



# **Johnson Vee-Wire<sup>®</sup> Screens For Water Wells**

# Filtration Expertise

Screen design is the most critical factor for the efficiency of a successful well.

The following criteria should be considered to enable the correct screen to be selected.

## Screen Selection

### Mechanical strength

Selected Screen must be resistant to :

- Tensile forces relating to supporting its own weight in the whole screen/casing installation.
- Radial compressive forces created by the formation, which will be higher on completion of well development.

### Resistance to corrosion

Corrosion can occur in instances where materials used are not adapted to the prevailing well conditions.

Water quality is important, but not the only factor. Johnson Screens

offer a wide range of technology related materials and surface treatments which minimize the corrosion phenomena.

### Selection of slot size

The screens purpose is to :

- Prevent sediments from entering the well.
- Support unconsolidated formations or gravel pack.
- Allow formation development
- Minimize clogging.

Selected slot size must give optimum open area: ie. Too small could easily block, too large would allow particles through.

### Flow rates and pressure drop

It is generally accepted that the water velocity as it ascends inside the screen should not exceed 1,5m/sec, and that the through-slot water velocity (for sandy aquifers) should not be greater than 3cm/sec so that the pressure drop will be less than negligible when compared with friction losses as flow ascends in the screen.

### Gravel pack selection

Coarse and non homogeneous material can be developed naturally, whereas fine and homogeneous material is best developed using a filter pack – Rule of thumb is that if at least 60% of particles are less than 0,75mm then a filter pack is required, with the screen slot needing to retain 90 % of the filter pack.



Slot & Gravel pack selections are linked together.

Slot size has to retain the gravel and this gravel is sized by the formation granulometry.



# Sand Control

## Risk analysis

Economic considerations, such as the increased cost of remedial work, have moved sand control to a central position in well management.

Production reliability and productivity is essential. The physical mechanisms that result in sand production in water well screens are very complex. Producing sand can cause a premature failure of submersible pump equipment.

Sand bridges formed in the casing or tubing can impede and

eventually obstruct the flow of a well.

The compaction or erosion of surrounding formations can cause failure of casings and liners. A screen failure in the producing zone can mean the loss of your well.

Other sand-related challenges include abrasion of downhole and surface equipment as well as difficulties associated to handling and disposing of produced formation sands.

## Interaction formation - gravel - screen

The goal for well screens is stoppage of sand infiltration with undue reduction of flow capacity. In order to determine the correct gauge for well screens, as well as the correct gravel pack annular, the formation granulometry must be known.

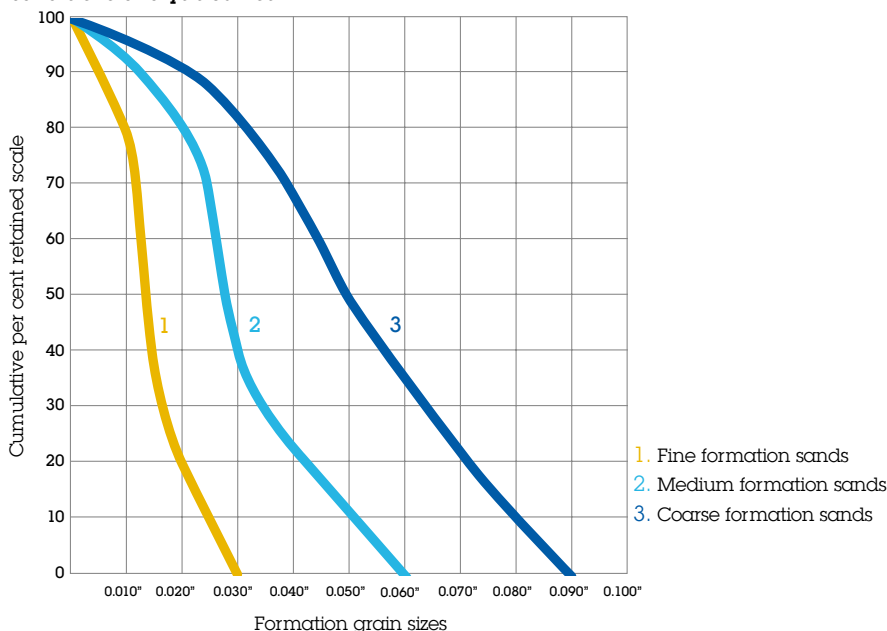
This data may be obtained by a sieve analysis of representative samples of the formation.

