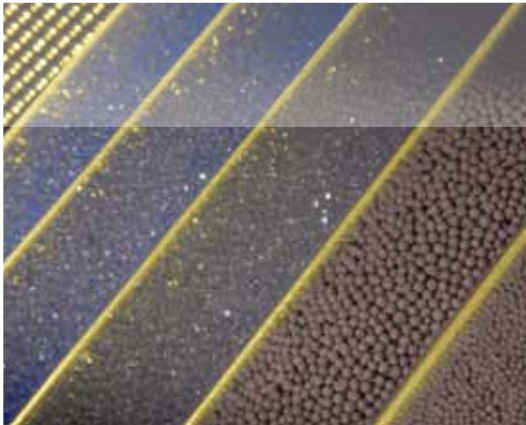


Muni-Pak™ Screens



WATER
WELLS



A GIANT STEP FORWARD IN WELL DESIGN TECHNOLOGY



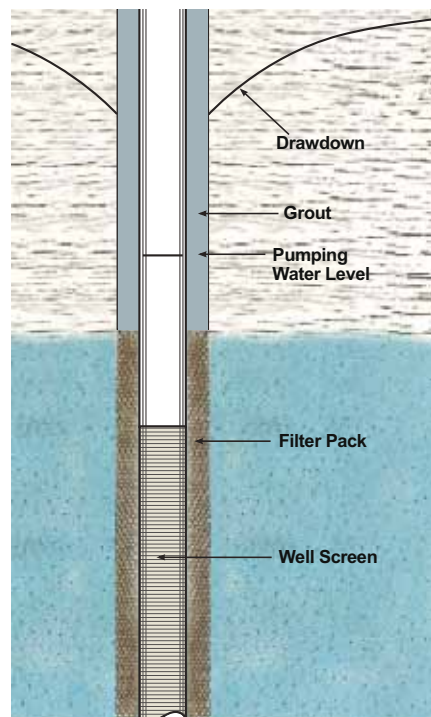
MUNI-PAK™ SCREENS: A BETTER WAY TO GRAVEL PACK

Artificial filter pack is one of the most common designs used today for high-capacity municipal, industrial and agricultural wells; but before the installation of a filter pack, the contractor and the well owner must take into account some significant issues:

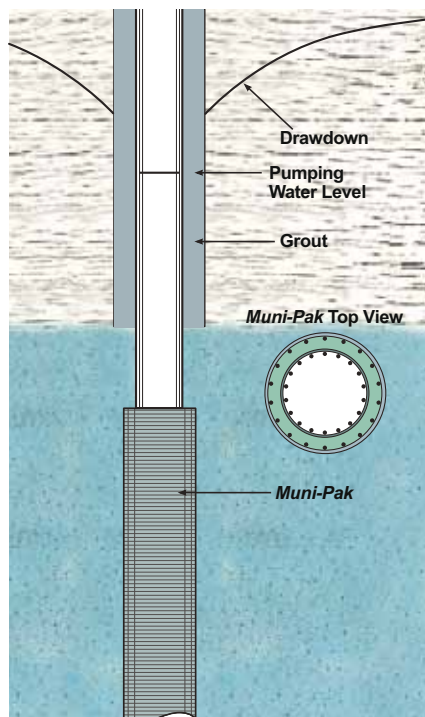
- The borehole must be sufficiently oversized to allow for adequate placement of the filter pack. In practice, an annular thickness of 3 to 5 in. is considered minimum.

Often an even larger borehole is advised. The oversized borehole is costly to the contractor (and therefore to the well owner) and keeps the crew on site for additional time.

- The filter pack must be carefully selected, placed and developed to avoid bridging and sand pumping.
- The well owner is concerned with long-term performance. Biofouling and encrustation are issues that will eventually affect performance.



A Typical Gravel-Pack Well



A Muni-Pak Well

Johnson's solution for improving the gravel pack is the *Muni-Pak* screen. For the contractor, this state-of-the-art pre-packed screen eliminates the need for a larger borehole, shortens the time required to drill a well, and speeds development time. It simplifies the contractor's work and improves the odds for successful development.

For the well owner, the *Muni-Pak* screen offers long-term benefits. This latest Johnson Screens innovation uses Carbolite® beads as the filter media—a unique concept that reduces the likelihood of filter pack fouling from biofilm and encrustation, lowering overall well maintenance costs.

