



# Coalescer Cartridges for Aviation Fuel and Industrial Use

## FEATURES

- Cost effective particle and emulsified water removal from hydrocarbon fluids
- Easy installation and replacement with one-piece design
- Choice of Threaded Base or Open End cartridges
- Choice of All-Fiberglass Media or Combination Fiberglass and Pleated Media
- Field proven performance
- Ongoing qualification testing to meet changing commercial and military requirements

## GENERAL

Coalescer cartridges are employed as the first stage in filter/separator vessels for hydrocarbon fluids. They perform two functions: (1) coalesce (combine) highly dispersed, emulsified water particles into larger water drops and (2) filter-out particulate contaminants.

## HOW COALESCER CARTRIDGES WORK

The top photo shows a highly magnified view of the coalescing process. Tiny droplets of water contact and adhere to strands of fiberglass. Flow pushes the droplets along the strand until they reach an intersection of strands where they combine with other droplets (coalesce) into large drops.

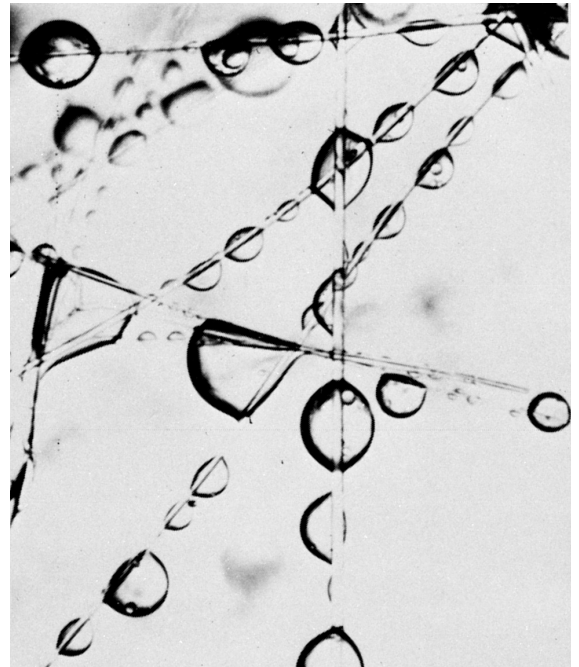
These large drops are then carried to the outside surface of the cartridge. Having a higher specific gravity than the hydrocarbon fluid, they release and settle to the bottom of the vessel. The larger the drops, the faster and more efficiently they fall out. (See bottom photo.) In general, particle removal efficiency increases with coalescing efficiency. This is accomplished by employing a tighter, finer filtration media.

Flow direction is from inside to outside of the cartridge. This minimizes surface velocity and helps prevent the water drops from breaking up and being carried downstream.

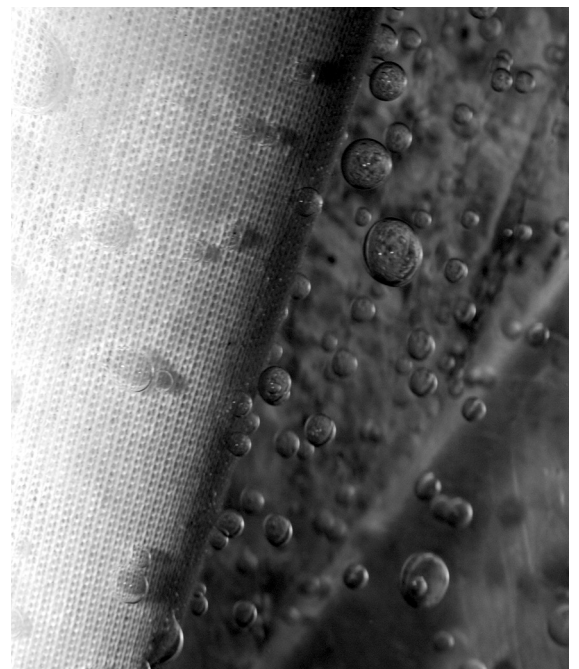
## APPLICATIONS

Coalescer cartridges are used primarily to coalesce emulsified water and remove particles from hydrocarbon fluids. The largest single application is the filtration of aviation jet fuel. They are also used with other types of fuels, process streams in refineries and petrochemical plants, and condensate streams where natural gas is produced.

