Peerless ULTRA FilterSep
Frequently Asked Questions

The Peerless ULTRA FilterSep integrates the high efficiency and high capacity features of separation and filtration technology to produce the most compact, optimum performing line of separation equipment in the industry.

Through advanced research, development and testing Peerless has produced a superior engineering design through a combination of advances. The result is the **ULTRA FilterSep** with:

T-FEED distribution
UltraMax filters
P6X vane technology

ULTRA re-defines the efficiency and capacity expected from a filter-separator design.

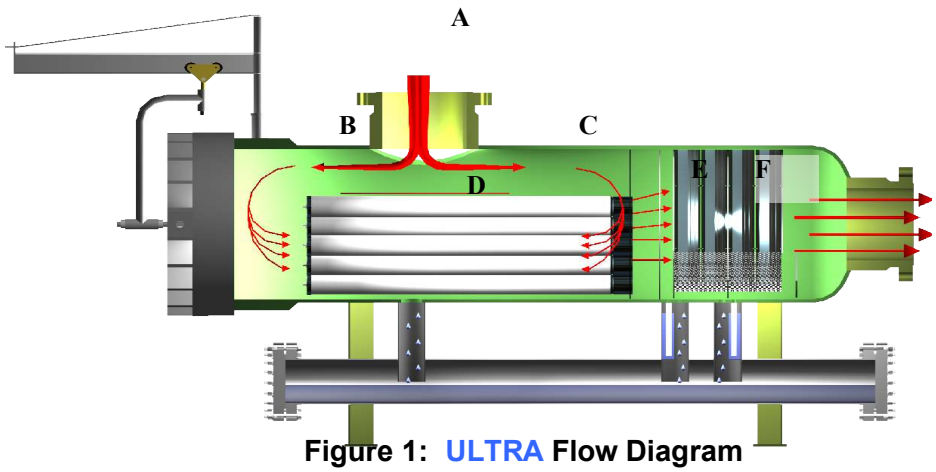

Figure 1: ULTRA Flow Diagram

How Does the ULTRA FilterSep Operate?

See figure 1. The gas enters the separator at the first-stage, filter-coalescer section through the inlet nozzle (A) and into the **T-Feed** chamber that distributes the gas flow into two directions, the closure end of the vessel (B) and the outlet end of the first-stage chamber (C). The flow enters the coalescing, filter element section (D) where the large solid particles and large liquid droplets fall to the bottom of the vessel to be removed in the first-stage sump. The smaller solid particles are trapped in the **UltraMax** Filters, utilizing ultra fine media in special barrier multi-layers. The small liquid droplets coalesce in the **UltraMax** filters where they are combined into larger liquid droplets (E). Gas and the coalesced liquid droplets flow into the second-stage, inertial **P6X** vane pack (F). The vane pack consists of high capacity patented **P6X** multi-stage, multi-flush-pocket vanes that separate the liquid droplets from the gas at high velocity, draining the liquid into the second-stage drain sump for complete removal.

How Does Peerless Assure Good Distribution of the Incoming Gas to the Filter-coalescer Elements?

To assure the good distribution of the incoming gas to the filter-coalescer elements, Peerless has perfected the >**T-Feed** Distribution System=.

What is the Principle of the >T-Feed Distribution System TM'?

Most designers of separators depend upon cross-flow to distribute the gas/liquid/solids to the filter-coalescer elements. In large element bundles, this causes an uneven flow distribution resulting in more frequent change-outs because solids will tend to accumulate faster in the elements around the outside of the filter bundle. The Peerless T-Feed Distribution System guides the flow and contaminants to the element ends where most contaminants drop out and allows the gas to flow unrestricted through the triangular openings between the elements. This provides for very even flow distribution to the entire bundle with minimal solids loading to the elements. In figure 2, Computational Fluid Dynamics (CFD) imaging allows one to see how even the pressure losses are in this process. Even pressure allows even flow distribution.

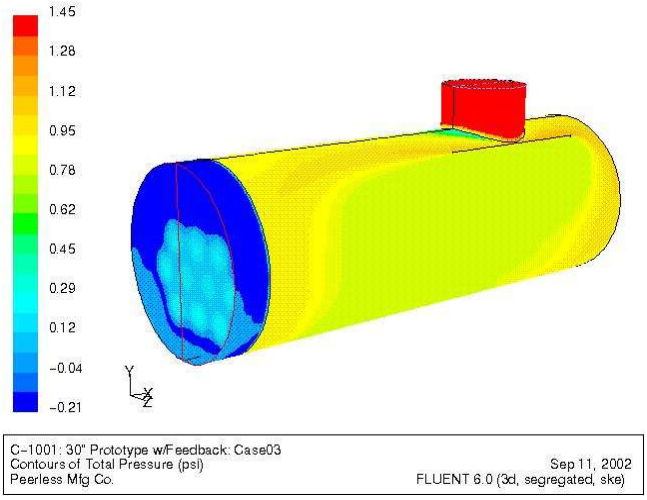

Fig 2: Contours of gas pressure in the ULTRA filter chamber

If the Peerless FilterSep Diameter is Smaller, How Can It Still Meet Efficiency (η)?

The limiting factor in most filter-separator applications is the allowable clean pressure drop (typically set by the customer at 2 psig or less) and the allowable gas velocity through the second-stage inertial vane section. The majority of pressure drop in the separator occurs through the tube sheet that supports the filter elements. By increasing the standpipe bore to 5" and using 72" long elements, the pressure drop is greatly reduced and, therefore, allowing maximum utilization of the maximum capacity of the **P6X** vane pack. Through extensive laboratory testing and computational fluid dynamics (CFD) simulations, Peerless developed and uses a patented multi-stage, ultra-high capacity **P6X** multi-flush-pocketed inertial vane to meet the required

separation efficiency for **Ultra FilterSep** applications. The combination of **UltraMax** filters and **P6X** high capacity vanes allows for the sizing of a **ULTRA FilterSep** which is consistently 2 or more diameters less than industry standards and guaranteed to meet the specified separation efficiency

What is the Surface Area and Dirt Handling Capacity (Q) of the UltraMax Filter-coalescer Elements?

