



# HYDROGEN SULFIDE SCAVENGING

## EQUIPMENT & CHEMICALS

Equipment	Product Code
1. Garrett Gas with H <sub>2</sub> S Dräger tubes & floating ball flow meter & CO <sub>2</sub> gas cartridges	EX1360
2. Sulfuric acid (5N)	EY1210
3. Dropper bottle with octanol defoamer or equivalent	EY1050
4. Hypodermic syringe (10 mL with 21 gauge needle)	EN3334
5. Two, minimum 400 mL jars with lids	
6. Osterizer blender, blade type, 10 speed	
7. Filter press	
8. Fresh sodium sulfide, (Na <sub>2</sub> S) stock solution (100 g Na <sub>2</sub> S per liter)	EY1200

## TEST PROCEDURE

1. Label two jars "A" and "B".
2. Measure 350 mL of drilling mud into jar "A".
3. Measure 350 mL of distilled water into jar "B".
4. Measure 20 mL of stock sodium sulfide (Na<sub>2</sub>S) solution into each jar, close both jars and shake vigorously by hand for thirty seconds. Transfer the contents of jar A to the Osterizer mixing jar, replace the lid, and stir at the slowest speed for 15 minutes. Transfer the drilling mud - H<sub>2</sub>S system back to jar A.

NOTE: Some drilling muds will thicken severely when the Na<sub>2</sub>S solution is added. If thickening occurs add a dispersant from rig stock at about 3 kg/m<sup>3</sup> (roughly a cone shaped pile on a dime). If thickening is observed during the first of a series of tests the mud should be pre-treated with dispersant prior to Na<sub>2</sub>S addition.

5. Extract 10 mL of dilute sodium sulfide (Na<sub>2</sub>S) stock solution from jar "B" and label this filtrate "B".
6. Prepare the Garrett Gas Train for testing as outlined below:
  - Be sure the gas train is clean, dry and on a level surface. NOTE: Moisture in the flow <sub>2</sub> can cause the ball to float erratically.
  - With the regulator T-handle backed off, install and puncture a CO<sub>2</sub> gas cartridge.
  - Add 20 mL distilled water to chamber No. 1. (The chambers are numbered beginning at the regulator.)

# HYDROGEN SULFIDE SCAVENGING

- Add 5 drops of octanol defoamer to chamber No. 1.
  - Install the top on the gas train and evenly hand tighten to seal all O-rings.
  - Select a high range Dräger tube, ( $\text{H}_2\text{S}$  0.2%/A, tube factor is 1500), for installation.
  - Break off the ends of the tube, apply Lubriseal to both ends and install the tube with the arrow pointing downward into the bored receptacle. Likewise, install the flow meter with the word "TOP" upward. (Be sure O-rings seal around the body of each tube.)
  - Attach the flexible tubing from the regulator onto the dispersion tube of chamber No. 1 and from the outlet tube of chamber No. 3 to the Dräger tube. NOTE: Use only latex rubber or inert plastic tubing. Do not clamp tubing unclamped tubing provides a pressure relief in the event the gas train is overpressured.
  - Adjust the dispersion tube of chamber No. 1 to within 5 mm from the bottom.
  - Flow  $\text{CO}_2$  gas gently through train for 10 seconds to purge system of air. Stop gas flow.
7. Proceed to the Garrett Gas Train operating procedure outlined below:
- Using the hypodermic syringe, inject 4.0 mL of filtrate ("B") into chamber No. 1.
  - Slowly inject 10 mL 5N sulfuric acid solution into chamber No. 1 through the septum using the syringe and needle.
  - Immediately restart  $\text{CO}_2$  flow. Using the regulator, adjust the flow so that the ball remains between the two lines on the flow meter tube. NOTE: One  $\text{CO}_2$  cartridge should provide 15-20 minutes of flow at this rate.
  - Observe a color change on the Dräger tube. In the units marked on the tube, note and record the maximum darkened length before the front starts to smear. Continue flow for 15 minutes although the front may attain a diffuse, feathery coloration. On the high range tube an orange color may appear ahead of the black front if sulfites are present. The orange region should be ignored when recording the darkened length.
8. Label the darkened, stained length as "B".
9. Filter the mud ("A") to obtain at least 4 mL of filtrate, label filtrate "A".
10. Clean the gas train:
- Remove the flexible tubing and gas train top.
  - Take the Dräger tube and flow meter out of the receptacles and plug the holes with stoppers to keep them dry.
  - Wash out the chambers using a brush with warm water and mild detergent. Use a pipe cleaner to clean the passages between the chambers.
  - Wash, rinse and then blow out the dispersion tube with air or  $\text{CO}_2$  gas. Rinse the unit with distilled water and allow to drain dry.
11. Run the gas train using 4.0  $\text{cm}^3$  of filtrate "A" (from the mud) repeating paragraphs 6 and 7. Label the darkened length "A".
12. Be sure to clean gas train after each test.

# HYDROGEN SULFIDE SCAVENGING

## CALCULATION

Approximate  $\text{kg/m}^3$  zinc carbonate =  $0.44 \times$  maximum number milliliters sodium sulfide solution used.

$\text{mg/L H}_2\text{S scavenging ability} = 375 (B-A)$

$\text{kg/m}^3 \text{ zinc carbonate} = 0.0037 \times \text{mg/L H}_2\text{S scavenging ability}$

**WARNING:** The reagents in the kit may be hazardous to the health and safety of the user if inappropriately handled. Please read all warnings before performing the test and use appropriate safety equipment.

**NOTE:** The  $100 \text{ g/L Na}_2\text{S}$  solution can deteriorate with time. If the  $4.0 \text{ cm}^3$  of filtrate "B" results in Dräger tube dark lengths, which are too short, the filtrate volumes can be increased. If filtrate sample volume is indeed increased the equation used to calculate  $\text{H}_2\text{S}$  scavenging ability is changed from:

$\text{mg/L H}_2\text{S scavenging ability} = 375 (B - A)$

to:

$\text{mg/L H}_2\text{S scavenging ability} = 1500 (B - A) \text{ new volume (ml)}$