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FOULING MITIGATION BY DESIGN [1]

J. M. Nesta and C.A. Bennett
Fluor Canada Ltd., Calgary, Alberta, Canada and
Heat Transfer Research, Inc., College Station, Texas, USA

Fouling is a nearly ubiquitous heat transfer phenomenon that costs industry billions of U.S. dollars annually. However, many fouling mechanisms can be mitigated with the no-foul design strategy[1]. The key points of this no-foul design method, regardless of service, are to maximize shear stress and control wall temperature. We also generally recommend replacing the use of fouling factors with 20% excess area. Application of this field-proven design methodology will significantly lower capital costs and substantially increase run time between cleanings (Table 1).

Table 1. No-foul versus standard heat exchanger designs[a]

Parameter	No – foul design	Standard design	Standard design with 10% coefficient margin
Surface area, m^2	832	1,564	1,875
Estimated cost, US$	996,000	1,527,000	1,775,000
Clean overall coefficient, $W/m^2 K$	361	231	204
Total fouling resistance, $m^2 K/W$	0.000634	0.00199	0.00268
Fouling margin, % excess surface	22	46	55
Shell side			
Pressure drop, kPa	175	66.9	63.4
Velocity, m/s	0.61	0.34	0.30
Shear stress[b], Pa	14.2	4.8	4.1
Tube side			
Pressure drop, kPa	185	66.2	55.2
Velocity, m/s	2.2	1.1	0.91
Shear stress, Pa	15.6	4.5	3.3

[a]Service is residue stripper bottoms/preflash bottoms exchanger
[b]Shell side shear stress is weighted for window and cross flow

[1] refer to article #49 for full-length manuscript