

# Recommended Practice for Shale Shaker Screen Cloth Designation

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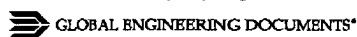
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**Note:**

This third edition supersedes the second edition of RP 13E dated May 1, 1985 and represents changes adopted at the 1992 Standardization Conference, and subsequently approved by letter ballot.

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## FOREWORD

- a. This recommended practice is under the jurisdiction of the API Committee on the Standardization of Drilling Fluid Materials.
- b. The purpose of this practice is to provide standard procedures for the labeling of shale shaker screen cloths. It is not a manual on solids control procedures. It provides a method for the direct comparison of the majority of the currently available screen cloths, independent of the type of machine on which they are installed or the type of screen configuration (i.e. square weave, oblong weave, layered, or panel design).
- c. This recommended practice is organized such that the recommended label, its position and the information required to be included on the label are described first. The procedures used to obtain the information for the label are then described and example calculations are shown.
- d. Use of the practice will allow direct comparison of screens on parameters such as separation potential, the ability of a screen to pass fluid, and the amount of area available for screening. From these values other comparative performance characteristics can be calculated at the discretion of the user. With this information, the user can select the screen type that most adequately suits the needs of the operation.
- e. Additional publications under the jurisdiction of this committee include:
  - Spec 13A Specification for Drilling Fluid Materials
  - RP 13B-1 Recommended Practice Standard Procedure for Field Testing Water Based-Drilling Fluids
  - RP 13B-2 Recommended Practice Standard Procedure for Field Testing Oil Based-Drilling Fluids
  - Bul 13C Bulletin on Drilling Fluids Processing Equipment
  - Bul 13D Bulletin on the Rheology of Oil Well Drilling Fluids
  - RP 13G Recommended Practice for Drilling Mud Report Form
  - RP 13I Recommended Practice for Laboratory Testing of Drilling Fluids
  - RP 13J Recommended Practice for Testing Heavy Brines
  - RP 13K Recommended Practice for Chemical Analysis of Barite

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## SECTION 1 SHAKER SCREEN LABELING

### 1.1 Description

- a. Oil field shaker screens are manufactured in a number of configurations. This diversity in manufacturing causes considerable confusion about the performance characteristics of each type of screen. Consequently, selecting the proper screen for a particular application frequently becomes a matter of trial and error.
- b. In order to provide a common ground for comparing the separation characteristics of different types of screens, a tag will be affixed to the screen in such a position that it will be both visible and legible after the screen is installed in the shaker. The exact placement of the tag and its material composition are left to the discretion of the supplier. The information contained on the tag will be recorded in such a manner that it will remain indelible for the life of the screen.
- c. The components of the designation system provide a complete description of the screen's identification and performance parameters. The designation system consists of the following elements:

Manufacturer's Designation

Separation Potential ( $d_{50}$ ,  $d_{16}$ ,  $d_{84}$  "Cutt" points)\*

Flow Capacity (Conductance and Total Non-Blanked Area)

### 1.2 Manufacturer's Designation

The manufacturer's designation is the combination of letters and numbers used by the manufacturer to describe the screen. The information contained in this designation will depend upon the individual manufacturer and may contain the screen panel type, composition, and other information deemed essential by the manufacturer.

### 1.3 Separation Potential

- a. The separation potential of the screen is recorded in terms of the  $d_{50}$ ,  $d_{16}$ , and  $d_{84}$  "Cutt" points. The "Cutt" points are the spherical diameters corresponding to the ellipsoidal volume distribution of the screen's opening sizes. The separation potential of a screen is presumed to be directly related to this distribution. This is usually a valid assumption since the relative separation efficiency of shaker screens must be related to the size of their openings. "Cutt" point measurements are described in Section 3.

**\*NOTE:** The terminology "Cutt" (pronounced "koot") point is used to differentiate separation potential from the traditional particle size cut points normally associated with separation devices. The terminology recognizes the efforts of the individual who first applied the technique to shaker screen cloths and published the results in SPE Paper #22570, "Shaker Screen Characterization Through Image Analysis."

- b. The term "separation potential" is used because the experimentally determined grade separation efficiency curve will not necessarily agree with the separation potential curve. Factors such as solids loading, fluid viscosity, shaker dynamics, and drill cuttings shape

will have a considerable effect on the experimentally determined grade separation efficiency. However, the ranking of each screen's relative separation ability under similar conditions will be in agreement between the two methods. Because separation potential is a function of only the screen composition, it provides a constant scale by which to rank the separation performance of shaker screens.

- c. The  $d_{50}$  "Cutt" point is the median, volume distribution of the opening (aperture) sizes, in microns. In relation to grade separation efficiency, the  $d_{50}$  "Cutt" point is comparable (but not identical) to the  $d_{50}$  cut point commonly used to represent the size of solid that has a 50% probability of removal by a device. Because of its importance, it is listed before the  $d_{16}$  and  $d_{84}$  values.
- d. The  $d_{16}$  and  $d_{84}$  "Cutt" point values are used to indicate the range of screen aperture sizes present in the screen. They represent the size of the 16th and 84th percentiles of the volume distribution of the aperture sizes in the screen.

