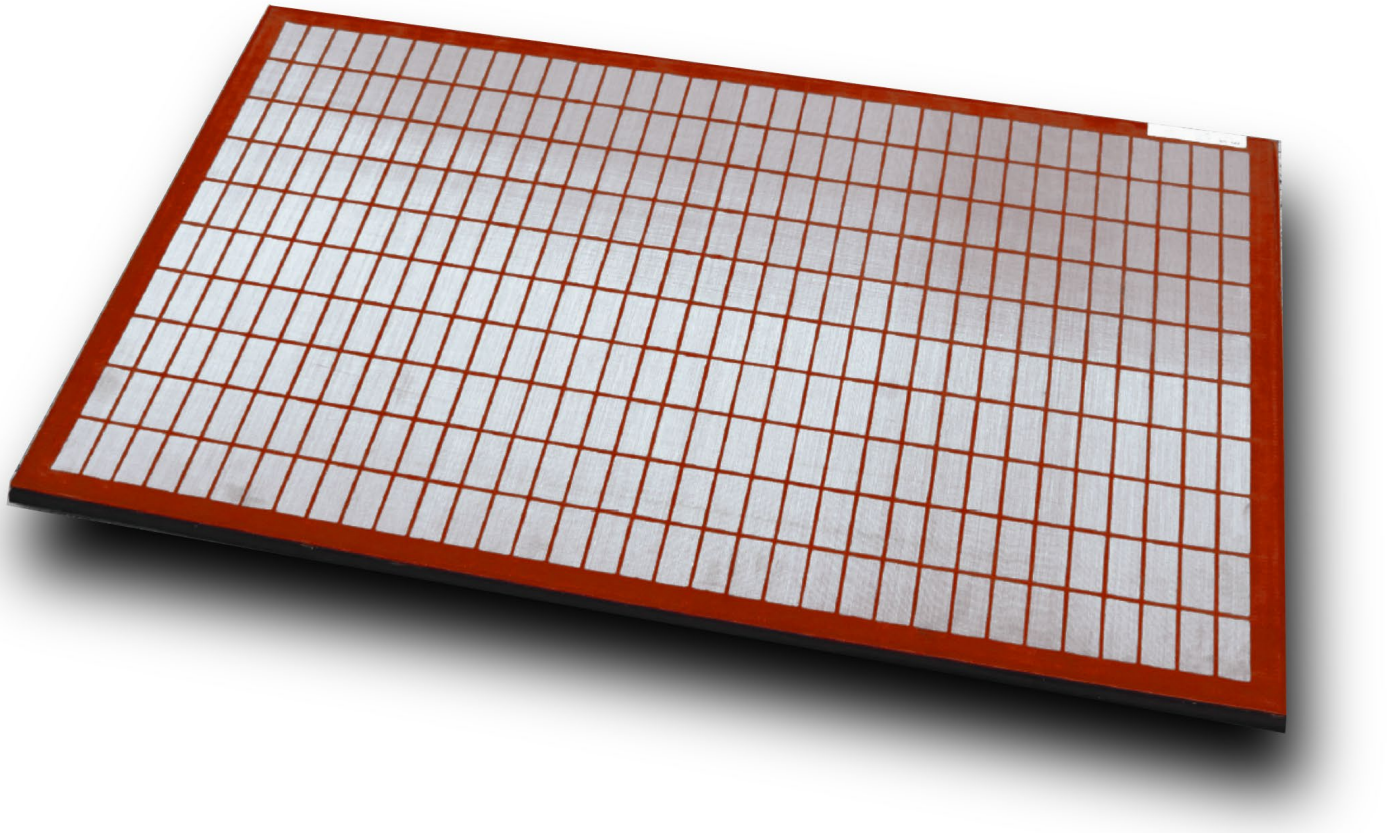
SHALE SHAKER SCREENS



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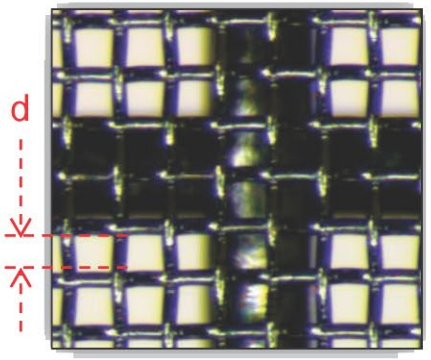
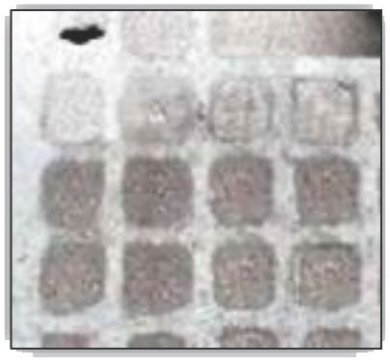
SHAKER SCREENS

The optimum shaker screen would have the following features:





Optimum Aperture

Ensures maximum separation efficiency for a defined cut (i.e. such that all particles over a pre-determined size are discharged, while the remaining pass through.

High Liquid Throughput

The capability to allow fluid to pass through the screen surface. Otherwise known as conductance. This is highly influenced by the geometric structure of the screens and the manner in which they are layered.

Screen Life

Screen life is affected by the quality of the wire mesh, the tension by which it is applied to the screen frame, and the quality of the adhesive that applies the screen mesh to the frame.

Resistance to Plugging

