

**INTERNALS FOR  
DOWNFLOW REACTORS**



*Johnson designs and manufactures a wide range of screens for media retention. Among these innovative products is a line of flat screens used in downflow or upflow systems to retain the often-costly media and to provide a collection area for the process flow across the entire vessel diameter or length. Because of their strength, durability and flow characteristics, our support grid systems are widely used in hydrotreaters, desulfurizers, molecular sieves, sandfilters, gas sweeteners and other adsorption systems.*

There are multiple advantages in using Johnson screens for demanding media retention applications:

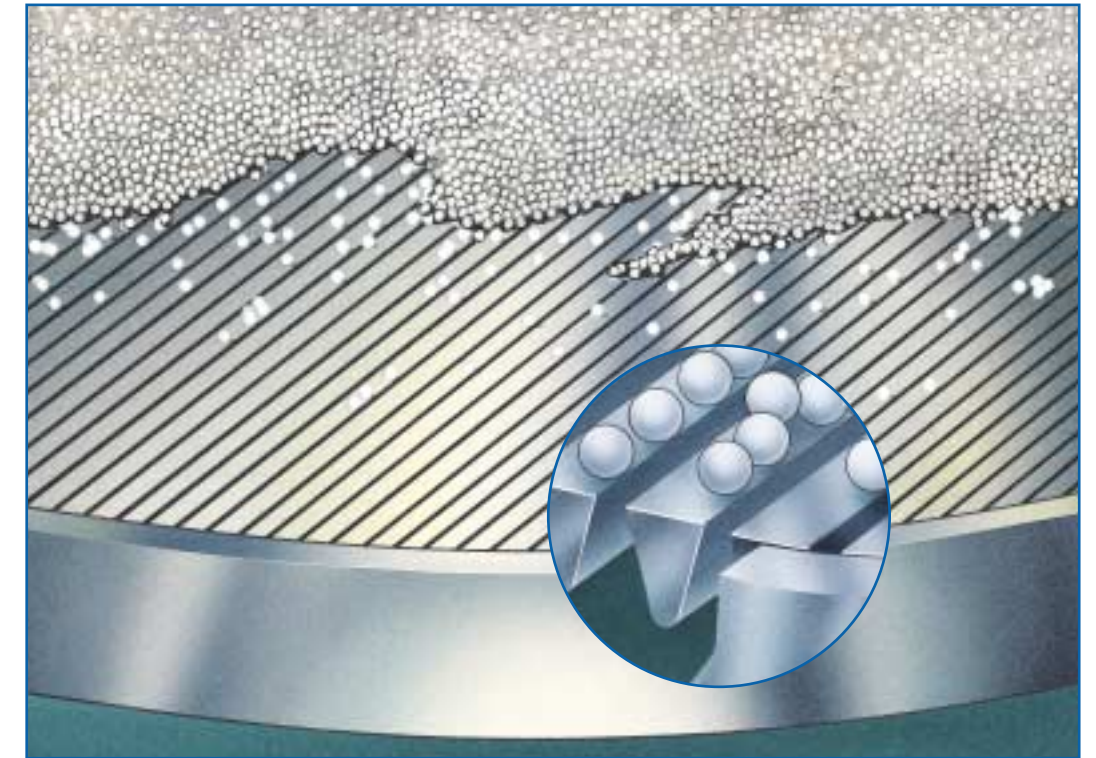
- **Johnson screens are extremely strong.** Made of welded wires and rods, Johnson screens have exceptional resistance to collapsing or buckling even in operations such as hydrocracking and desulfurizing operations where screens must withstand loads of 350 kPa or more.

- **Johnson screens offer precise media retention.** Johnson support grids can have slots as narrow as 0.05 mm to dependably retain even very small size catalyst, resin or molecular sieve. Despite the narrowness of these individual slots, the screen has a much higher total open area than grids using wire mesh on grating. This increased open area translates directly into superior process efficiency.