In some cases, sufficient sand control can be achieved by the installation of a well screen without the use of a gravel pack. Some well screens, such as the Muni-Pak™ screen from Johnson Screens®, have been designed specifically to stop fine formation sands without the need for a separate gravel pack. In the absence of a gravel pack, well screen openings must be sized in direct relationship to the formation sand to be excluded. When well screens are installed with a gravel pack, a different design basis is required. The loss of even a small amount of gravel may have a detrimental effect on well completion.

Therefore screen slot selections are required to be sized for complete gravel retention. The keys to the successful use of gravel are :

- correct sizing of gravel
- correct annular thickness
- homogenous gravel pack

Sand sieve analysis curves



# Vee-Wire® Technology

Unlike any other type of screen, Johnson Screens® has a unique design consisting in a series of stainless steel support rods around which a continuous length of wire is wrapped. Each intersection of wire and rod is automatically welded, making a very strong cage-like cylinder with one continuous slot spiralling along its full length.

## Quality Standards and Operations

Screen performances depend on several parameters, including wire and rod shape, construction, steel grade and microstructure as well as slot accuracy over the full length of the screen. To meet the most demanding requests, Johnson has been investing in state-of-the-art wire drawing and annealing capabilities as well as wire wrap machines to supply screens from range I to range III and from 2" up to 40" OD. Over the last 5 years we have doubled our manufacturing capacity by adding new equipment and expanding our factories.

### Construction materials

Stainless steel types 304L, 316L and 904L according to ASTM A580. Other corrosion-resistant alloys are available on request.

### Slot Sizes

Between 0,1 et 3 mm

### Profiles

For specific projects we have the technology to manufacture wires to DIN Standard 4935 i.e. for radii tolerances.



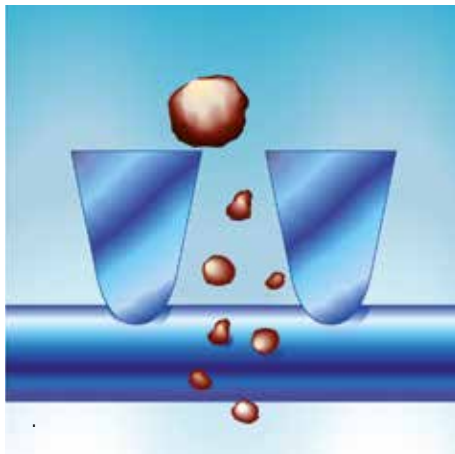
**Johnson Screens have over 100 years experience in water well screen technology with DWI approval and ISO 9001 certification, this, coupled with manufacturing facilities in Australia, France, Japan and the USA, ensures quality products at realistic costs.**





## Advantages

Johnson's specific screen construction, developed over a century for a world wide demanding customer base, optimises flow rates, minimises clogging thus helping faster formation development.



### Maximising flow rates

When considering screens of equal length, diameter and slot size, flow rates through Vee-Wire® screens can be :

- three times higher than bridge-slot screens
- nine times higher than slotted casing

### Non clogging slot

Johnson's Vee-Wire® is designed to provide unique structural strength. The "V" shaped openings allow only two contact points with sand grains,

thus reducing clogging and making cleaning easier.

### More efficient well

At the end of the "well development", in which finer sand grains are pumped into the well and removed, only the larger sand and gravel particles are left next to the well screen; the water then passes freely around these coarse particles and enters the well.

## Applications



Continuous slot Vee-Wire® screens are recommended for the following installations:

- formation comprised of small or fine particles
- water wells where gravel packs will be installed
- thin aquifers, where maximum open area is required
- small diameter wells



# Rod-Base Screens

Our standard rod-base screen has been a worldwide “best-seller” for many decades and has even influenced the market with what is now called the “Johnson-type” screen.

## Collapse strength

Screens must be resistant to multiple radial pressures including natural formation pressure.

This is why collapse resistance is a key parameter to consider; calculations are based on wire dimensions and shape (7 wires available).

## Tensile strength

Based on column weight considerations, tensile strength calculations will be made to determine the rod section and diameter (7 rod sizes available). Our manufacturing capabilities cover the full range of wells from shallow to deep whereby correct collapse resistance can be achieved with the use of heavy duty Vee-Wire®.



