



**Johnson  
Screens**

A brand of  
Aqseptence Group



# Internals for Down Flow Reactor



# Johnson Screens has the Solution with World Renowned Screening Technology

Johnson Screens designs and manufactures a wide range of vessel internals for media retention. Amongst these innovative products is a line of internals used in down-flow or up-flow 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 and distributor tray systems are widely used in hydrotreaters, desulfurisers, hydrocrackers, molecular sieves, sand filters, gas sweeteners and other absorption systems.

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

## **Screens are extremely strong:**

Made of wires and rods welded at every intersection, our screens have exceptional resistance to collapsing or buckling even in operations such as hydrocracking and desulfurising where screens must withstand loads of 350 kPa or more.

## **Screens offer precise media retention:**

Support grids can have slots as narrow as 0.002 in. to retain very small catalyst, resin or molecular sieves. 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.

## **Screens provide a stable interface:**

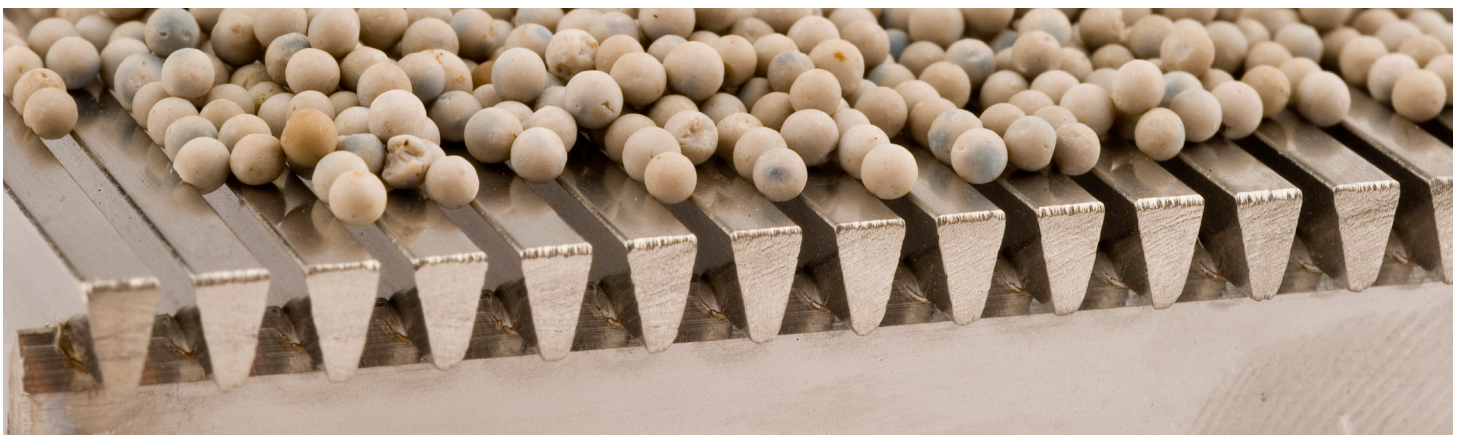
Unlike wire mesh, our screens directly retain the media without an intermediate layer of inert balls. This smooth surface of the screen also reduces abrasion of the catalyst.