The surface area of the filter section has been increased through the use of Peerless patented 5 7/8" O.D. (5" I.D.) by 72" long coalescing **UltraMax** filter elements, each totaling over 1290 square inches per element. This design allows for greater solids holding capacity because of their high void fraction and porosity. Solids can find many >hiding= places among the microscopic fibers of media. Additionally, the multi-layered design of the element allows solid particles to accumulate between the first few layers in great quantities forming a >cake effect=. This >cake effect= makes a superior barrier to microscopic solids and improves the **UltraMax** filter capability to coalesce liquids.

What are the Unique Characteristics of the Peerless UltraMax Filter/Coalescing Element?

The element is manufactured with a micro-fine, non-woven, polyester fiber material in 5 layers that ensures superior solids filtration and liquid coalescing at every layer with minimum pressure drop. The design has a high void fraction to increase solids loading, resulting in fewer change-outs.

Elements are installed on a four-legged, full-length support to prevent misalignment, vibration, or collapsing under heavy loads. A larger than average, 5 7/8" diameter filter means there are fewer elements to replace, so change-out time is reduced.

The filter-coalescer elements are sealed against a special tapered sealing surface to prevent gas bypass. This Peerless seal design assures a positive seal.

Is Test Data Available for the Peerless UltraMax Filter-coalescer?

Peerless operates its own research and development laboratory in Dallas, Texas. Test data is available from both the Peerless facility and an independent lab that removes all doubt about the performance of the UltraMax filter.

Why is the Second-Stage Vane Section So Important?

The majority of solid particles and liquid droplets are removed in the first-stage, coalescing filter section. However, in pipeline applications where this type of filter-separator is utilized, the gas is mostly clear of large particles, but can be contaminated with small pipe scale particles and lube oil mist. The first-stage is designed to remove

solids and coalesce the small liquid droplets as they pass through the UltraMax filter-coalescer elements. The smaller droplets (less than 10 micron) are coalesced into droplets greater than ten micron in size. The second-stage, multi-pack, vane section removes the coalesced liquid droplets entrained in the gas stream, efficiently and rapidly. The first-stage filter/coalescing section is not designed to separate the smaller, sub-micron liquid droplets, but to coalesce them for proper separation by the P6X vane section. Final vane packs are essential in any filter-separator design to ensure the removal of small liquid droplets from the gas stream.

What is the Pressure Drop Across the Internals?

The guaranteed clean pressure drop across the internals at rated capacity (Q) is 1.5 psi or less. Low pressure drop is designed into the ULTRA FilterSep. The standpipes to filter diameter ratio is larger than the traditional filter-separator, allowing greater flow with less pressure drop. So despite the larger flow rate, the overall pressure drop remains low.

What is >Inertial Vane Separation Technology=?

An inertial, pocketed, vane type separator was patented in 1933 by the founder of Peerless Mfg. Co., Donald Sillers, Sr. This type of vane separates liquids from a gas stream using the inertia of the gas passing through a tortuous path created by the >zig-zag= design of Peerless vane profiles. Liquid droplets are heavier than the gas and cannot make the turns as easily as the gas. Additionally, turbulence created by the bends cause a rapid, random motion of the droplets. The combination of these forces results in droplets coalescing into a liquid film that adheres to the walls of the vane. The film moves toward a pocket and is captured, removing the liquid from the gas stream. The liquid in the pocket is drained to the vessel sump by gravity.

Why are Pocketed Vanes Superior to Vanes Without Pockets?

Pocket-less vanes must remove the liquid films without the sheltering effect of pockets. In draining the unsheltered liquids, an unstable liquid film will form liquid waves on the vane walls. Once this occurs, the liquid will re-entrain into the gas stream and carry-over will result. Therefore, pocket-less vane capacity is limited and efficiency is poor when compared to pocketed vanes.

What Makes the Peerless P6X vane an Efficient (η) Performer?

The Peerless P6X vane has a very high liquid capacity (Q) because of its multi-staged, multi-flush pocketed design. The ability of the pockets to shelter the captured liquid from the gas stream and drain it out of the system ensures positive liquid removal and high efficiency. The vane design utilizes a larger spacing than conventional vane separators, to accommodate almost twice the gas capacity of double pocket vanes. At comparable gas velocities, this design can handle 50 to 100 times more liquid than a

conventional double pocket vane, an important factor when slugging is a possibility.

Why is filter sealing so important?

Most filters rely on flat gaskets to seal. Peerless lab tests prove that rounded sealing surfaces seal better with less force. The UltraMax uses a custom designed sealing system that has been proven to seal better than flat gaskets. The mating surface is a tapered design what will tolerate a great deal of misalignment of the filters. At the cap end, sealing is made positive by using a smooth mating surface with a rubber grommet. The rubber grommet is forced into position with fasteners. The overall result is a very positive seal under that will not break under extreme conditions of service.

How is the filter fastening system different than the usual FilterSep?

Most filter vessels rely on national coarse hexagonal or wing nuts to fasten the filters in place. The UltraMax uses self-locking hexagonal nuts that are protected from erosion inside a recess of the filter cap. Self-locking nuts prevent the metal-to-metal contact that usually results in seizing due to crevice corrosion. O