**What is Water Well Sand Screen?**

A well screen is a manufactured Stainless Steel or PVC product that allows water in and keeps unwanted materials out. The basic job of any screening device is to keep sand/gravel/shale out of the well while letting the maximum amount of water in. Ground water is found in the tiny spaces between the particles of rock, sandstone, sand, or gravel beds beneath the surface. Sands and Gravel beds are called “unconsolidated aquifers”. Rocks and sandstones are called “consolidated aquifers”.

The things that affect well screen design are:

- **Required Well Production (in Gallons Per Minute) & Required Water Quality matched to intended uses—Human Consumption, Agricultural, Industrial, Irrigation, etc.**
- **Well Depth—Feet below surface determines radial and axial pressure.**
- **Production Zone Thickness—Total vertical feet of drilling that has entered the usable part of aquifer.**
- **Porosity of Production Zone—How Coarse, Sharp, Tight, or Homogeneous the Production Layer is.**
- **Casing Diameter—**
  - Water wells typically have a telescoping screen, where the screen must fit down the center of the well casing.
  - Cost benefit ratio: Increasing amounts of money required VS. Resultant production & water quality gains. The more money you spend on development & screening will result in a better producing, more reliable, and cleaner well.

**Entrance Velocity**

Entrance velocity is the speed of the water as it passes through the screen slots. If the entrance velocity is too high, the water will undergo a pressure drop. This can cause dissolved minerals to precipitate out of solution. The resulting calcium or magnesium carbonate can encrust the screen, creating what is known as “calcification”, block the openings, and lead to reduced production or total well failure. High entrance velocity can also speed up erosion of the screen (widening of slots) resulting in sand or gravel production causing early pump failure. The solution to these problems is to keep the entrance velocity low - about 0.1 feet per second. This is possible only if the screen has a very large amount of open area (large Slot Size in well screens).

**Screen Porosity**

The exact size of the screen slot is determined by analyzing the formation samples brought up during the drilling process. We want to maximize the screen porosity by making the slot as wide as possible without letting more than a certain percentage of the formation materials through (typically we WANT 60% of the formation to come through). Well Screens can be made with slot increments as small as 0.001 inch allowing much flexibility to produce the exact slot opening your well needs.

By allowing a larger percentage of the formation to pass through the screen, porosity becomes less dependent on screen sizing and more dependent on Development of the well. The longer that you develop the screen in the well, the more fine material you pull through the screen, resulting in a screen with large coarse material packed around it. This creates even larger surface areas and higher porosity, resulting in even lower intake velocities.
Screen strength is important, too. The screen takes a lot of punishment during installation, and has to resist crushing and collapse pressures, which, in a deep well, can be very high. Screen size is another consideration. The longer the screen the more water it's able to take in, but you obviously don't want to install more screen than necessary. Because of their high open area, screens 4 to 5 inches in diameter, 5 to 20 feet long are suitable for most household wells.

**Screen Material and Construction**

Water well screens have been made of many materials. The most common materials are stainless steel, galvanized steel, PVC, and fiberglass. Stainless steel screens and PVC coated wrapped-on-pipe screens are normally produced by wrapping stainless or PVC coated ribbon around stainless steel rods, hole-punched PVC pipe, hole-punched stainless steel pipe, or hole-punched galvanized-steel pipe. PVC pipe slotted, galvanized pipe slotted, and fiberglass pipe slotted screens are usually have multiple slots cut in many different arrangements with slot thickness ranging from .004” to .060”, and spacing between slots ranging from 1/8” to 1”. Some new and innovative screens are Pre-Packed Gravel Double Walled Stainless Steel Screens and Stainless Steel Mesh Screens.

All screens are generally sized by the Slot Size—a measure of the height of the opening that water/material can come through. A 0.004” (4 thousandths of an inch) screen opening is called a 4 Slot screen, a 0.040” (40 thousandths of an inch, or 4 hundredths of an inch) is called a 40 Slot screen.