Carbolite is a registered trademark of Carbo Ceramics, Inc.



A Muni-Pak screen staged for installation in an industrial well in south Texas.

MUNI-PAK™ SCREENS: FIT FOR PURPOSE – YOURS



Johnson Screens' screen-packing tower is equipped with a high-intensity shaker to ensure filter media is tightly packed for optimal sand control.

APPLICATIONS

- Controls sand infiltration in new high-capacity municipal, industrial and agricultural wells.
- Can be used as a liner in existing wells to eliminate the need for constructing a new well.
- Custom applications such as infiltration galleries
- Environmental remediations
- Horizontal applications

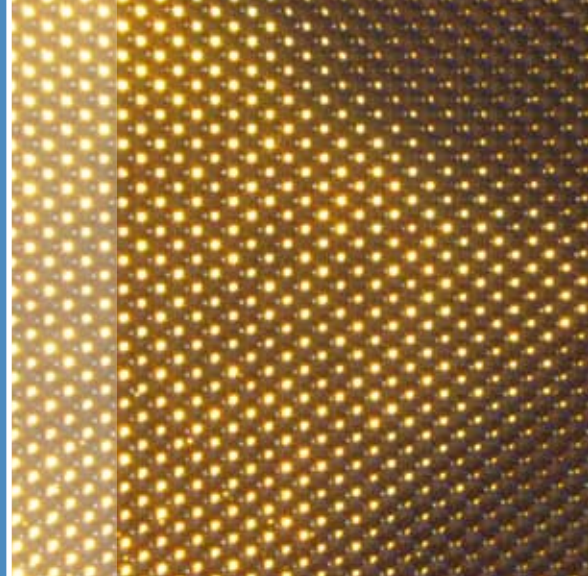


Muni-Pak screens are used in new and existing wells.

INSTALLATION COSTS: MUNI-PAK SCREEN VERSUS GRAVEL-PACK FILTERING

Description	Single-String Completion	
	Gravel Pack	Muni-Pak
Mobilization	\$13,000	\$13,000
Demobilization	\$7,500	\$7,500
Drilling	\$94,509	\$74,184
Casing	\$35,827	\$35,827
Screen	\$27,633	\$76,700
Gravel Pack	\$14,959	\$0
Grout	\$40,881	\$28,350
Development	\$24,844	\$16,148
Testing	\$7,800	\$7,800
Disinfection	\$275	\$275
Video	\$700	\$700
Site Cleanup	\$12,000	\$12,000
Totals	\$279,928	\$272,484

Savings in underreamed completions can be greater than in single-string completions.



MUNI-PAK™ SCREENS: MAKING A DIFFERENCE YOU CAN SEE

FEATURES, ADVANTAGES AND BENEFITS



Packing process allows for a thinner filter pack.

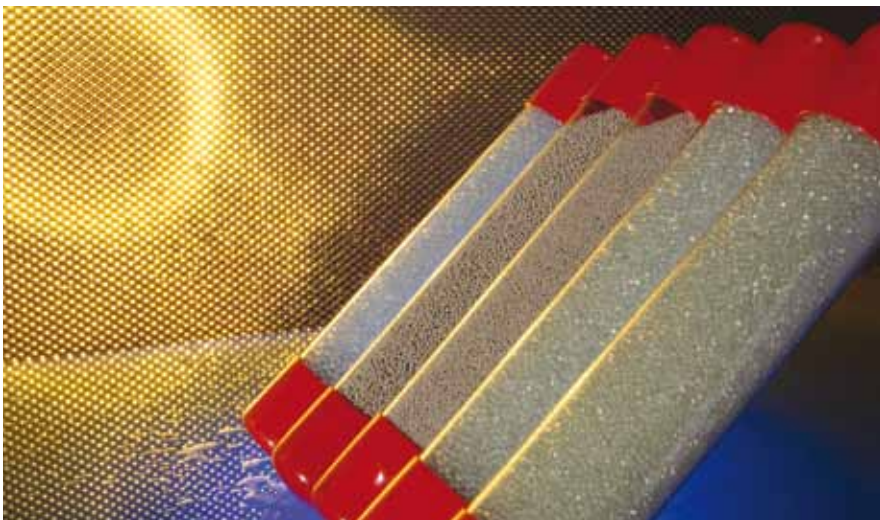
Johnson's *Muni-Pak* screens provide numerous unique features, advantages and benefits for the contractor and the well owner.