Other liquids can be separated if they are immiscible, the specific gravities differ, and high concentrations of surface active agents are not present. As a rule of thumb, if a sample of the mixture readily separates in an hour or two, a coalescer can probably be used. If the mixture hasn't separated after 24 hours, coalescing probably won't work.



Photomicrograph of coalescing process inside fiberglass media.



Coalesced water drops releasing from the knitted sock at the outside surface of the cartridge.

# Coalescer Cartridges

## CONSTRUCTION

Velcon single-unit coalescer elements are offered with Threaded Base or Open Ends and with Fiberglass Media or Fiberglass and Pleated Media combinations.

**Threaded Base Coalescers** are recommended for use in most applications. They simplify installation and replacement by eliminating the need for cover plates, center plates, nuts, washers, and gaskets. They are for use in Velcon and other make filter/separators. Threaded base adapters are available to convert vessels presently using open end elements.

**Open End Coalescers** are offered with single unit construction which reduces the number of gasket seals and improves overall reliability.

**All-fiberglass Media Coalescers** combine depth particulate filtration with a deep coalescing structure. All-fiberglass designs have successively finer media layers to achieve depth-type filtration of particles.

**Combination Fiberglass and Pleated Media Coalescers** remove particles primarily in the high surface area pleated core. They have one or more layers of pleated media inside a cylinder of molded fiberglass laminations to provide an extended surface area for particulate filtration. Pleat corrugation and separation materials are used to keep pleats open for full utilization.

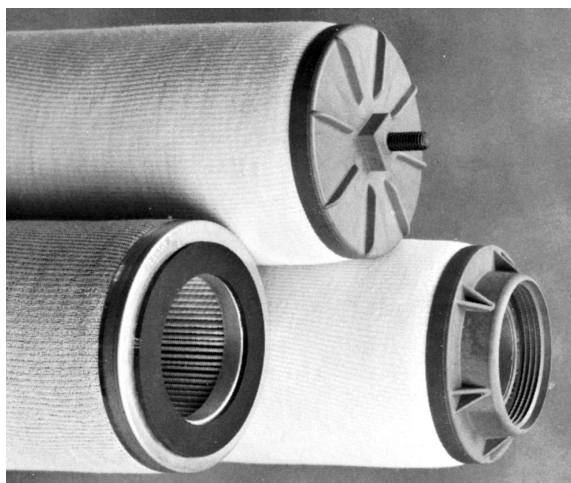
Coalescing and filtration performance depends largely on the fiber diameter and bulk density of the fiberglass media. Both the All-Fiberglass and the Combination coalescer cartridge designs incorporate phenolic resin impregnated fiberglass media. Several grades with fiber diameters ranging from 1 to 10 micrometers are used in various combinations to achieve desired results. Velcon's latest coalescer designs (85, 87 and C5 series cartridges) achieve even higher filtration and coalescing efficiency by incorporating pure micro-glass fibers with diameters of less than 1 micrometer in the pleated media.



All-Fiberglass "6" Series Coalescer



Fiberglass and Pleated Media  
"87" Series Coalescer



6" Diameter  
Threaded Base  
and Open End  
Coalescer  
End Caps



6000T Threaded Base Adapter

## COALESCER CARTRIDGE SERIES DESCRIPTION

**Model Number System.** Refer to the box at right. The one or two digit Series Designator relates to the approximate micron rating of each model coalescer cartridge. Note that this is a nominal rating and should be used for reference only.

The “0”, “2”, and “4” Series all-fiberglass cartridges are rated at 25, 5, and 3 microns respectively. The “2” and “4” Series are commonly used with diesel and other fuel oils, and are a compromise between filtration efficiency (cartridge life) and water removing capability. They coalesce gross water, but normally do not remove fine water haze.

The all-fiberglass “6” Series was originally developed for jet fuel service (the original MIL-F-8901 specification). With a 2-micron rating, it has proven to be the most cost effective design in some jet fuel applications. “6” Series cartridges are also used in gasoline filtration service. However, it should be noted that the powerful detergent additives in most automotive gasolines reduce the coalescing capability of this and other cartridge designs.

