



cTMF – Coiled Tubular Membrane Filters

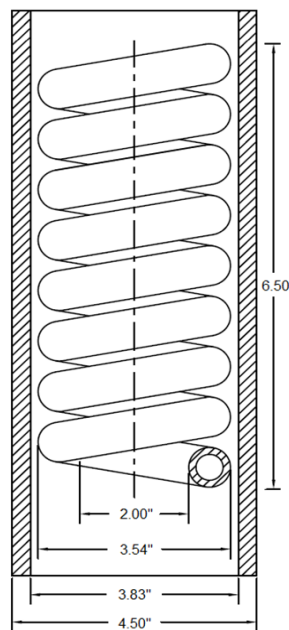
cTMF, a coiled tubular membrane filter, has a ½” tube employed in a cross-flow mode for ultrafiltration. The innovative design of cTMF resourcefully generates a secondary flow called Dean Flow to prevent foulants from building up on the membrane surface through the advantage of its hydrodynamic action. With the cTMF, unboxed modules can be created to fit into any enclosure or tank. The FIT (Filters In Tank) design is therefore compact, cost-effective, and ideal to be conveniently installed at its point of use. cTMF is based on a Porex’s tubular membrane filter, which has polyvinylidene difluoride (PVDF) membrane casted on the inside surface of an ultra-high molecular weight polyethylene (UHMWPE) tube. This configuration provides the cTMF membrane with excellent chemical resistance (pH 1-14) and its structure with excellent impact strength and abrasion resistance.

Applications

With its large channel diameter, cTMF is capable of handling solids with a concentration as high as 50,000 mg/liter and particle size as large as 125 µm without any additional pretreatment. Separating at 0.05 µm, cTMF allows only water and dissolved matter to pass, rejecting everything that is undissolved. For highly challenged surface water treatments, the permeate turbidity of <0.1 NTU is constantly attainable. With its capability to produce high effluent quality from high solids influent, it is effective in removing precipitants generated in processes involving coagulants and flocculants. All these characteristics make cTMF an ideal choice for critical applications such as RO pretreatment and SDI reduction. Some common areas of applications are: heavy metal removal, e.g. wastewater from plating, printed circuits; wastewater treatment from vibratory tumblers, silica wafer die sawing; fluoride removal; cooling tower water recycling; etc.

cTMF Modules

The cTMF is available with two coil diameters (based on ID, Inside Diameter), i.e. 2” and 4”. As shown in the figure below, a 72” tube can be transformed to a 3.5” x 6.5” coil. This improvement not only accommodates shipping and handling, but also reduces the installation footprint. With the compact dimensions and robust tube construction, it is practical to use a cTMF without need of a conventional housing. Available unboxed modules are shown in the Table below. The 4” coil is created so the 2” coil can be inserted in the center space to improve packing ratio. The unboxed modules can be mounted under the cover of a working tank to further improve space utilization. The integrated units with several prescribed capacities are provided by FSI as its FIT product line.