Data below indicates representative collapse resistances which are dependant on wire sizes used.

Nominal diameter (pouces)	ID (mm)	OD (mm)	Weight (kg/m)	Collapse strength* (bar)
2 3/8	50	60,3	3,4	97,2
3 1/2	78	88,9	4,2	29,9
4	88	101,6	5,7	66,6
4 1/2	101	114,3	6,7	46,5
5	114	127,0	7,4	33,8
5 1/2	127	139,7	9,5	64,3
6 5/8	156	168,3	15,0	77,0
7	164	177,8	16,0	65,1
7 5/8	177	193,7	17,6	50,2
8 5/8	205	219,1	18,7	48,7
9 5/8	230	244,5	26,2	39,2
10 3/4	256	273,1	27,8	42,6
12 3/4	305	323,9	34,6	33,2
14	336	355,6	37,6	25,0
16	387	406,4	42,9	16,6
18	436	457,2	47,6	11,6
20	484	508,0	53,9	8,4
24	585	609,6	63,4	4,8
30	730	762,0	92,0	2,5
32	780	812,0	100,0	2,0



(\* Non contractual collapse strength values - Indicative values depending on screen construction & including a safety factor

# Pipe-based Well Screens



Pipe-based screens combine the hydraulic efficiency of continuous slot with the strength of pipe.

This construction is recommended when high collapse resistance is required and also when the screens length generates a high longitudinal constraint.

The pipe strength allows smaller wrap wires to be used yielding greater open area.

Base pipes can be manufactured using stainless steel grades or API 5CT carbon steel casing.

Johnson Screens® uses prime pipe thoroughly cleaned and deburred after perforating.

## Wrap-on Pipe screen

The wrapped on pipe screen is a technologically advanced version of the pipe-based screen.

The jacket is directly wrapped on the perforated base pipe so that it tightly grips the pipe along its entire length. The result is an all-welded, wrap-on pipe screen.

The features and benefits are the same as a conventional slip-on type screen, however this construction is recommended for very high collapse resistances (>100 bars) to secure full sand control and integrity of the jacket.

## Slip-on screen

The "Slip-on" pipe base well screen is produced from two components, a perforated pipe base and a rod base wire wrapped screen. The pipe and the wire wrap screen (the "Jacket") are selected to meet the requirements of each individual job.

Longitudinal support rods direct inflow to the nearest pipe perforation. Screen and pipe are welded together to make a rugged, reliable unit for deep vertical wells and long horizontal remediation or supply wells.



Nominal Diameter (pouces)	Pipe OD (mm)	Pipe Thickness (mm)	Weight (kg/m)	Max OD (mm)	Collapse strength* (bar)
4 1/2	114,3	6,02	15	129	145
5 1/2	141,3	6,55	21	158	98
6 5/8	168,3	7,11	27	189	74
7	177,7	9,20	36	199	138
8 5/8	219,1	8,18	42	250	51
9 5/8	244,5	10,00	56	275	67

(\*) Non contractual collapse strength values - Indicative values depending on screen construction & including a safety factor

# Muni-Pak™

## Pre-packed Screens

Johnson Screens® solution to improve the gravel pack is the Muni-Pak™. It simplifies the contractor's work, improves the odds for successful development and offers long-term benefits for the owner.



### The state-of-the-art technology for pre-packed screens

For the contractor, the Muni-Pak™ screen:

- eliminates the need for a larger borehole
- shortens the amount of time required to drill a well
- speeds development time.

Muni-Pak™, uses ceramic beads as the filter media.

This unique resin-free concept provides a filter pack that is less likely to get fouled with biofilm and encrustation.

Muni-Pak™ lowers overall maintenance costs for the owner.

### Benefits

- Thinner filter pack
- Smaller borehole
- No gravel placement
- Increased collapse resistance

