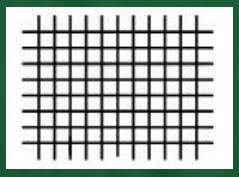
Introduction

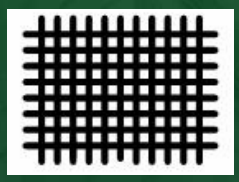
API RP 13C is a revision to and replaces API RP 13E

- Separation
  - "Mesh" was accepted as the screen descriptor
  - Theoretical test for determining cut point at D16, D50, and D84
  - Based on optical measurements of the screen opening
- Conductance
  - Individual screen layers were tested and mathematically combined to calculate conductance
  - New test uses a section of an actual screen panel to determine conductance

Mesh Definition

- "Mesh" referred to the number of openings per linear inch in a screen, counted in both directions from the center of a wire
  - It did not tell you anything about the size of particles removed
- Size of solids moving through a screen depend on the size of the openings in a screen
  - Due to the difference in wire diameters, the screen on top will have a greater flow capacity but will also return more solids to the drilling fluid





Reason for the Change

- Inconsistent screen labeling across manufacturers
- Pressure from operators to establish a uniform, accurate screen labeling procedure
- To enable you to easily compare screens based on physical solids removal capabilities

The New API RP 13C

Physical test for determining:

- Absolute separation potential of a screen, or D100
  - Any particle larger will not pass through the screen
- Screen Conductance
  - Same test screen is used in both tests

Separation Test

- New API RP 13C separation test is based on a time-proven testing method that classifies particles by size
  - Utilizes a series of standardized ASTM test screens (sieves)
  - Test media is aluminum oxide
  - Sieves have demonstrated accuracy since 1910
- API RP 13C adapted this time proven test method to relate screens to ASTM sieves of similar cut points

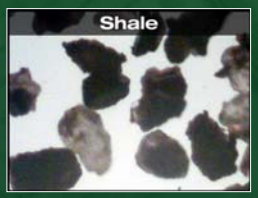


Table 5 (found on page 40 and 41 of API RP 13C)

D100 Separation and API Screen Number

D100 Separation (Microns)	API Screen Number
>780,0 to 925,0	API 20
>655,0 to 780,0	API 25
>550,0 to 655,0	API 30
>462,5 to 550,0	API 35
>390,0 to 462,5	API 40
>327,5 to 390,0	API 45
>275,0 to 327,5	API 50
>231,0 to 275,0	API 60
>196,0 to 231,0	API 70
>165,0 to 196,0	API 80
>137,5 to 165,0	API 100
>116,5 to 137,5	API 120
>98,0 to 116,5	API 140
>82,5 to 98,0	API 170
>69,0 to 82,5	API 200
>58,0 to 69,0	API 230
>49,0 to 58,0	API 270
>41,5 to 49,0	API 325
>35,0 to 41,5	API 400
>28,5 to 35,0	API 450
>22,5 to 28,5	API 500
>18,5 to 22,5	API 635

Screen Comparison

- An independent lab tested 4 screens for API's Task Group 5 to determine cut point and conductance
- Photographs below are all magnified 200x

Screen Labeled As:
Brand A 200

Actual API Screen Number
API 170 (88 microns)

Screen Labeled As:
Brand B 175

Actual API Screen Number
API 80 (173 microns)

Screen Labeled As:
Brand C 200

Actual API Screen Number
API 60 (234 microns)

Screen Labeled As:
Brand D 180

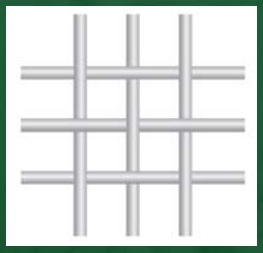
Actual API Screen Number
API 80 (173 microns)

Screen Comparison

- API RP 13C compliant screens will allow you to easily compare screens with similar cut points
- With solids removal being similar, the issues to address are:
  - Conductance (Flow Capacity)
  - Screen Life
  - Cost

Actual Use

- API RP 13C describes the openings of the screen and does not predict its performance
- Separation test is a dry sieve test and in actual use the wires will be coated with fluid which will make the effective openings smaller
  - Better separation performance than the API number indicates can be expected