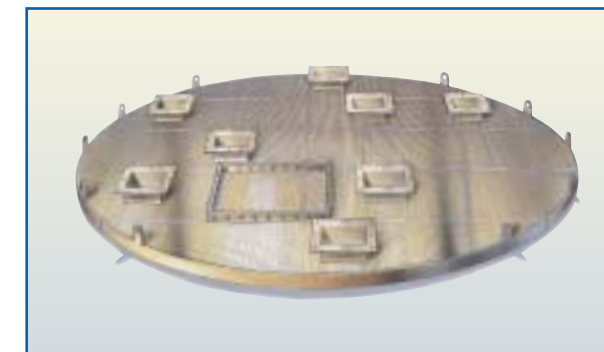
- **Johnson screens provide a stable interface.** Unlike wire mesh, Johnson screens directly retain the media without an intermediate layer of inert balls. The smooth surface of the screen also reduces abrasion.

- **Johnson screens are virtually maintenance-free.** Once installed, the screens require very little maintenance. Their special slot design virtually eliminates plugging but if it should ever occur, cleaning with a wire brush is quick and easy and can be done without fear of damage to the screen surface.

- **Johnson screens have maximum design flexibility.** Johnson support grids are fabricated in a variety of custom shapes and sizes to meet any process or vessel requirement. Made of a variety of materials such as type 304, 316, 316L, 321 and 410S stainless steel, they may also be fabricated in sections and include manways, dump ports and other features required by vessel or operational constraints.

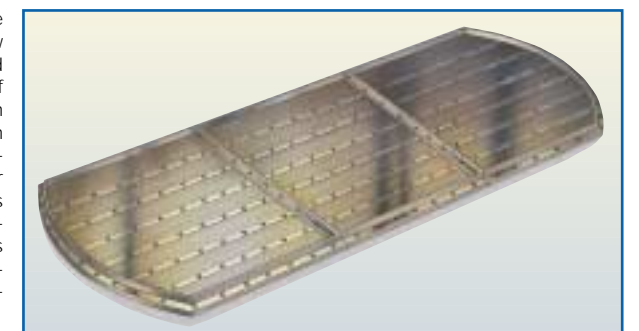


Johnson screens have high open area, non-plugging slot design and present a stable, smooth interface with the media.



Johnson screen grids can be fitted with manways lifting lugs, thermowell guide and catalyst dump tubes.

In horizontal vessels, the screen is placed below the center line and extends the full length of the vessel. Depending on vessel size, the screen may span the entire distance or rest on one or more support beams. As with circular grids for vertical vessels, the screen is often made in flanged sections to facilitate installation.



JOHNSON GRID DESIGNS SOLVE DIFFICULT PROBLEMS



To deal with the extreme loads often encountered in media retention systems, we typically recommend side-by-side (SBS) construction (top left). In this design, large rectangular bars are welded to the screen support rods creating a very strong structure. For lighter loads, single rod (SR) construction may be used (top center). We can also design grids with larger, heavier flanges (top right) which allows the grid to span greater distances, minimizing the needed support structures.

Each section of screen is furnished with bolted joints for quickly sealing to a gap smaller than your requested slot size. The entire structure is normally stainless steel for best performance in your application. The screen surface can be made of a stainless steel thermally compatible with a carbon steel support structure allowing a low cost installation. If a flush surface is required, inverted flanges or seams prepared for welding can be supplied.

We provide edge banding on the screen to create an annulus between the vessel wall and the grid. This gap is normally packed with multiple wraps of rope packing suitable for the temperature and chemical environment. Flanges are also available if gasketing is required between the grid and the vessel support ring or if the grid is to be bolted to the support ring.

Materials are matched to special process conditions. Type 304, 316, 316L, 321 and 410S stainless steel are widely used but other materials such as Alloy 20, Alloy 400, Alloy 600 and Alloy C-276 are available for special applications.

For special circumstances, we manufacture grids

with catalyst dump tubes, sealing arrangements for thermowell penetrations and other special features. We segment the grids into chordal sections or pie-shaped panels and install removable manways for access to the screen's underside and to equipment installed between beds. Making placement of Johnson grids substantially easier and faster than those using wire mesh.