### Specifications

Size* (pouces)	ID (mm)	OD (mm)	Support (mm)	Inside filter open area (%)					Outside filter open area (%)					Weight (kg/m)
				Slot (mm)					Slot (mm)					
				0,3	0,5	0,75	1	1,26	0,3	0,5	0,75	1	1,26	
2 × 4	60,0	114,3	27,0	15	26	35	42	48	13	23	31	38	44	25
3 × 5	88,9	139,7	25,4	14	23	32	39	45	13	23	31	37	41	34
4 × 6	114,3	168,3	27,0	13	23	31	38	44	10	18	25	31	36	37
5 × 7	127,0	177,8	25,4	13	23	31	37	41	11	19	27	33	38	40
6 × 8	168,3	219,1	25,4	10	18	25	31	36	10	18	25	31	36	52
8 × 10	219,1	273,0	27,0	10	18	25	31	36	10	18	25	31	36	82
10 × 12	273,0	323,0	25,0	10	18	25	31	36	9	16	22	28	32	104
12 × 15	323,0	375,0	26,0	9	16	22	28	32	9	16	22	28	32	126
14 × 16	355,0	406,0	25,5	9	16	22	28	32	7	13	18	23	27	149
16 × 18	406,0	457,0	25,5	7	13	18	23	27	7	13	18	23	27	171
18 × 20	457,0	508,0	25,5	7	13	18	23	27	7	13	18	23	27	190

\* Other sizes and deep-well construction specifications available on request.



# Customisation

## Surface Treatment

The main properties of stainless steels, i.e. their corrosion resistance, is due to a 'passive', chromium rich complex, oxide film that forms naturally on the surface.

However stainless steel cannot be considered corrosion resistant under all service conditions: depending on its composition and the surrounding environment, the passive layer can be broken down and prevented from reforming. The surface then becomes active, resulting in corrosion. It usually occurs in small areas deprived of oxygen such as around mechanical joints, tight corners or welding areas.

The result can be localised forms of crevice or pitting corrosion.

This is why the correct selection of the stainless steel grade is important. This, together with appropriate surface treatment of the finished product, will ensure adequate resistance properties.

Johnson Screens® carry out pickling and passivating surface treatments, "in house", to the finished products ensuring guaranteed first class quality.

## Connections

### Connections for welding

Screens can be prepared with plain or bevelled ends for side butt welding or with welded socket joint.

### Threaded connections

Male/female threaded joints can be supplied according to various standards

- BSP (gas) thread for the smallest diameters, up to 6"
- API threads such as STC (up to 13 3/8") or BTC
- Connections according to the German DIN 4922 standard can also be supplied.

### JSL connections

Available with 1 or 2 O-rings for water tightness.

### Connections to PVC Casing

Sockets, threads according to DIN 4925 as well as others are available on request.



# Well worth the Investment

## Johnson Vee-Wire® screens do make the difference

### From your well...

#### Protection for your pump

The slots can be very narrow and precisely sized to keep out even fine sand grains which could otherwise destroy your pump through abrasion.

#### Lower pumping cost

Even with narrow slots, the total open area for the water to enter is far higher than any other kind of screen design.