**Rod Based Stainless Steel Screens vs. PVC Slotted Screens**

JKA Enterprises, Inc. mainly uses these two types of screens. Rod based stainless steel screens and PVC slotted screens both can have slot sizes narrow enough to keep very fine-grain sand out while producing adequate volumes of water. S.S. screens are made with one continuous triangle-shaped ribbon spiraling around multiple axial rods throughout the full length of the screen. PVC screens are simply pipe with fine slits throughout the entire length of the screen. Therefore, S.S. screens are much tougher than PVC screens. S.S. screens are rated for much deeper depths than PVC screens (we typically will not set a PVC screen in depths exceeding 500′). Encrustation & Calcification is more of a problem in S.S. screens because calcium or magnesium carbonate can encrust the crystalline structure of the S.S. screen much easier than the amorphous structure of the PVC screen. The open surface area/foot ratio for S.S. screens ranges between 2 to 5 times higher than PVC screens. However, S.S. screens are normally 2 to 10 times more expensive than PVC screens. Each of these screens have strengths and weaknesses. It is our job to decide which of these screens is most practical and beneficial to use for each well we drill. In unconsolidated formations, 99.99% of the time, we’ll specify a Stainless Steel Sand Screen.

**Development**

Well screen development is the next most important thing, besides just installing a sand screen in the first place. Proper well development creates a filter pack around the well, creates lower intake velocities, and creates longer lasting cleaner running screens.

How much development is necessary? It’s dependent upon the screens & formations. In the residential market, we’ve seen competitors use screens that are typically 5 to 15 slot, and then they don’t charge for development time (probably because with such a small slot size, they can’t get any of the formation through anyway). We typically size screens between 20 and 40 slot, with development time taking anywhere from 30 minutes to 4 hours. Municipal well screens are often sized in the 50 to 100 slot range, requiring up to and in excess of 2 WEEKS of development time.
Sand, screens, & open area

Once water is discovered, it becomes drillers job to determine where the best place in the aquifer is to get the water. There's no such thing as an underground 'lake' in unconsolidated materials (sands, gravels, clay, etc) – all the aquifers are made up of sand & gravel formations with water in them, and gravel works better than sand as a transmissive medium (meaning that the water moves through gravel faster & better than sand).

In these situations, drillers using casing hammer drilling technology will telescope a screen down the inside diameter of the well – most often by pulling the bit out of the well and dropping the screen down the inside of the well. Following placement, the driller will put the drill string back in the well to hold the screen on the bottom, then pull back the casing to expose the screen to the aquifer. Once the screen has been exposed, the driller will use the air compressor on the rig, or a bailer, to 'develop' the screen. Development is the process of surging a fluid through the screen to force the fine particulates in the formation to come through the screen and into the well, where it can then be removed from the well prior to placing the well into operation. This technique, known as a “naturally developed” screening process uses the formations own material to create a filter pack around the screen. The picture on this page is of a naturally developed well screen, photo courtesy of Johnson Screens.

Screens are sized by 'slot' size, equal to one thousandth of an inch (0.001 inches), which is the distance between each V-shaped wire wrapped horizontally around the screens skeleton. Typically, residential wells have anywhere from 12 to 35 slot screens installed (though we use 25 to 35 slot screens 95% of the time). The 'old' technique for sizing well screens was to allow for 60% of the formation to actually go through the screen. Once the screen was in place, it was developed until the sand no longer showed up in the surged water.

Notice in the above picture (probably of a 40 slot screen) how their well screen has gravel packed around it, but the formation is mostly sand as you look further away from the screen – this is because during the development time, the sand was surged out of the formation.

Slot size means almost as much as putting a screen in in the first place. If we size the screen too small, the well doesn't make as much water as it could, if we size it too big, it will take FOREVER to develop the fine particles out of the well. But, we have found that in most areas, a fine balance can be established with 20 to 35 slot sand screens (2 to 3 times larger slot sizes than our competitors typically run).

To emphasize the difference between all these options – remember that a well only takes in water through the bottom of the well or through a screened opening. An open bottom well has only 28 square inches of surface area, while a 6” diameter well with a 10 slot screen, five feet long, will have

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151 square inches of surface area, but a 30 slot screen will have over 350 square inches of open area. This means, all else equal, a 30 slot screen has more than 12 times the open water producing area of an open bottom screen-less well. In fact, a 30 slot screen has more than DOUBLE the open area of a 10 slot screen!

Additionally, by sizing, installing, and developing screens this way, the wells 'intake' from the formation is effectively moved out to the outer radius of the developed portion of the formation – which means that the surface area from which the well is collecting water is much greater, resulting in reduced intake velocities and increased yield.

As time has passed, drilling companies have moved towards using smaller and smaller screens – mainly because it results in much less development time, thereby costing them less money – we've steadfastly refused to decrease screen sizes to increase profits. For the best well you can buy, call JKA Well Drilling today!