As the difference between these two values increases around a common  $d_{50}$  point, the slope of the separation potential curve becomes less vertical. This implies that a larger total volume percentage of finer solids will be removed and that a larger percentage of solids coarser than the  $d_{50}$  size will not be removed. Triple-layer screens will generally have a larger spread between the  $d_{16}$  and  $d_{84}$  points than a single square mesh screen with the same  $d_{50}$  size. These values can be significant when the removal of fine solids from an unweighted mud is important or when the unwanted removal of barite from a weighted mud is a concern.

- e. Flow capacity is the rate at which a shaker can process mud and solids. It is a function of many variables including shaker configuration, design and motion, mud rheology, solids loading, and blinding by near size particles. This is an extremely complex system for which no satisfactory model currently exists. However, for a given shaker under constant conditions, flow capacity is largely controlled by the screen parameters of conductance and area.

Conductance, measured in units of kilodarcies/ millimeter, defines the ease with which fluid can flow through a unit area of screen. In very simplistic terms, it can be thought of as the permeability of the screen. Conductance is calculated from the mesh count and wire diameters of the screen.

The area available for screening is the net unblocked area, in square feet, that will permit the passage of fluid. Some screen designs may eliminate as much as 40% of the gross screen panel area from fluid flow due to backing plate and bonding material blockage. The total non-blanked area of a shaker screen panel is therefore important when considering the flow capacity of the screen.

## SECTION 2

### SHAKER SCREEN SEPARATION POTENTIAL

#### 2.1 Description

- a. This procedure is a method for determining the separation potential of shale shaker screens through the visual analysis of their openings, or apertures.

#### b. Definitions

**Aperture** the opening between the wires in a screen cloth.

**Martin's Radii** the distance from the centroid of an object to its outer boundary. The direction of this measurement is specified by the azimuthal orientation of the line (The radii in the 0°, 90°, 180°, 270° angle from horizontal).

**pixel** the smallest unit of a video picture, composed of a single color or grey level.

**separation potential** the relative potential grade efficiency of a screen composition as defined by the ellipsoidal volume distribution of its openings as a function of spherical diameter, also called the "Cutt" point distributions.

**shute** in a woven cloth, the direction of the wires running perpendicular to the loom.

**warp** in a woven cloth, the direction of the wires running parallel with the loom.

#### 2.2 Equipment

- a. **Image Analyzer System:** An image analyzer processes and dimensionally analyzes the raster graphics images produced by a video camera and captured by a video image converter (frame-grabber). Most image analyzer systems use two monitors: one for viewing the video image of the subject material and the second for display of input/output test data of the PC software.

Several PC-based image analyzer systems are commercially available. For this application, the image analyzer software must provide the capability to simultaneously measure the Martin's Radii dimensions of up to 50 screen apertures per image. This dimensional data must be made available in an ASCII or spreadsheet-compatible format for subsequent manipulation. The camera, frame-grabber and display monitor must provide a minimum resolution of 512 x 512 pixels.

- b. **Microscope:** The resolution of the image analyzer system is primarily linked to the microscope magnification. For accurate dimensional analyses of typical screen cloth samples with up to 460 openings per lineal inch, a wide field microscope such as the Olympus SZH Zoom Stereo Microscope equipped with a phototube and the following optics is required:
- Specifications: Objective: 1x, 2x  
 Zoom: 7.5 to 64x  
 Photo eyepiece: 2.5x, 3.3x, 5.0x

- c. **Illuminator Table:** A light table with sufficient illuminated area to support and backlight the screen sample is required to enhance contrast between the wires and the apertures in the cloth.

- d. **Video Camera:** The video camera captures the magnified image from the microscope and feeds a raster graphics image to a frame grabber board within the minicomputer for image processing and display on a television monitor. The frame grabber is usually supplied as part of the image analysis system. Refer to the image analysis system manufacturer's recommendations regarding minimum camera requirements for this application.

- e. **Example Equipment List:** The following equipment or equivalent can be used for this procedure:

Computer: IBM-Compatible 386 MHz with  
 - 2Mb RAM, Math Coprocessor  
 - VGA Monitor

- Frame Grabber Board with 512 x 512 pixel resolution

Software: Olympus Cue-2 Image Analyzer  
 Lotus 123 Spreadsheet

Microscope: Olympus Model SZH  
 Olympus MTV 3 Phototube Boom Mount

Optics: Olympus DF Plan 1x Objective  
 Olympus DF Plan 2x Objective  
 NFK 2.5x Photoeyepiece  
 NFK 3.3x Photoeyepiece  
 NFK 5.5x Photoeyepiece

Video Camera: Dage-MTI CCD72

Video Monitor: Sony PVM 1910 Color Video Monitor

Illuminator Table: Aristo HF-810

#### 2.3 Procedure — Image Analyzer Calibration

Calibrate the image analyzer to the microscope magnification prior to analyses in both the x and y direction using standard microscope calibration slides. Refer to the calibration instructions for the specific image analysis system in use.

#### 2.4 Procedure — Sample Preparation

- a. Oil field shaker screens can be composed of one to three layers of screen cloth. Include only the top two layers of any composition in the analysis. The third "backing cloth" does not significantly affect a triple-layer screen's separation potential. Its inclusion will cause errors and depth-of-field problems during analysis.

Include both layers when screens are composed of a single screening mesh over a backing cloth. Although the backing cloth will not normally influence separation potential, it can begin to have an affect as its mesh count begins to approach that of the top cloth.