that of stainless steel. Titanium heat exchangers can however be safely designed with low cost thin wall welded tubing, to the point where the tube resistance r^m is less than 2.5% of the total resistance, (Fig.1). The corrosion and general fouling resistance of titanium, and its ability to withstand higher fluid velocities permits design for equal and frequently superior overall heat transfer rates than can be achieved with full metals of higher thermal conductivity. The published (HEI) metal correction factors for titanium reflect lower values than achieved in many applications and may act as an artificial restraint to fully cost effective design, (Table 6), (4). Test results from titanium tubes installed in England showed titanium tubes to be operating at a heat transfer rate 9% higher than the clean calculated HEI rate. After 14 months service without cleaning the tubes were still performing with a cleanliness factor of 0.96. These levels of performance have also been confirmed by the Swedish State Power Board.

Figure 1: Total Resistance of Heat Exchanger Tubes

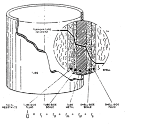

Table 6: Comparison of Heat Transfer Rates - HEI vs Resistance

Material	BWG	HEI Clean* BTU/hr ft² °F	Resistance Method BTU/hr ft² °F	Cleanliness Factor	DesignRate BTU/hr ft² °F
Al. Brass	18	675		.85	574
90/10 CuNi	18	626		.85	532
90/10 CuNi	19	640		.85	544
Titanium Ti-50A	22	564	617	.90	555
Titanium Ti-50A	25	598	646	.90	581

*Includes metal correction factor
The above method indicates improved performances over HEI design with thin wall titanium tubes.