## **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.

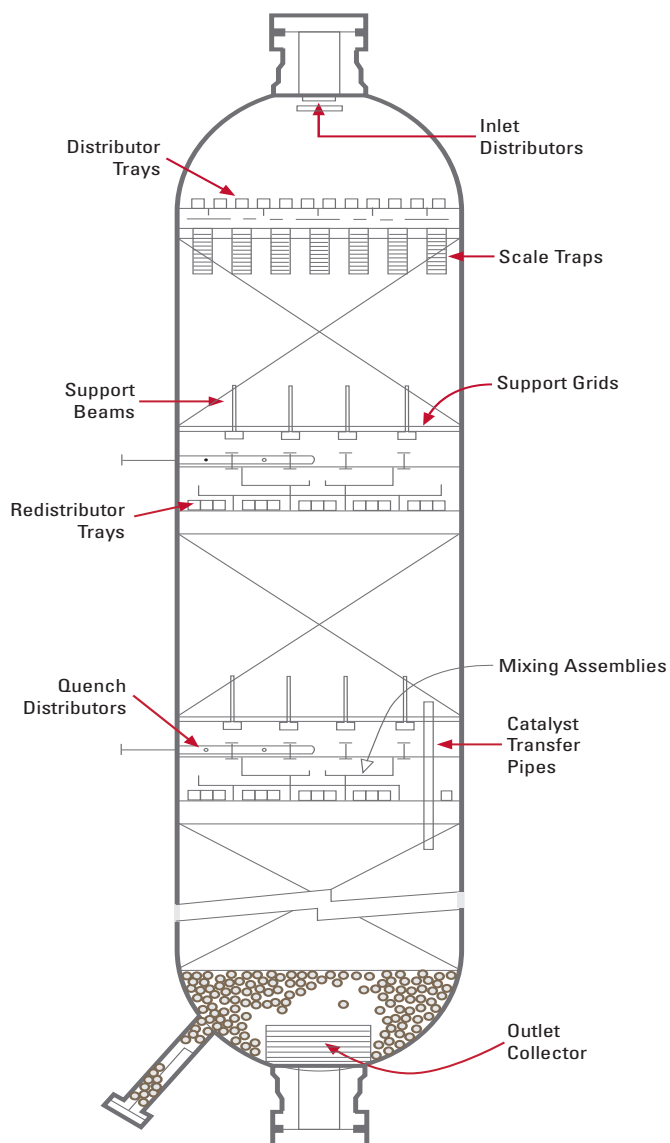
## **Screens have maximum design flexibility:**

Our support grids are fabricated in a variety of custom shapes and sizes to meet any process or vessel requirements. Made of variety of materials such as type 304, 316, 316L, 321, 347 and 410S stainless steel and exotic alloys, the grids may also be fabricated in sections and include manways, dump ports and other features required by vessel or operational constraints





**Figure 1**



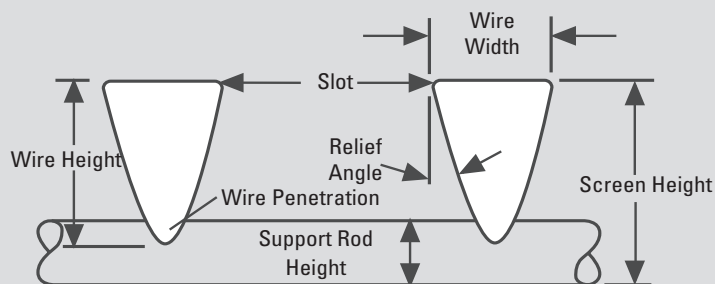
**Figure 2**

Johnson Screens provides a fully developed product line of down flow internals to meet our clients' needs. Petrochemical refineries and gas processing plants commonly utilize arrangements similar to figure 1 in a multitude of their processes including: single stage reactors, adsorption units, dehydration units and amine scrubbers. These clients' have been taking advantage of Johnson Screens products longevity for nearly 65 years!

Refineries also take advantage of Johnson Screens down flow reactor internals which can be arranged in a single stage reactor, as in Figure 1, or a multi stage reactor, as in Figure 2. Johnson Screens partners with licensors to supply the reactor internals for refineries' hydrotreaters, hydrocracker and related processes.

Johnson Screens experience with designing and supplying reactor internals provides our clients with assurance that the products will be manufactured with the newest technology, the highest quality and premium service.

Wire No.	Width (in.)	Height (in.)	Relief Angle
47	.047	0.088	10°
63	0.060	0.100	13°
69	0.071	0.177	7°
93	0.089	0.138	13°
118	0.116	0.185	13°
130	0.130	0.250	8°



# Support Grids

**Johnson Screens provides industry leading technology to industrial screen problems. No matter what obstacles are present in the vessel, we can manufacture grids that accommodate many design features such as dump-tubes, thermowells, thermocouples and other special requirements.**

- Support grids can be made into a variety of shapes including pie-shaped panels and chordal sections.
- To provide access to the underside of the grid, a removable manway can be installed.
- Our designs vary to accommodate different load, temperature and special configurations.

To deal with extreme loads often encountered in media retention systems, we typically recommend side-by-side (SBS) construction. In this design, large rectangular bars are welded to the screen support rods, creating a very strong structure.

For lighter loads, strip rod (SR) construction may be used. We can also design grids with larger, heavier flanges, which

allows the grid to span greater distances, mitigating the need for a support structure.

