosities for gum-thickened and polymer-thickened products used in wildland fire operations.

Without a conversion table, the flow-through times can be used to determine batch to batch consistency of a single product, and in limited circumstances to compare similar products.

The directions for use of a Marsh Funnel are given below. The procedures for modifying the Marsh Funnel for use in determining the viscosity of long-term retardants (Forest Service modification) and the consistency of water enhancers (California Department of Forestry and Fire Protection, CDF modification) are provided in the following pages.

Materials:

Marsh Funnel (Use small tip, 3/16" diameter, for low-viscosity products such as Phos-Chek 259 or Phos-Chek LC-95A. Use the large tip, 17/64" diameter, for high-viscosity products such as Phos-Chek D75.)
Container marked to 1 quart, a tall straight-sided container is best
Stopwatch or timer with a "time up" function
Thermometer

Method:

1. Allow the test sample to stand until it reaches room temperature (70°F) and all air bubbles are dissipated since both of these factors have an influence on viscosity.
2. Ensure that the properly modified funnel is clean and dry and secured in an upright position (a ring stand works fine).
3. Cover the funnel orifice with a finger while pouring the test sample through the screen until the sample exactly reaches the bottom of the screen. Water enhancers should be poured around the screen as they may clog the screen rather than running through.
4. Keeping the funnel over the measuring container, remove finger from the orifice and at the same time start the timer.
5. Measure the time required for exactly 1 quart (946 ml) of the test sample to flow out of the funnel.
6. Record the flow-through time and the temperature of the test sample.

Reference:

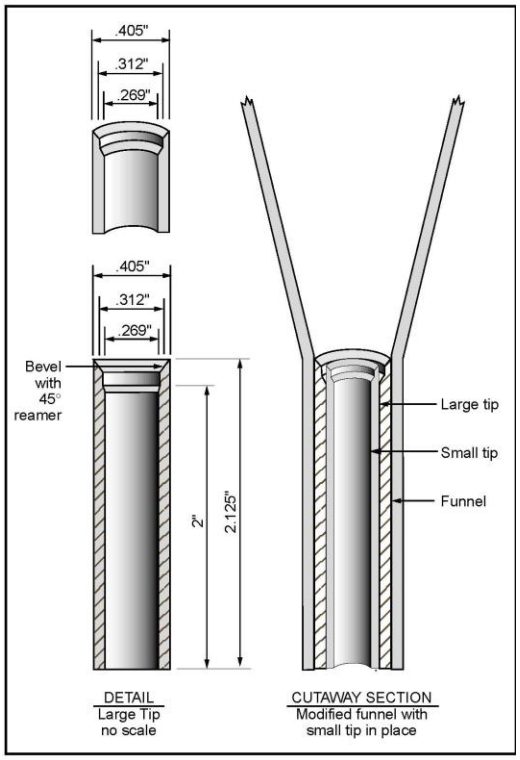
American Society for Testing and Materials. Standard Test Method for Marsh Funnel Viscosity of Clay Construction Slurries; D6910-04.

Marsh Funnel – Forest Service Modification

Summary: The orifice of the original Marsh funnel tip is too small for determining the viscosity of most long-term fire retardants. Instructions for modifying the Marsh funnel for use with higher viscosity materials are described below. The figure shows the details of the modification.

Method:

1. Use new, or freshly-sharpened, high-quality twist drills for the modification.
2. Remove the original 1/4-inch outside-diameter brass tip. Drive the tip out with a 1/4-inch punch or similar tool, taking care not to damage the brass tip.
3. Save the original brass tip as it can be used to measure the viscosity of some of the lower viscosity materials.
4. Enlarge the hole in the plastic funnel with a 13/32-inch drill bit, leaving a smooth surface inside the funnel. Use a guide to ensure a vertical hole, drilling slowly to prevent overheating the plastic.
5. Make a new tip from a 2 1/8-inch section of 1/8-inch regular seamless red brass pipe. The dimensions are nominally 0.405-inch outside diameter and 0.269-inch inside diameter.
6. Enlarge the hole at one end of the new tip to 5/16-inch and to a depth of 1/8-inch. Taper the inside of the enlarged end of the tip with a 45-degree reamer. Ensure that after reaming, the tip end is smooth and the overall length of the tip has not changed.
7. The flared end of the original tip should now fit neatly into the enlarged end of the larger tip.



8. Insert the large tip, machined end up, in the Marsh funnel and fix into place using a waterproof adhesive. If the fit is tight, allow the lower end of the funnel to soften and expand by warming it in hot water (not boiling) for a few minutes.

Marsh Funnel – CDF Modification

Summary: The orifice of the original Marsh funnel tip is too small for determining the viscosity of enhanced water mixtures.

The California Department of Forestry and Fire Protection (CDF) modified a standard Marsh funnel for use with these higher viscosity materials. The instructions for making the modifications are described below and shown in the figures.

Method:

1. Cut 3 3/4 inches off the tip of the funnel with a saw.
2. Glue a 3/4-inch threaded PVC bushing into the opening
3. Obtain several 3/4-inch threaded PVC plugs (sizes 3/8 inch, 5/16 inch, 1/4 inch, and 3/16 inch) that can be threaded into the bushing to change the inside diameter of the tip.
4. Label the plugs with the diameter of the hole.

To use:

1. Screw the appropriate size tip into end of funnel:
2. Follow the general instructions on page 1.