To increase effective vessel height, we can use a recessed grid design in which screen panels sit within instead of on top of the vessel's support structure.

Sometimes a screen is needed to separate catalyst from a layer of inert balls or to help maintain a level top surface. For these conditions, we make a lightly constructed hold-down screen which normally floats on the catalyst or inert balls without being tied to or supported by a vessel ring. The perimeter is not sealed.

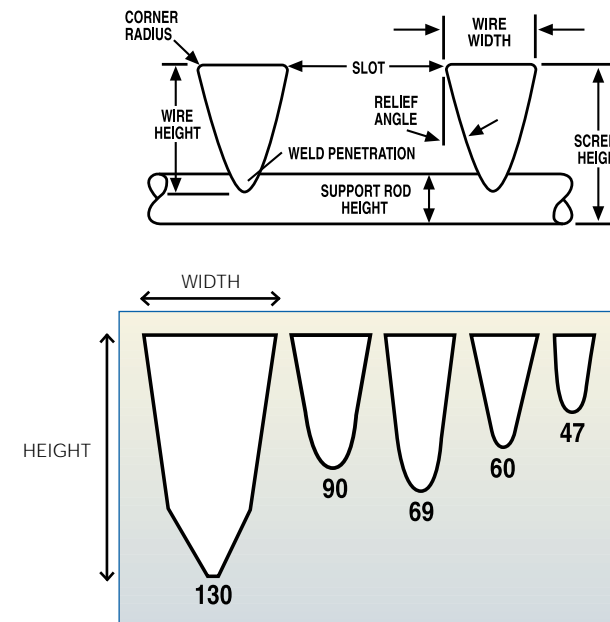
Other special designs can be developed for unique processes. Our engineers will work with you to arrive at the best, most cost-effective design.



In retrofitting fixed bed systems, damaged wire mesh is removed, leaving still-serviceable support grating in place. Johnson screens are then installed over the grating, creating a very strong, efficient and long-lasting system.