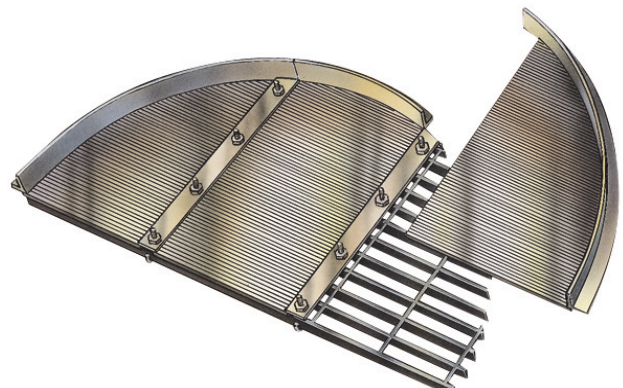
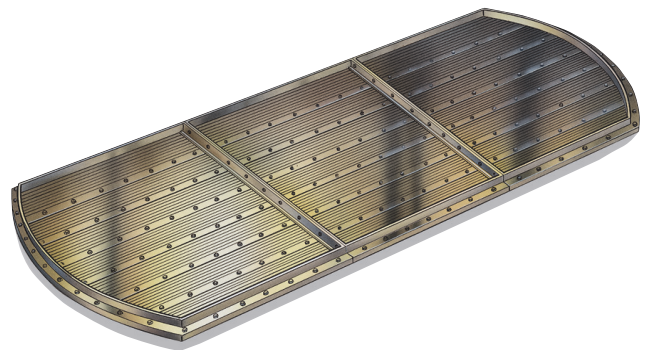
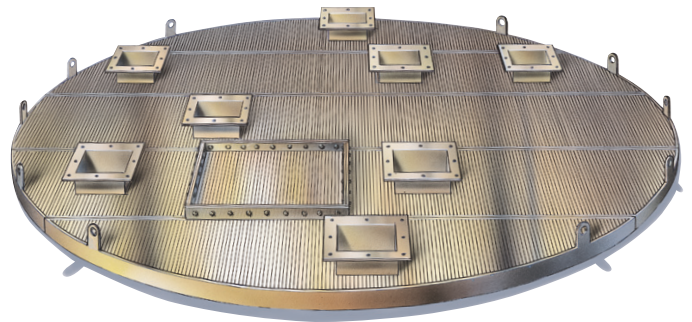
Dehydrator systems with cyclic pressure and temperature impose difficult constraints on grid design. Working together, we can define the correct vessel support ring size, grid metallurgy and perimeter seal to achieve trouble-free operation.

When complex geometry, as-built reactor conditions or unknown problematic interfaces are present in the reactor, Johnson Screens can provide internal reactor 3D scanning to identify the problem and design the proper solution to mitigate the installation risk during your turn around.

**Johnson support grids can be fitted with manways lifting lugs, thermowell guide and catalyst pump 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.

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

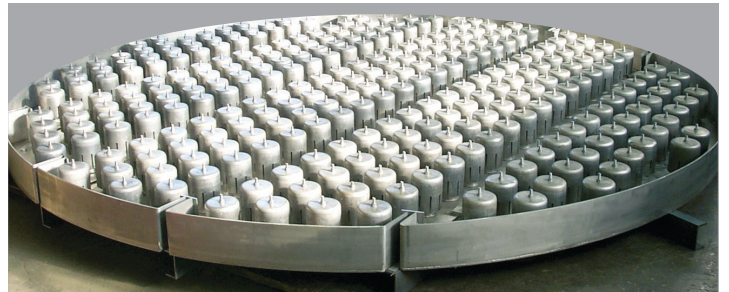


# Distributor Trays

Gas/Liquid distributor trays and mixing chambers are key components in refinery applications such as hydrocracking, hydrotreating and hydrodesulphurization. High performance distribution trays provide excellent mixing of incoming liquid flow. Ensuring an even distribution over the entire reactor cross section into the catalyst bed, results in a uniform flow pattern and optimum catalyst utilization. Adding a mixing chamber to an interbed quench system provides the necessary cooling of reactants in hydroprocessing units.

Made from an assembly of bolted plates and distributor nozzles/chimneys, distribution trays may also include support beams and manways. Gaskets and installation hardware with spare quantities are included in our supply package. Pre-assembly of the complete package is provided to ensure all parts match properly and meet our strict quality control requirements.

Tightness of all joints is defined by our product engineers, thus avoiding by-pass and mal-distribution of the flow into the catalyst bed during operation of the unit.