Screens are typically built from a combination of screen layers. Based on the number of layers and the manner in which they are bonded can influence the tendency of the screens to plug.

Shaker performance is dictated more by the quality of the screens, then the quality of the shaker. Shakers do not remove solids, screens remove solids.

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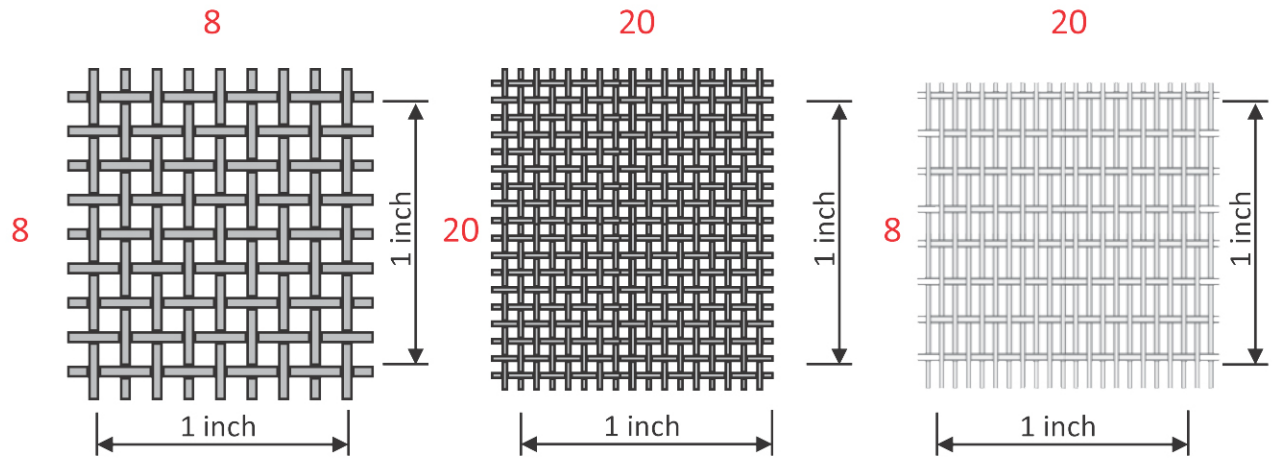
SHAKER SCREENS MESH RATING

Mesh size is an indication of the number of apertures in a woven screen cloth.



Square Mesh – 8x8 Mesh

An 8 mesh screen will have 8 apertures in one inch of length. The mesh count is the same in both directions.

Square Mesh – 20x20 Mesh

An 20 mesh screen will have 20 apertures in one inch of length.

Oblong Mesh - 20x8 Mesh

An 20x8 mesh screen will have 20 apertures in one inch of length and 8 apertures in one inch of width. Mesh count is different between width and length.