- The pre-packed construction of *Muni-Pak* screens allows the use of a smaller borehole versus gravel-packed filtering, with fewer cuttings, reduced circulating volume and increased uphole velocity. This feature lowers bit and cement costs and reduces the drilling time.
- Since the media is included as part of the screen package, gravel placement is not required—eliminating bridging filter packs
- The *Muni-Pak's* dual-screen construction is four times stronger than standard rod-based screens, allowing more aggressive development and better immunity to unexpected hole problems—providing lower costs.
- A thinner filter pack results in a smaller annulus for easier development and rehabilitation of the near-well area over time, better formation penetration and

and time spent packing, as well as reduction of equipment requirements. The results are reduced installation time and lower costs.



Dual screen design ready for assembly.



Johnson Screens offers a variety of packing medias to cover your well needs.



A wide range of screen sizes are available.

- more aggressive development. The benefits are a perfect media pack, reduced site time and lower risk.
- The wide range of diameters (1-1/4 to 20 in.) and connections (weld rings or threaded fittings) provides flexibility for meeting most application needs with a variety of standard or custom-end fittings—offering easier adaptation for a wide array of uses.
- The continuous-slot construction provides maximum open area, optimizing development and redevelopment. The result is thorough development.
- With custom lengths up to 40 ft with no mid-weld, on-site welding requirements are reduced; thus, minimizing field assembly time and associated costs.

- Multiple wire-size and filter-media options enable custom applications and maximum depth capabilities, providing a wide range of uses.
- Carbolite ceramic media improves efficiency by offering excellent roundness and sphericity; a lower uniformity coefficient for better hydraulic conductivity; better flow characteristics than silica sands; less buildup of biofilm and encrustation; and easier media cleaning than with irregularly shaped silica sand grains.
- *Muni-Pak* is suitable as a liner in existing well construction, eliminating the need for constructing a new well and saving the cost of a new well.



Screen is being filled and packed in Johnson Screens' packing tower.



MUNI-PAK™ SCREENS: MAKING THE RIGHT SELECTION

SPECIFICATIONS

Size* (in.)	Approx. Screen ID (in.)	Approx. Screen OD (in.)	Media Annular Thickness (in.)	Inner Screen Open Area (in. ² /ft)					Outer Screen Open Area (in. ² /ft)					Approx. Screen Weight (lb/ft)
				Screen Slot Size (0.001 in.)					Screen Slot Size (0.001 in.)					
				12	20	30	40	50	12	20	30	40	50	
2 × 4	2.2	4.5	0.85	13	23	31	38	43	22	39	53	64	74	17
3 × 5	3.0	5.7	0.97	18	31	42	51	59	27	47	64	77	88	23
4 × 6	4.0	6.7	0.87	22	39	53	64	74	25	45	62	77	89	25
5 × 7	5.0	7.7	0.84	27	47	64	77	86	28	51	71	87	101	27
6 × 8	6.0	8.7	0.84	25	45	62	77	89	33	59	81	100	116	35
8 × 10	8.0	10.8	0.84	33	59	81	100	116	41	74	101	125	145	55
10 × 12	10.0	12.8	0.84	41	74	101	125	145	42	77	107	133	155	70
12 × 15	12.0	15.0	0.84	42	77	107	133	155	39	73	102	129	153	85
14 × 16	13.2	16.0	0.69	46	84	117	146	170	42	78	110	138	163	100
16 × 18	15.2	18.0	0.69	42	78	110	138	163	47	88	123	155	183	115
18 × 20	17.0	20.0	0.78	47	88	123	155	183	52	97	137	172	204	128

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

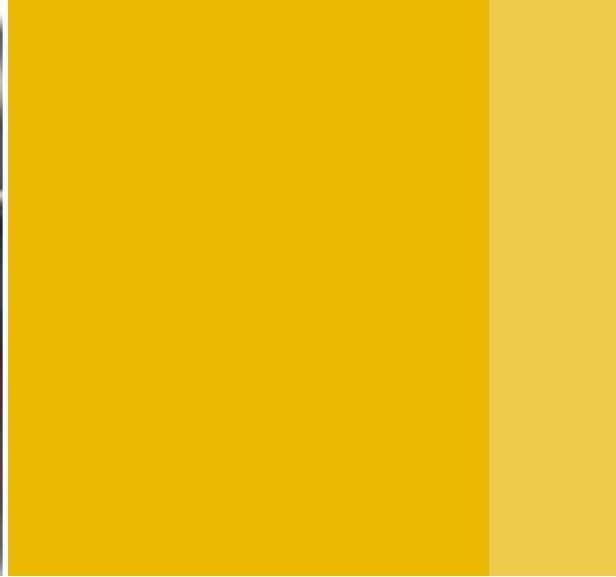
MUNI-PAK SCREEN VERSUS STANDARD ROD BASE