# Scale Traps Extend Bedlife and Increase Flow Area

Down flow processes often carry metallic contaminants or scale, which can quickly plug the top surface of a vessel's catalyst bed. Scale traps effectively increase the surface area of the bed which disperses the scale over a larger area, thus extending the bed's useful life. By placing an array of scale traps in the upper part of the catalyst bed the total effective bed area can be increased by up to 400% and trap a majority of the contaminants present in the flow.

Scale traps are designed to resist normal operating stresses and survive being dumped with the catalyst during removal of catalyst beds. Scale traps robust design allows for easy cleaning by either vigorously wire brushed or blasted without damage to the assembly. After cleaning the scale traps can be reinstalled with the new load of catalyst.

Standard scale traps range from:

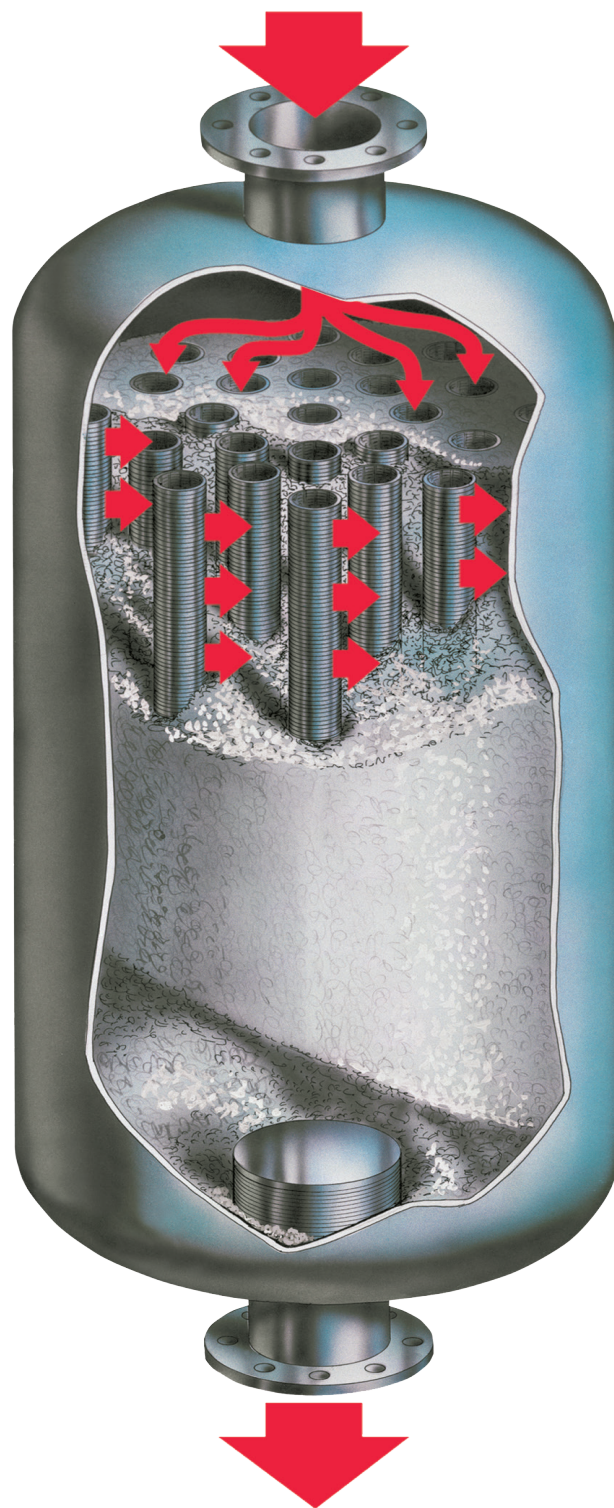
- OD: 4 in. to 6 in.
- Length: 12 in. to 36 in.
- Slot Opening: 0.020 in. to 0.060 in.
- Total screen open area can be as high as 50%.

## Outlet Collectors

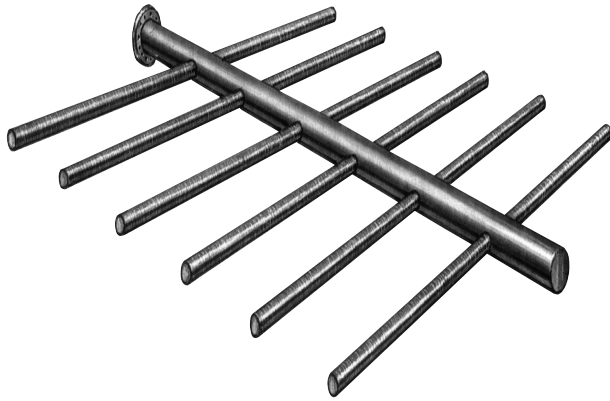
In down flow processes, a screen at the outlet is usually necessary to prevent treatment media from migrating out of the vessel. This function is best performed with a Johnson Screens outlet collector. Outlet collectors are made of wires and rods welded at every intersection, our screens have exceptional resistance to collapsing or buckling even under extreme loads and high temperatures.