**“83” Series Cartridges.** The 1-micron rated “83” Series is a pleated media/fiberglass cartridge. The very practical “83” Series cartridges have become the most widely used design in applications including gasoline, condensate, and insulating oil filtration.

**“85” and “87” Series Cartridges.** The “85” Series is rated at 0.5-micron while the “87” Series is rated at 0.3 micron. Both incorporate multi-layered pleated media. The “85” Series has consistently shown superior dirt holding capacity in the field.

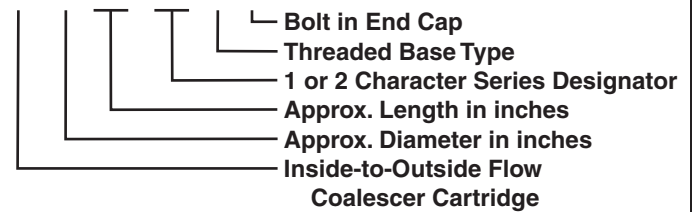
**EI\* 1581 Fifth Edition Cartridges.** I-6xxC5 (TB), I-6xxMM, and I-6xxA4 Series of coalescers incorporate a multi-layered pleated media designed to provide superior dirt holding capacity in the field, combined with 0.4 micron efficiency. The I-6xxC5 (TB) replaces both the I-6xx85 (TB) and I-6xx87 (TB) cartridges. These cartridges are available in either threaded base or open-end configuration. See data sheets 1923 and 1934 for more specific information on EI 1581 Fifth Edition.

**Cartridge Dimensions.** 6” diameter cartridges are the current industry standard. They are offered in lengths of 11”, 14”, 22”, 28”, 33”, 38”, 44”, and 56”. However, not all series are available in all lengths or in both end cap designs. Contact your Velcon Distributor for details.

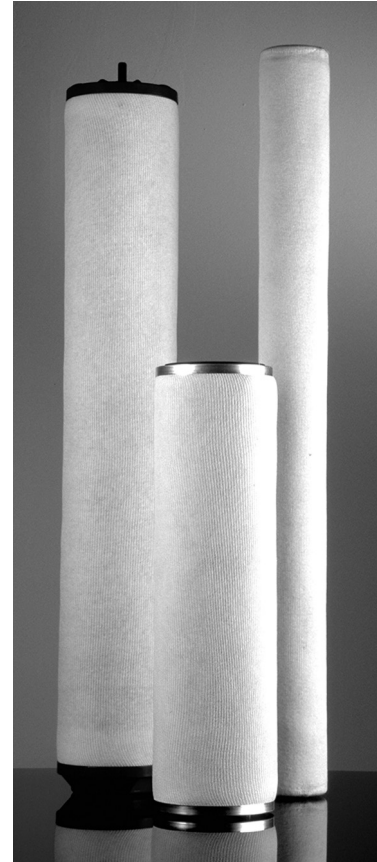
4” diameter cartridges are also offered for use with older equipment. They are available in a variety of lengths ranging from 8 to 40 inches.

**Velcon Model Numbers** include significant product information. **Example:**

**I - 6 2 8 C 5 T B**



Note that **I-628C5** would designate the open end version of this cartridge.



## GENERAL SPECIFICATIONS

- 75 psi maximum pressure differential rating
- 5 to 9 pH range
- 150°–160°F maximum operating temperature
- Aluminum center tube
- Buna-N gaskets
- Injection molded end caps are standard on 6” diameter threaded base coalescers;
- Aluminum end caps are standard on 6” diameter open end cartridges
- All 6” diameter cartridge end caps are bonded directly to the media with high strength epoxy or urethane
- 4” diameter cartridge have molded polyester resin or injection molded end caps

\*EI (Energy Institute) is the new specification authority. API (American Petroleum Institute) is no longer involved in aviation fuel filtration specifications.

# Coalescer Cartridge and Filter/Separator Vessel Selection Guidelines

Aviation Fuel Filtration in commercial applications is governed by the complex, stringent requirements of EI 1581, 5<sup>th</sup> Edition. Refer to the appropriate Velcon literature or contact your Velcon Representative for assistance. For non-aviation applications the following guidelines have proven to be useful. Note, however, that these guidelines are general in nature and should be used for guidance only.