Nominal Size (in.)		Collapse Strength (psi)		Tensile Strength (lb)	
Rod Base	Muni-Pak	Rod Base	Muni-Pak	Rod Base	Muni-Pak
2	2 × 4	3,830	16,500	4,000	18,800
3	3 × 5	1,350	5,650	4,800	21,400
4	4 × 6	660	2,830	5,800	25,700
5	5 × 7	420	1,550	6,600	28,300
6	6 × 8	180	990	17,600	33,200
8	8 × 10	320	1,160	24,200	67,500
10	10 × 12	170	630	30,800	81,600
12	12 × 15	150	880	35,200	127,900
14	14 × 16	220	1,110	34,000	127,900
16	16 × 18	150	760	34,400	135,400
18	18 × 20	110	540	39,600	143,000

Typical construction for 500 to 1,500 ft



Once the Muni-Pak is filled with filter media the final end-cap is welded in place.



MUNI-PAK™ SCREENS: IMPROVING THE LIFE CYCLE OF WELLS

Success Showcase

NEW LIFE FOR AN OLD COLLECTOR WELL

Collector wells are major investments and not easily replaced. The City of Nekoosa, Wisconsin, constructed two in the 1960s. One became so severely biofouled and encrusted that pumping just 200 GPM practically dewatered the laterals. The problem was that the design of the original laterals did not facilitate effective rehabilitation. The original laterals were slotted 8-in. PVC.

Johnson Screens introduced the contractor to the advantages of *Muni-Pak* screens.

- The prepack design simplified installation.
- The high open area with a compact, highly conductive Carbolite® pack facilitated development (and future maintenance).
- The properties of the Carbolite ceramic beads deter biological growth.

Three *Muni-Pak* replacement laterals were successfully installed without removal of the existing PVC laterals. After development and testing, the refurbished collector well had more than a sevenfold increase in specific capacity, and testing determined that 78% of the production was coming from the *Muni-Pak* laterals.

NEW PREPACK SCREEN INSTALLED IN INDIANA WELL

The City of LaPorte, Indiana, was planning construction of a new well in its Warneke field in 2000. Existing wells in this field were underreamed, gravel-packed completions drilled by reverse circulation and had been plagued with decreased specific capacity.

Johnson Screens worked with the City's contractor on presenting the *Muni-Pak* product to City engineers.

Despite an initial concern about proper packing and adequate production from a prepack design, the City chose the *Muni-Pak* solution for several reasons:

- The prepack design negated concerns over proper pack placement.
- The slim pack afforded greater development potential than an underreamed completion.
- The Carbolite pack was considered superior to conventional silica sand.

After successful placement of the *Muni-Pak* screen, the new well was developed without a problem, and a 24-hour pumping test was conducted. The well produced 805 GPM with a specific capacity of a 24.6-gal/min/ft drawdown. This production compares

favorably to the existing wells in the Warneke field, which had much larger underreamed holes. The *Muni-Pak* screen passed the test.



Water well drillers find *Muni-Pak* screens easy to install.

Providing over 100 years of experience,
innovation and customer satisfaction.
Contact us today.



OUR WIDE RANGE OF PRECISION ENGINEERED EQUIPMENT IS SUITABLE FOR MORE APPLICATIONS THAN EVER.

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- Custom lighting
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- Furniture
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- Grating
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- Inspection
- Repair
- Assistance
- Supervision

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- Effluent treatment equipment
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- Progressive Cavity Pumps
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- Reject handling equipment, drums
- Sieve bends, screen panels
- Water treatment equipment

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- Distributor trays
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- Outlet baskets
- Overlay grids
- Scale traps
- Scallop screens
- Vessel internals

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- Conveyors and compactors
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WATER WELL

- Nu-Well™ chemicals
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- PVC drop pipe
- PVC well screens
- Pre-packed well screens
- Rod-based well screens
- Stainless steel casings and risers
- Well screen fittings and accessories

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