The nomenclature was consistently used in the industry for decades, but it was discovered that screens with the same mesh ratings could perform different.

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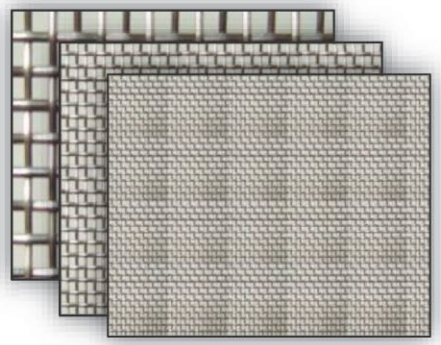
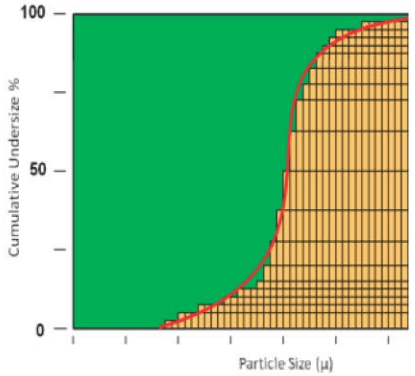
SHAKER SCREENS CONVENTIONS

API 13C prescribes the methods used to characterize shaker screens





Non-Blanked Screen Area

The non-blanked are of a screen describes the net unblocked are in square feet or square metes available to permit the passage of fluid.

American Petroleum Institute

Screen Conductance

Conductance is a measure of ease by which a Newtonian fluid will pass through a screen. Conductance is measured in kilodarcies/mm (KD/mm).

American Petroleum Institute

D100 (Aperture in μ)

The cut point of a screen is the particle size at which no particles greater in size will pass through the screen.

American Petroleum Institute

It is important to note that API 13C is simply a "Recommended Practice" and not a certification standard.

SHAKER SCREENS CONVENTIONS

API 13C product designations are based entirely on the D100 Cut Point

API RP 13C (ISO 13501) CUT POINT NUMBERS

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

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

Despite the fact that the Cut Point is the only defining feature relative to API 13C ratings, the non-blanked surface area and conductance must be noted on the screen.

SHAKER SCREENS MESH – OPEN AREA

Open non-blanked area is influenced by the mesh rating and wire diameter

$$A = \frac{(25.4 - (m \times D))^2}{25.4^2}$$

A = Screen open area (%)
m = mesh rating
D = Wire diameter (mm)

Non-Blanked Area as a Percentage

Describes the amount of screen that is 'open' as opposed to that taken up by wire. Screen open area is not related to the screen surface area.

200 Mesh Screen With 0.04mm Wire

$A = ((25.4 - (m \times D))^2)/ m)$

$A = ((25.4 - (200 \times 0.04))^2 / 25.4^2)$

A = 47%

200 Mesh Screen With 0.05mm Wire

$A = ((25.4 - (m \times D))^2)/ m)$

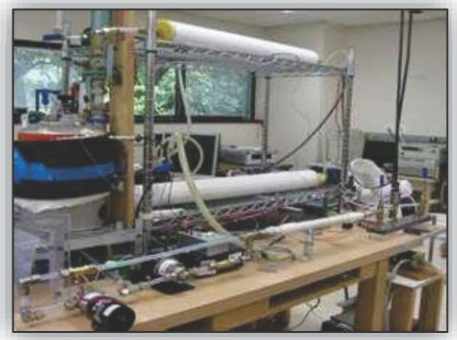
$A = ((25.4 - (200 \times 0.05))^2 / 25.4^2)$

A = 37%

The term "open area" is only attributed to the wirecloth itself and not the finished screen. Steelwork, plastic bonding, clamping bars, etc. can all affect the effective screening area.

SHAKER SCREENS CONDUCTANCES

Conductance is a measure of ease by which a fluid will pass through a screen.



Determined Via Flow Loop

Determined analytically from wire diameters and weaving specifications, conductance is measured in kilodarcies/mm (KD/mm). The larger the net aperture of the mesh the higher the conductance.