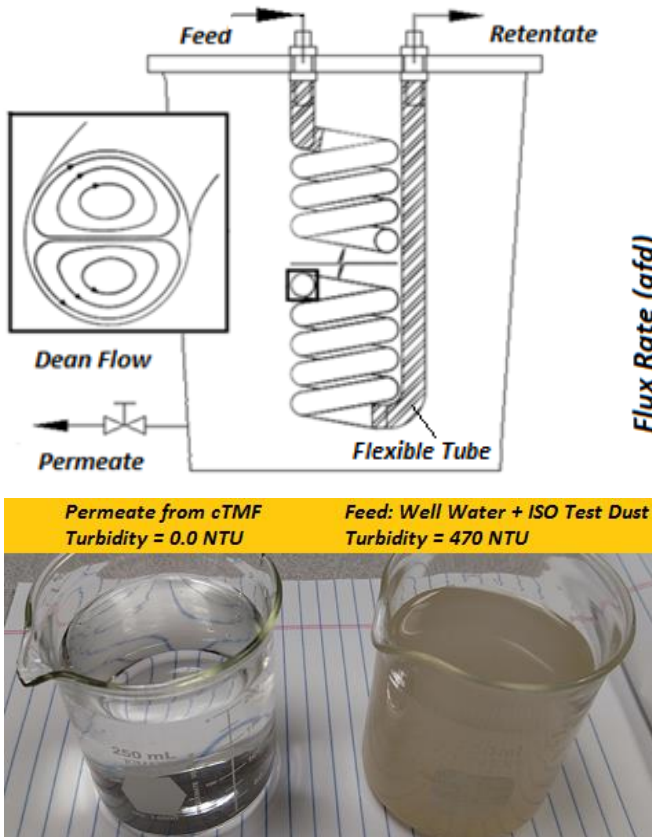


Inside a 4” Schedule 80 pipe From 72” tube to 3.5” x 6.5” coil

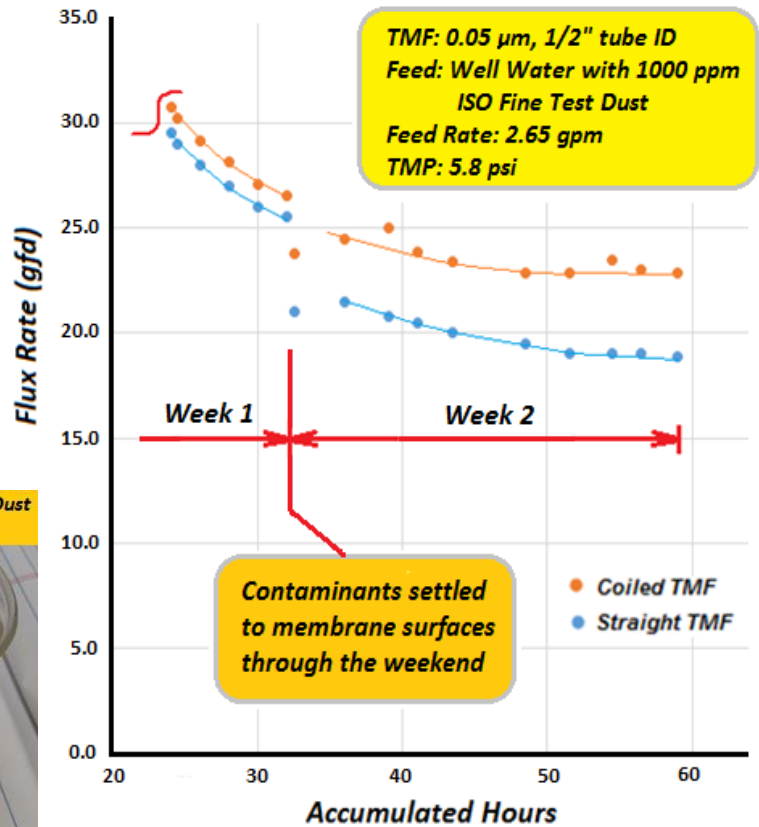
Part Number	Membrane Area	# of 72” TMFs
cTFM 3 x 7	0.75 FT ²	1
cTFM 3 x 20	2.25 FT ²	3
cTFM 3 x 40	4.5 FT ²	6
cTFM 5 x 20	6 FT ²	8
cTFM 5 x 40	12 FT ²	16

Power of Dean Flow

Dean Flow, which takes the form of a double-vortex, is generated as the flow spirals down in a circular motion through the cTMF. The shear forces of the developed vortices prevent contaminants from adsorbing to the membrane wall. At the same time, the flow trajectory pushes solids and contaminants toward the eye of the vortices (low pressure zone), keeping them off the membrane surface to minimize the fouling. This mechanism efficiently controls the growth of the cake layer, thereby providing higher productivity at lower costs.



The effect of Dean Flow was demonstrated by having a conventional (straight) TMF and a cTMF running side-by-side processing a highly concentrated fluid from a common tank. The initial flux rate did not really show significant difference until cake was formed on the membrane surface. By allowing the particles in the processed fluid to settle on the membrane surfaces, more than 20% difference in flux rate was observed. The data presented in the chart below was gathered by simply halting the test units at the end of a week and restarting them after a weekend pause.



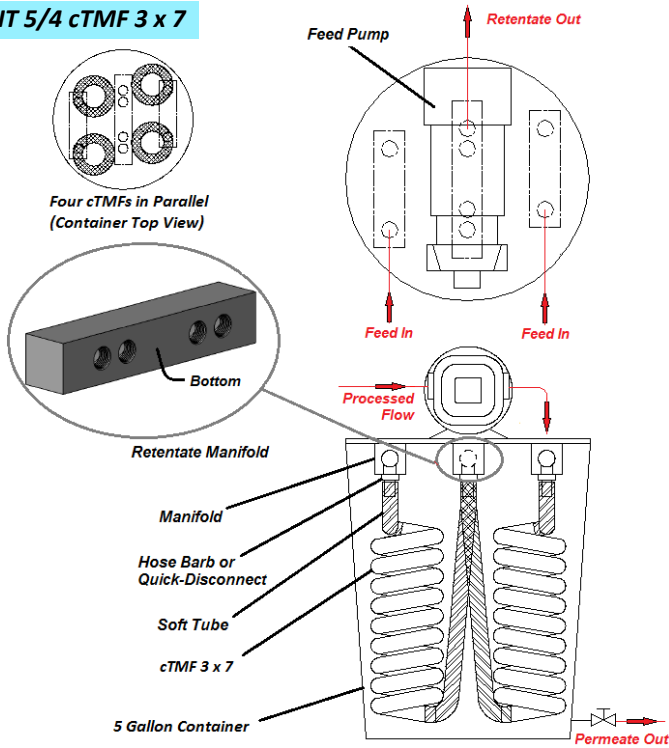
Features	Advantages
Dean Flow	Controls cake layer formation
	No additional components and moving parts required
	Saves energy - due to effective membrane self-cleaning at low flow velocities
cTMF	Compact - accommodates shipping and handling, and installation footprint e.g. 3.5" x 6.5" relative to a liner length of 72"
	Makes an unboxed design feasible
Unboxed module design	Saves weight and size, which allow filters to be mounted under a tank cover
	Eliminates cost of housing
	Back-washing can be done by vacuuming, if needed
Integrated with working tanks	Simplifies design, e.g. filters in a tank (FIT)
	Saves piping and fittings, i.e. cost savings, and further saves weight and size
	Can be outfitted with a UV light to provide a compact device at Point of Use