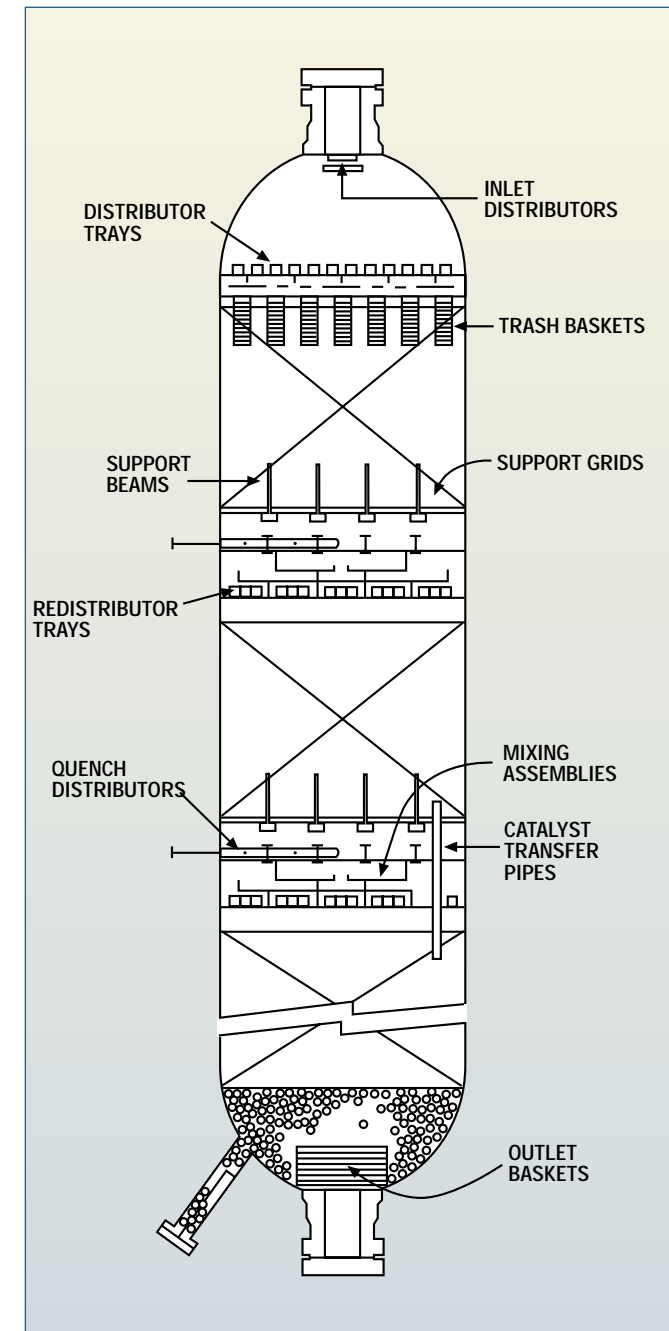
WE CAN SUPPLY ALL YOUR VESSEL INTERNALS

In addition to support grids for media retention, we also design and fabricate virtually every other vessel internal you may require. These include transfer pipes, mixing assemblies, support structures, Vee-wire trash baskets, distributors and outlet baskets. In short, everything you need to move, distribute and collect fluid flow through your vessel can be supplied – and supported – by Johnson Screens, the world leader.



WIRE NAME	WIRE NOMINAL WIDTH	WIRE NOMINAL HEIGHT	RELIEF ANGLE
	(mm)	(mm)	
47	1.19	2.24	10°
60	1.52	2.54	13°
69	1.80	4.50	7°
90	2.26	3.50	13°
130	3.30	6.35	8°

Notes: Not all wire shapes shown are available in all materials. All dimensions and names are subject to change without notice. Most commonly used wire shapes and sizes are shown above. Other shapes and sizes can be recommended to suit special applications.



## SCALE TRAPS



Downflow processes often carry metallic contaminants or scale which can quickly plug the surface of a vessel's catalyst bed. Our solution is to effectively increase the surface area of the bed which disperses the scale over a wider area thus extending the bed's useful life. This is easily done by placing an array of Johnson screens in the upper part of the catalyst bed where – depending on screen size and placement – they can increase the total effective bed area by up to 400% and trap most of the contaminants in the flow.

## DISTRIBUTOR TRAYS

In downflow processes, amongst main applications in refineries, hydrocracking, hydrotreating and hydrodesulphurisation, Johnson gas/liquid distributor trays/mixing chambers are installed across the entire section of the vessel.

Their characteristics are good mixing of incoming liquid and gas flows. Ensuring an even distribution through the entire reactor cross section results in uniform flow pattern and optimum catalyst performance. Made of an assembly of bolted plates and distributor nozzles/chimneys, Johnson trays detailed design also include support beams, manways, gaskets and all the hardware required for installation and testing. Pre-assembly is offered in order to make sure that all parts match together. Tightness is controlled after trays final assembly in the vessel thus avoiding by-pass and mis-distribution of the flow to the catalyst bed.



As other Johnson reactor internals, trays are made of type 321, 347, 304, 316 stainless steel or any other material.

## HEADER LATERAL SYSTEMS

A typical vessel would use a header lateral assembly at the top to distribute inflow evenly across the bed surface. A second assembly, located near the vessel bottom, could collect the treated flow and pass it either through the vessel sidewall or – by attaching the laterals to a central hub – out the vessel bottom. For counter-current flow, a similar distribution and collection system can be designed.



## OUTLET BASKETS



In downflow processes, a screen at the outlet is usually necessary to prevent treatment media from migrating out of the vessel. This function is best performed with a Johnson screen outlet basket. Made of wires and rods welded at every intersection, Johnson screens have exceptional resistance to collapsing or buckling even under extreme loads and high temperatures.

The screens may be built as a single unit or segmented for installation through manways. Sizes and installation options available for particular vessel requirements.