Conducted without Solids

The problem with conductance is that it is based upon a static screen with laboratory grade fluid, historically this was a mixture of glycerin and water (i.e. no solids present).

Conductance is not a Cut Point

Conductance and solids cut point are not related. Conductance is related to the fluid flow and has no bearing on the quality of the solids cut.

The use of conductance should be limited to comparative tests between mesh types.

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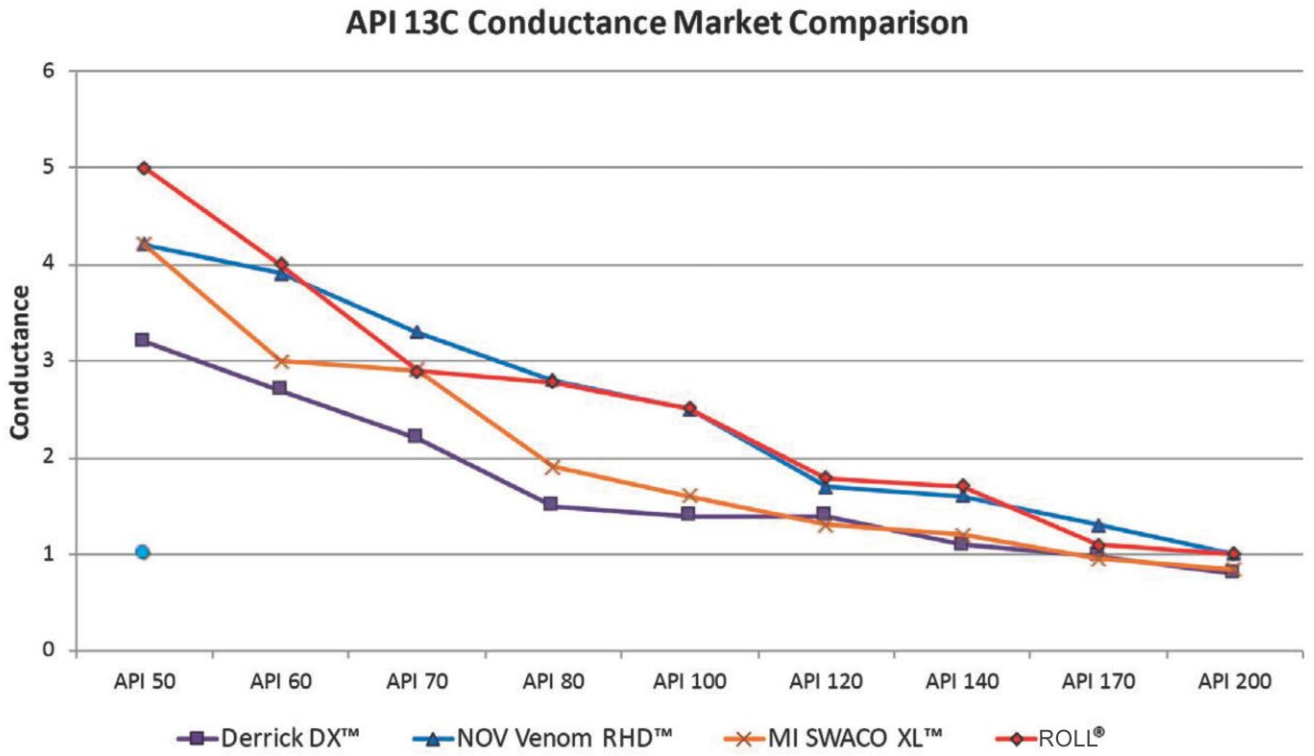
SHAKER SCREENS CONDUCTANCE