## 1 Determine total length (inches) of 6" diameter cartridge required:

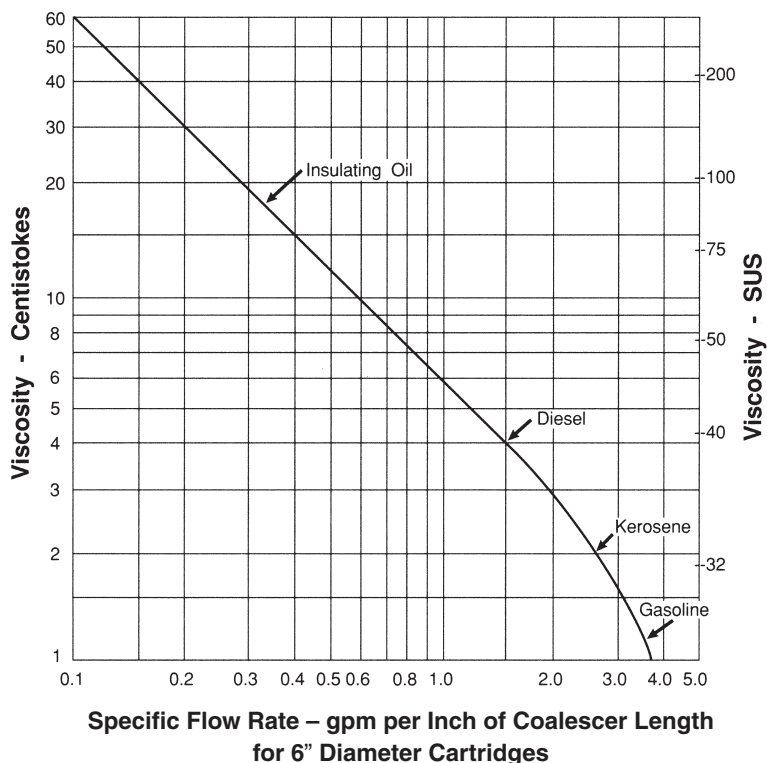
- Find the approximate viscosity of your hydrocarbon fluid on the Chart Y-axis.
- Find the corresponding Specific Flow Rate (gpm/inch) on the X-axis.
- Divide Total Flow Rate (gpm) of your application by this Specific Flow Rate to calculate total inches of coalescer required.

## 2 Select cartridge model and calculate quantity required:

- Choose model (type and length) cartridge to use. **83 Series Coalescers** are recommended for most applications. Other types and sizes are offered for special applications.
- Calculate minimum number of cartridges required by dividing total inches (from Step 1) by length of cartridge selected.

## 3 Select the Filter/Separator Vessel for your application:

- Refer to the Velcon literature for **HV** (horizontal) or **VV** (vertical) Filter/Separators.
- Find the appropriate vessel for the model and quantity Coalescer Cartridge selected in Step 2.



## NOTES

- These guidelines assume a specific gravity of 0.92 or less, and an influent water concentration of 3% or less. In general, if the Interfacial Tension (IFT) of the hydrocarbon over water is 36 dynes per centimeter or greater, effluent water levels of 15 ppm or less can be achieved.
- Surfactants will significantly lower IFT with a corresponding decrease in coalescing performance. Surfactants can occur naturally (diesel fuel) or they can be intentionally added as corrosion inhibitors (pipelines, lube and hydraulic oils) and detergent dispersants (automotive gasoline).
- As previously discussed, diesel and fuel oils are a special category. **2 or 4 Series Coalescer Cartridges** are commonly used. Pleated paper separator cartridges are typically specified since diesel often contains materials that adhere to TCS separators and cannot be cleaned off – nullifying their cost effectiveness. Refer to Velcon **V Series Filter/Separator Vessels** literature.
- Oversizing filtration equipment improves performance and extends cartridge life.
- Strong bases (high pH fluids) attack glass microfibers and break down the coalescing media. Caustic washing or applications with high concentrations of MEA or DEA should be avoided.
- Initial differential pressure (with clean coalescer cartridges) will be less than 5 psi. Cartridges should be changed when the differential pressure reaches 15 psi or after one year – whichever occurs first.



Velcon products are sold and serviced by a world-wide representative network. To order, contact Headquarters or your **LOCAL REPRESENTATIVE**:

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