Screen Conductance

- Conductance is a measure of the ability of a Newtonian fluid to pass through the screen
- API recommends motor oil because it is a viscous fluid that remains in laminar flow, which is necessary to provide reproducible results

$$V = \frac{Q}{A}$$ 3 cm/sec or lower

Screen Conductance

- Darcy's Law provides the method for calculating the permeability of a porous medium

$$Q = \frac{K(\Delta P \bullet A)}{\mu \bullet L}$$

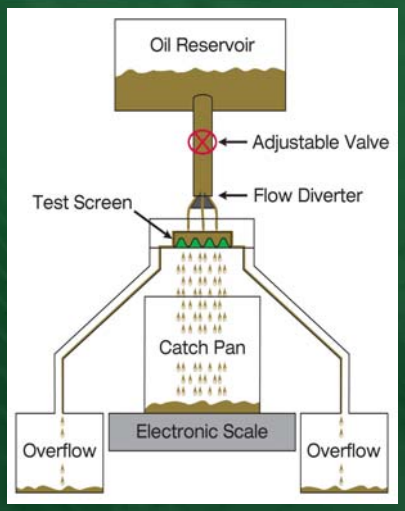
- Solving Darcy's Law for the ratio of permeability (K) per unit length (L), or conductance (C) is as follows

$$\text{Conductance} = \frac{K}{L} = \frac{\mu \bullet Q}{\Delta P \bullet A}$$

A = screen area (cm^2)
K = permeability (Darcy)
L = screen thickness (cm)
Q = volume flow rate (cm^3/sec)
V = velocity (cm/sec)
μ = fluid viscosity (cP)
ΔP = pressure drop across the screen (atm)

Screen Conductance Test Procedure

- When flow through the screen is constant, the amount of fluid is captured for a specific period of time
- Density and viscosity is tested at different temperatures
- Screen area is the inside area of the screen holder, not the screen itself
- Pressure differential is determined and then used with screen area to calculate the conductance



Screen Conductance

Conductance can be increased by

- Larger openings
- Less wires – Rectangular openings
- Smaller diameter wires
- More non-blanked screen area
  - Less bonding material
  - Corrugated screen surfaces

Surface Area and Conductance

Corrugated screens have up to 125% more surface area than conventional flat screens

HP 150 / API 120	Conductance (Kd/mm)	% Increase over PWP™
PWP™	1.25	N/A
Pyramid™	2.33	86%
Pyramid™ Plus	2.94	135%

Actual Use

- The new conductance test is performed under static conditions with a solids free fluid
- Actual screen performance will vary depending on:
  - Fluid properties
  - Size, shape, and amount of solids present
  - Operating parameters of the shale shaker

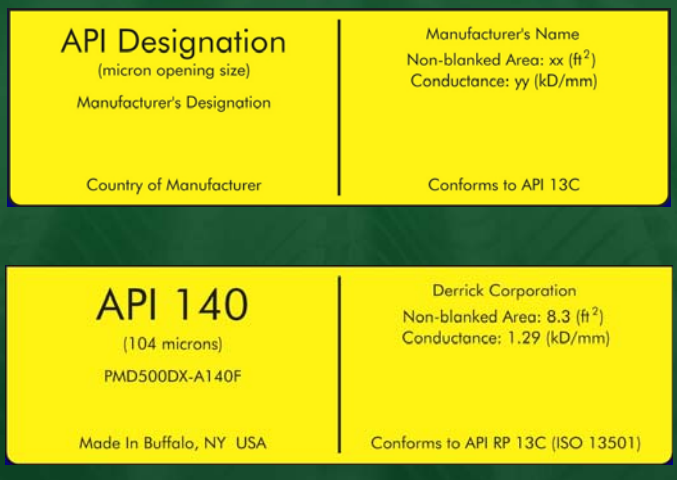
API RP 13C Labeling

API RP 13C specifies that a permanent tag or label shall be attached to screen in a position that is both visible and legible

Required information:

- API Screen Designation (Must be 2X larger than any other information)
- Equivalent aperture in microns
- Conductance (kilodarcies / mm)
- Non-blanked area (ft^2)
- Manufacturers designation / part number

Sample Label



Results of the Change

- API RP 13C enables end-users to easily compare screens based on physical solids removal capabilities which has been a challenge for decades in the drilling industry
- API RP 13C test procedure can be performed any where in the world – ISO document 13501

DERRICK EQUIPMENT COMPANY

Request API RP 13C compliant screens from your vendors

Questions