



Heat Transfer Calculations

Heat Emission Rates from Pipes Submerged in Water

Published Overall Heat Transfer Rates	Btu/ft ² h °F
Tank Coils, Steam/Water (Temperature difference 50 °F)	100 to 225
Tank Coils, Steam/Water (Temperature difference 100 °F)	175 to 300
Tank Coils, Steam/Water Temperature difference 200 °F	225 to 475

Reasonable Practical Heat Transfer Rates	Btu/ft ² h °F
Tank Coils, low pressure with natural circulation	100
Tank Coils, high pressure with natural circulation	200
Tank Coils, low pressure with assisted circulation	200
Tank Coils, high pressure with assisted circulation	300

Heat Emission Coefficients from Pipes Submerged in Miscellaneous Fluids

The viscosity of fluids has a considerable bearing on heat transfer characteristics and this varies in any case with temperature. The following figures will therefore serve only as a rough guide.

Immersed steam coil, medium pressure, natural convection

	Btu/ft ² h °F difference
Light Oils	30
Heavy Oils	15 to 20
*Fats	5 to 10

Immersed steam coil, medium pressure, natural convection

	Btu/ft ² h °F difference
Light Oils (220 SSU at 100 °F)	100
Medium Oils (1100 SSU at 100 °F)	60
Heavy Oils (3833 SSU at 100 °F)	30

Average Heat Loss from Oil in Storage Tanks and Pipe Lines

			* Heat Transfer Rate in Btu/ft ² h °F temperature difference between oil and surrounding air	
	Position	Oil Temperature	Exposed	Insulated
Tank	Sheltered	Up to 50 °F	1.2	.3
		Up to 80 °F	1.3	.325
		Up to 100 °F	1.4	.35
Tank	Exposed	Up to 50 °F	1.4	.35
		Up to 80 °F	1.5	.375
		Up to 100 °F	1.6	.4
Tank	In Pit	All Temperatures	1.2	—
Pipe Line	Sheltered	Up to 80 °F	1.5	.375
		80 to 260 °F	2.3	.575
Pipe Line	Exposed	Up to 80 °F	1.8	.45
		80 to 260 °F	2.75	.7

* For maximum heat loss the "surrounding air temperature" may be 25 °F higher or lower according to country and locality.

Heat Loss from Open Tanks

Liquid Temp. °F	Heat Loss from			Heat Lost through			
	Liquid Surface Btu/ft ² h			Tank Wall Btu/ft ² h			
	Evap. Loss	Rad. Loss	Total	Bare Steel	Insulation		
					1"	2"	3"
90	80	50	130	50	12	6	4
100	160	70	230	70	15	8	6
110	240	90	330	90	19	10	7
120	360	110	470	110	23	12	9
130	480	135	615	135	27	14	10
140	660	160	820	160	31	16	12
150	860	180	1040	180	34	18	13
160	1100	210	1310	210	38	21	15
170	1380	235	1615	235	42	23	16
180	1740	260	2000	260	46	25	17
190	2160	290	2450	290	50	27	19
200	2680	320	3000	320	53	29	20
210	3240	360	3590	360	57	31	22

The above values are for open tanks in 60 °F still ambient air.

For rough calculations it may be taken that 1 ton of fuel oil occupies 36 .4 ft³. The specific heat capacity of heavy fuel is 0.45 to 0.48 Btu/lb °F.

Heat Transfer from Steam Coils

Approximately 20 Btu/h per square foot of heating surface per °F difference between oil and steam temperature.

Heat Transfer from Hot Water Coils

Approximately 10 Btu/h per square foot of heating surface per °F difference between oil and steam temperature.