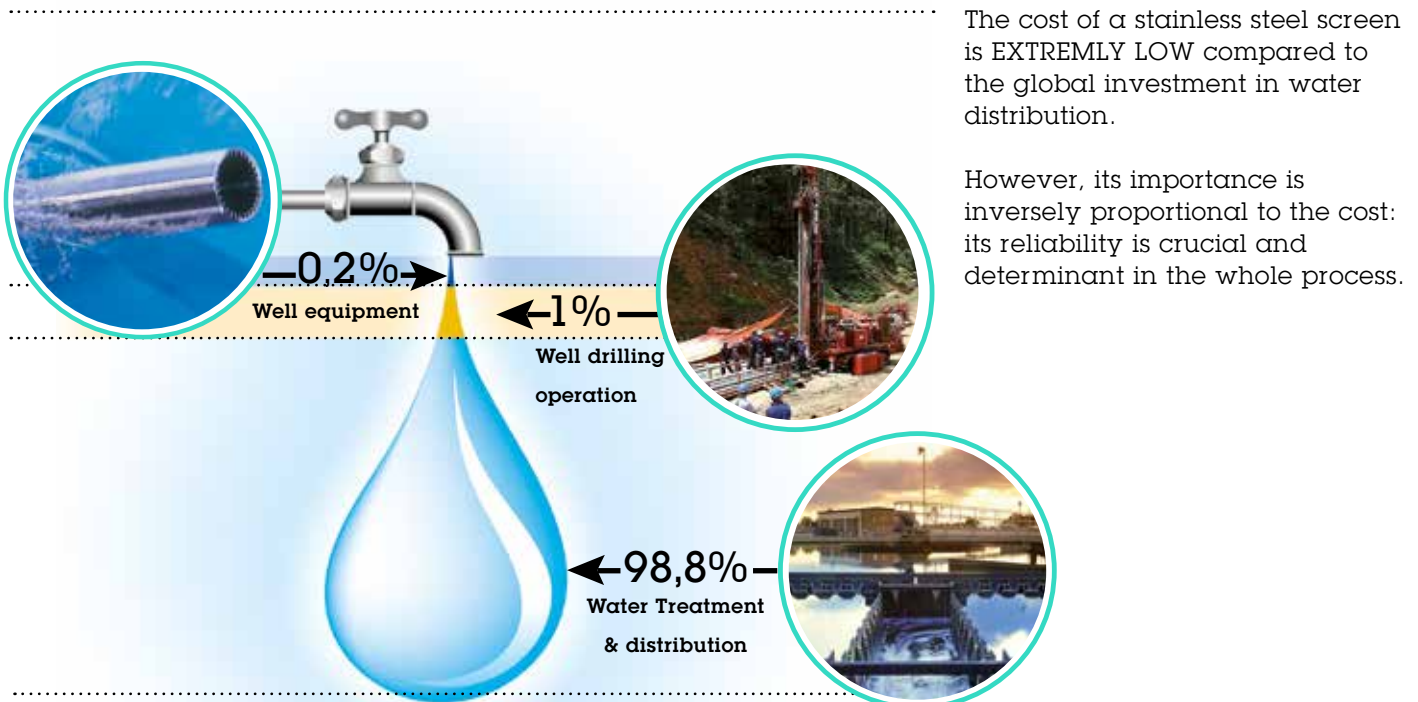
#### Longer wear life

The slots widen inward so sand grains don't wedge and plug. The screen can be stainless steel for maximum corrosion resistance.

The high open area of a Johnson Screen® lets the water enter slowly to avoid the problems which arise when water is pumped at high velocity.

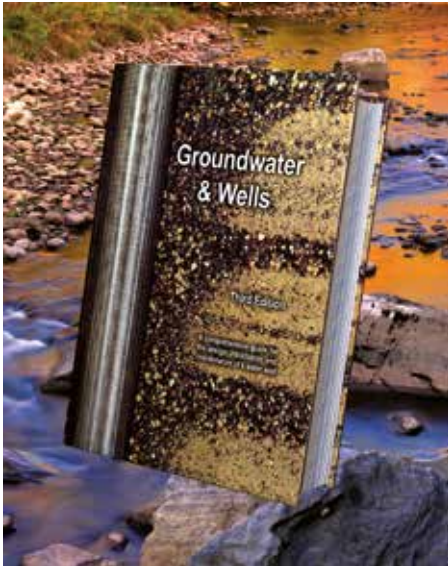
(If water passes into the screen too quickly, pressure drops and gasses are released, allowing minerals to drop out of solution and form encrustation on the screen surface. High velocity water can also erode the screen, causing the slots to widen and allow sand to enter the well).

### ...to your home



**But remember, every drop of water from your well must first pass through the well screen.**

## Groundwater and Wells



Groundwater & Wells third edition is an update of the classic 1986 second edition (by Driscoll). It focuses on the practical aspects of design, maintenance and drilling methods. Theoretical concepts are discussed but the emphasis is on useful everyday application.

Specific chapters are written by groundwater professionals, and experienced Johnson Screens® staff has integrated the content into a comprehensive discussion.

Recognised worldwide by engineers and scientists as the authoritative text on hydro-geology, well

hydraulics, design, construction and materials. We recognise the growing importance of environmental engineering.

Groundwater and Well's third edition includes comprehensive coverage of the accepted practices in environmental well management.

The third edition is also an excellent training manual and a valuable handbook for those concerned with groundwater protection and extraction.

## Chemical cleaning, disinfection, and decontamination of water wells



The Chemical Cleaning, Disinfection and Decontamination of Water Wells is a compact but complete assessment of the important place certain chemicals have in modern water treatment and water system construction and maintenance programs.

Included in this text are complete descriptions of nearly every chemical frequently used in water supply applications. The focus is on effective, efficient use of these chemicals to achieve better well rehabilitation, water system cleaning and water quality treatment. Diagrams, formulas, mix ratios and other technical data are included.

Also included is a discussion of the proper handling techniques for each chemical and where appropriate, clear warnings about possible hazards and the conditions that can cause them. This book can be purchased from the Johnson Screens® website.

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