FIT Designation and Arrangement Examples

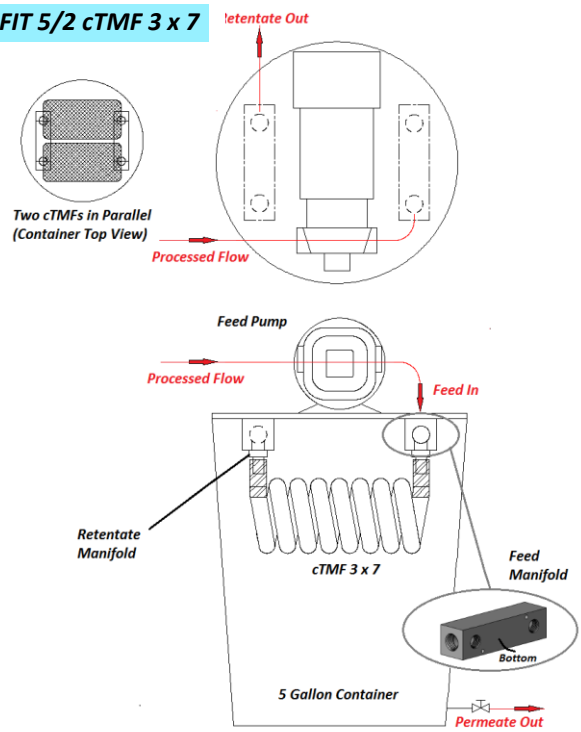
FIT product line is designated as **FIT Tank Volume (Gallons)/Number of Filter Modules**

For example, **FIT 5/4 cTMF 3 x 7** means four 3 x 7 cTMFs are fit in a 5 gallon tank.

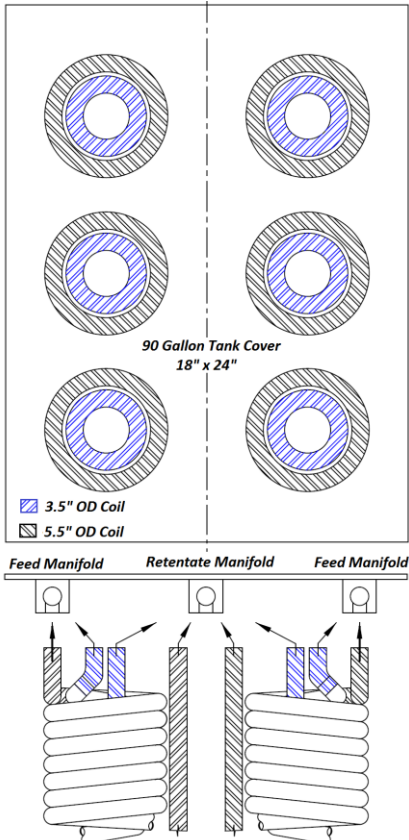
FIT 5/4 cTMF 3 x 7



FIT 5/2 cTMF 3 x 7



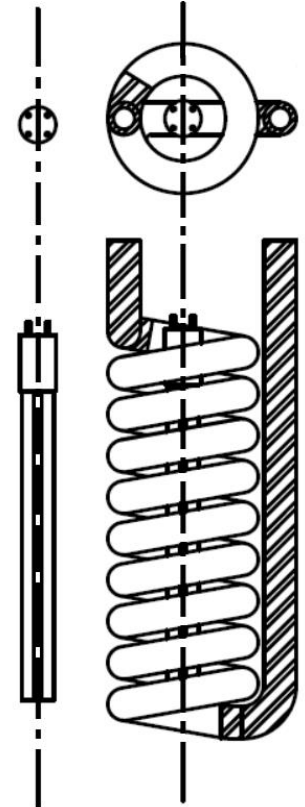
FIT 90/6 cTMF 5 x 40



Demo Unit: FIT 5/1 cTMF 3 x 7



cTMF Integrated with UV Light



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