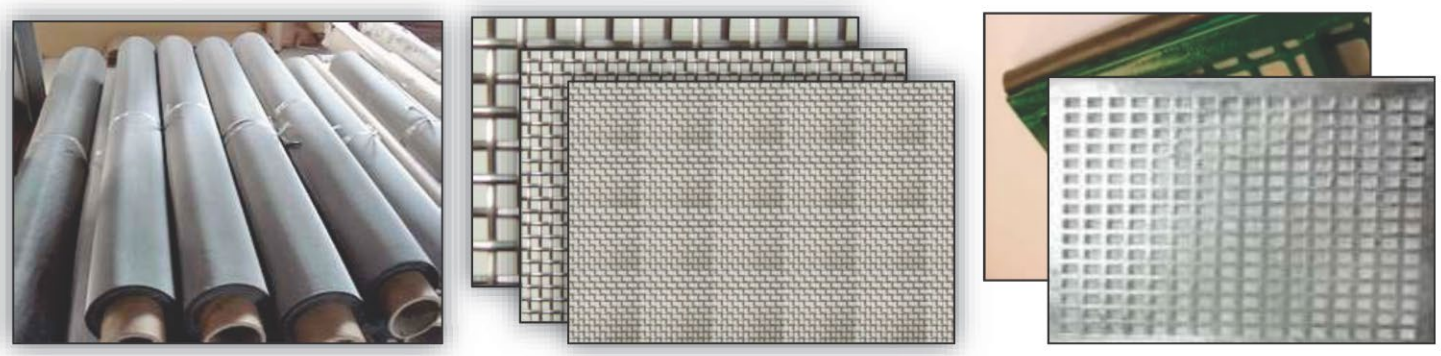
Conductance can vary greatly, even with similar API 13C ratings.



Conductance can vary greatly from one supplier to the next, which can affect customer performance expectations.

SHAKER SCREENS CUT POINT INFLUENCES

Even with similar mesh rated screen, cut points can vary greatly.



Screen Mesh Tolerances

Due to the manufacturing tolerances associated with the wire mesh, each aperture is not exactly the same. These slight variations effect separation efficiency.

Screen Mesh Layering

Modern shaker screens are made from a set of layered fine mesh screens. The layering provides additional strength, but further effects screen separation efficiency.

Mesh Support Structures

In addition to the impact layered screens have on separation efficiency, the support structures used to hold the wire mesh will influence separation efficiency.

API "Cut Point" is the size micron where 100% of the particles that size, or greater, will be discarded.

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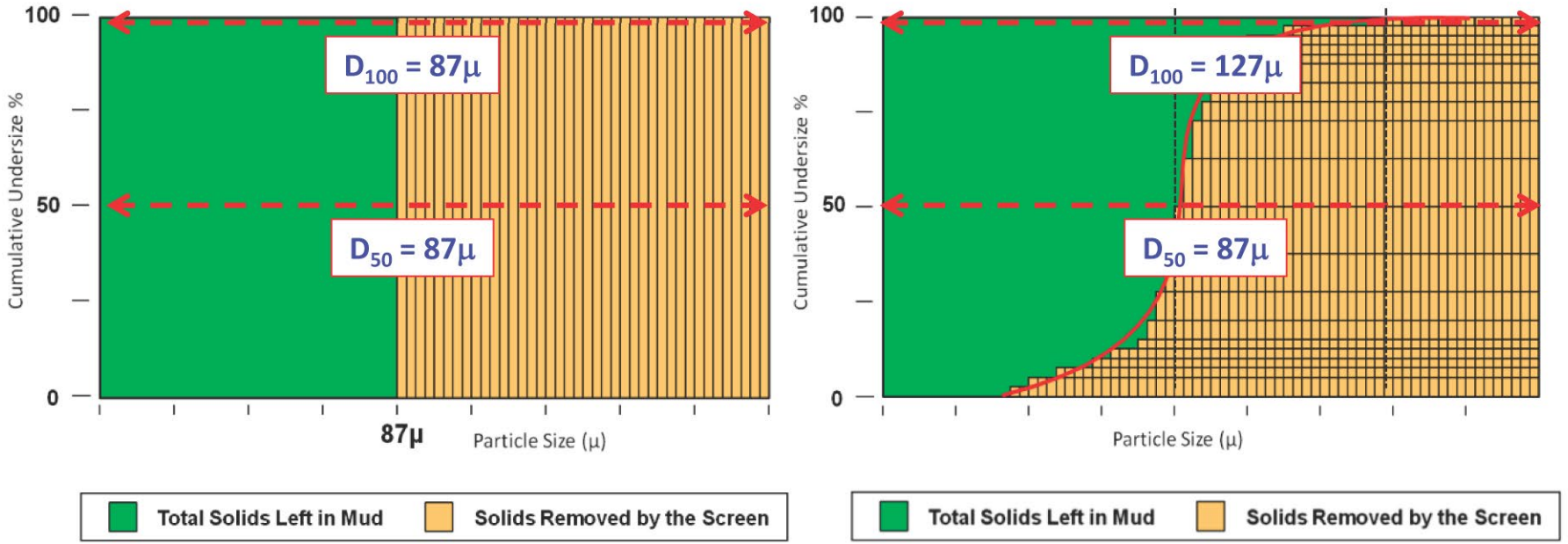
SHAKER SCREENS CUT POINT