The outlet collectors may be built as a single unit or segmented for installation through a manway. Sizes and installation options are available for particular vessel requirements. Optimum performance of an outlet collector requires proper relationship of diameter-to-length and side-to-top open area. We can assist in defining your final design.

Johnson Screens outlet collectors can directly retain the catalyst without needing transition layers of inert balls. Special fabrication and cleaning techniques allow the collectors to be used in high purity gas service



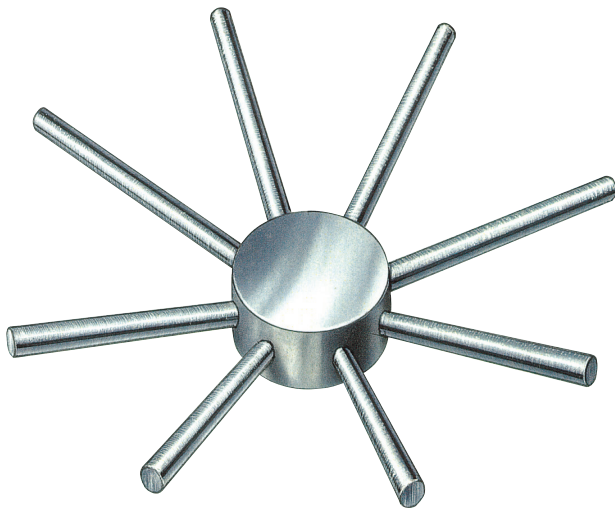
# Header Lateral Systems



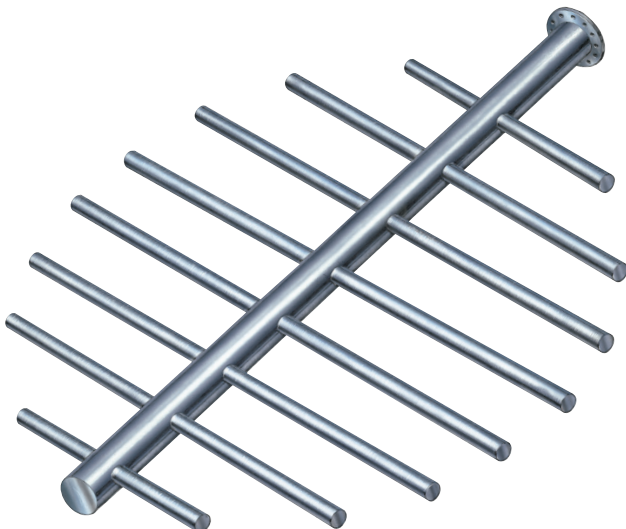
Header lateral systems consist of a series of screen laterals attached to either a central header or hub. The assemblies allow process engineers to design for uniform flow through the treatment media at a wider range of rates and for a variety of vessel sizes and shapes.

A common vessel arrangement would use a header lateral assembly at the top of the vessel to distribute inlet flow evenly across the bed surface. A second assembly, located at the bottom of the vessel, collects the treated flow ensuring uniform fluid distribution across the entire length and cross section of the vessel. For counter-current flow, flow with an inlet at the bottom of the vessel, the arrangement is inversed with the distributor at the bottom of the vessel and the collector at the top of the vessel.

Header lateral system can be design to accommodate a variety of process conditions and requirements, while maintaining their characteristics of high distribution efficiency. Several design options can be chosen to achieve the uniform distribution and collection.



- Lateral spacing, length diameter and slot opening size are based on individual system needs. Slot sizes can be any width from 0.002 inches and up in 0.001 inch increments. Laterals can be as small as 0.75 inches in diameter or larger. The number and spacing of the laterals can also be varied.
- Laterals attach to headers of hubs with either threaded fittings, couplings or flanges.
- A perforated pipe-base can be used inside the screen laterals for increased collapse resistance and enhanced flow distribution.



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