

## Fouling Factors

At times, there is confusion as to exactly what fouling factors should be used for plate and frame type heat exchangers. Many engineers insist on using the fouling factor developed for shell and tube units by the Tubular Exchanger Manufacturers Association (TEMA). This bulletin seeks to explain why this may not be the proper approach.

As you are aware, the turbulence-inducing patterns of Superchanger plates produce local velocities ranging from 1 to 5 fps. These velocities result in high shearing. This high shear characteristic decreases the tendency of plate and frame units to foul as quickly as tubular type units.

In fact, Heat Transfer Research Incorporated (HTRI) has developed data that shows the fouling build-up on plate and frame units is significantly lower than tubular type exchangers in typical cooling water applications ( $F = 0.00015 \text{ hr ft}^2 \text{ }^\circ\text{F} / \text{BTU}$  versus  $F = 0.001 \text{ hr ft}^2 \text{ }^\circ\text{F} / \text{BTU}$  respectively).

Since plate and frame units have lower fouling tendencies than tubular units, TEMA fouling resistance factors should not be used for plate and frame units, because they will be several times larger than necessary.

Specifying too large a fouling factor can create problems rather than provide a solution. For one, the unit will be oversized with more channels in parallel than necessary. This results in a unit with more surface area than required, and a much higher price. Also, an oversized unit will have lower velocities than one properly sized. This results in increased fouling and the attendant need to clean the unit more frequently.

Although fouling factors are an important consideration when designing a plate and frame heat exchanger, they often receive too much emphasis. Fouling resistances, when specified, should not result in a design that causes the unit to be more than 25% oversized. An excess of 25% in oversurfacing will result in premature fouling.

An alternative to a fouling factor is to specify a cleanliness factor. Even then, care must be taken not to specify a cleanliness factor lower than 0.75. Typical plate and frame designs for most industrial fluids and waters utilize a safety factor of 5% – 10%. Utilizing a greater percentage indicates that the fluid is a high fouling liquid.

Remember, that regardless of fluid type, a Superchanger plate and frame heat exchanger will always clean easier than a shell and tube unit.