Visually illustrating screen separation efficiency to determine D_{100},



Theoretical Cumulative Undersize Curve for a "Perfect Screen"

Illustrates a perfect screen capable of removing 100% of solids >87µ ($D_{50} = D_{100}$).

Actual Cumulative Undersize Curve for a Standard Screen

The above graph illustrates a typical screen targeting an 87µ solid ($D_{50} < D_{100}$).

This test describes the openings of the screen and does not predict the performance of the screen in the field.

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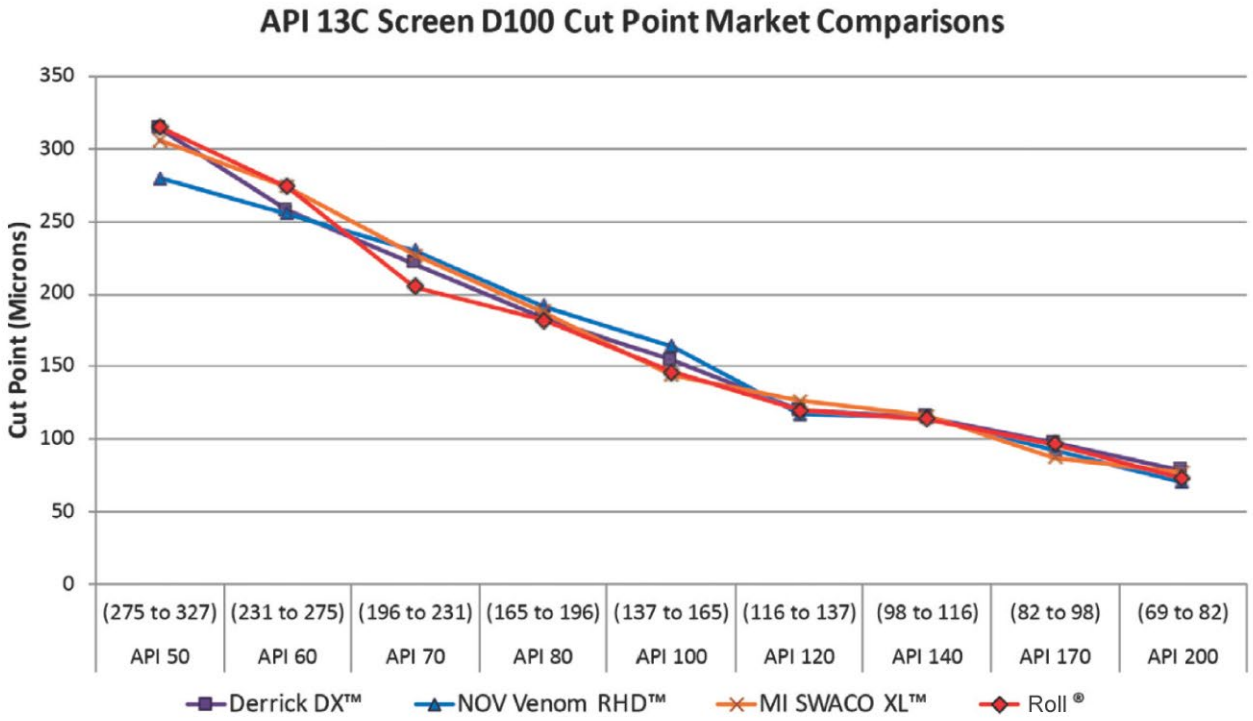
SHAKER SCREENS CUT POINT

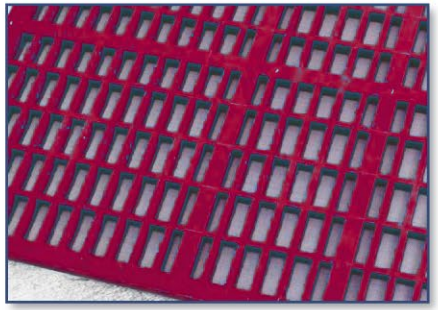
The actual cut point can vary, even with similar API 13C ratings.



Cut points do slightly change from one supplier to the next. Though there is some continuity, the effects can be meaningful with respect to performance.

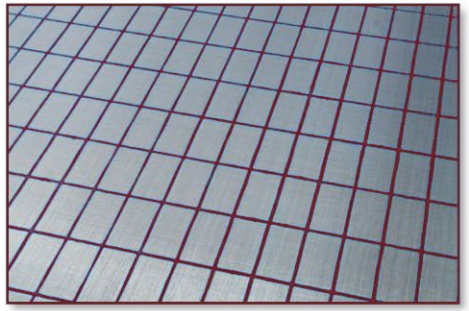
SHAKER SCREENS COMPOSITE SCREEN DESIGN

Roll Industries screen incorporate a series of quality-driven design features.



Composite Material with Steel Reinforcement

Composite screens inherently have a higher quality control with increased strength, longevity, and per-formance. There is no chance for discontinuities and/or variations in manufacturing.



Higher Surface Tension

Composite screens provide higher surface tension. When using powder-coat, the applied temperature is lower than when the product is molded. The heating process causes the wire mesh to contract and provide for a tighter surface tension.

Gaskets Molded into Screen

By adding the gasket during the molding process, there is less chance of premature separation of the gasket from the frame and yields improved performance and screen life.

Composite screens provide the additional value in longer shelf life due to the nature of the mesh bonding and the lack of any exposed carbon steel.

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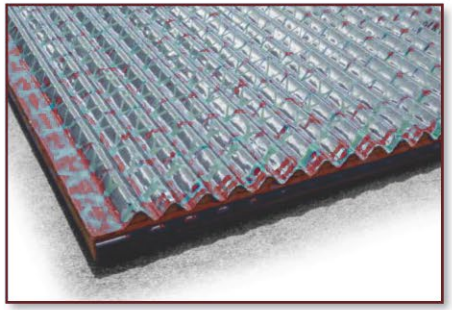
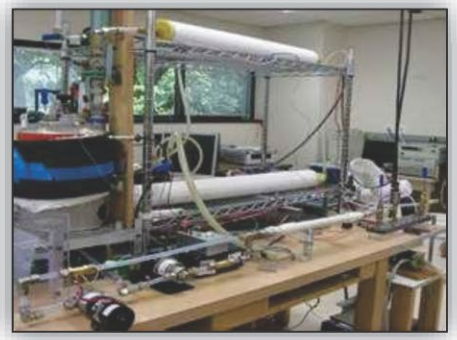
SHAKER SCREENS Composite Wave Screen Design

Roll Industries screens incorporate a series of quality-driven design features.





Surface Area, Surface Area!

Due to the corrugated profile, Roll's composite screens have 40% more surface area than a flat panel screen. Surface area remains the most important factor for shaker performance.

Higher Conductance

As a result of the concentrated pooling, wave screens provide improved "hydrostatic head". This additional hydrostatic head enhances the conductance of a wave screen, despite the lack of support via API 13C testing.

Enhanced Flow Distribution

As a result of the inherent channels provided in a wave screen, flow distribution is dramatically improved. Each channel ensures that the fluid flow cannot migrate to one side or the other, regardless of shaker performance.

As a result of the three factors noted above, wave screen performance will exceed flat screen performance by a factor of 1.5X.

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