ESTIMATION HEAT FLUX LOSSES CRUDE OIL HORIZONTAL TANK

1. Heat flux analysis

The following tables refer to an analytical estimation, based on the given data, of the energy losses on horizontal tank.

Figure 1 show the layout of the tank to be treated including the insulation.

The analysis has been carried out by considering a steam inner temperature equal to Ti= 160°C. A constant air temperature equal to Tair=15°C was assumed for the analytical simulation.

Table 1 shows the analytical results, based on the assumed data, considering the insulation type Hot Pipe Coating with a total thickness of 8 mm, in order to achieve an external surface temperature equal to Te ≤ 60 °C.

Table 2 shows the analytical results in terms of heat losses, energy savings, external surface temperature and HPC consumption as function of the HPC thickness.

Figure 2 and Figure 3 show respectively the heat flux losses and wall temperatures as function of the HPC thickness and the heat flux losses and energy savings as funtion of the HPC thickness.

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HOT PIPE COATING™

HPC application on horizontal tank

Figure 1 – layout of the tank

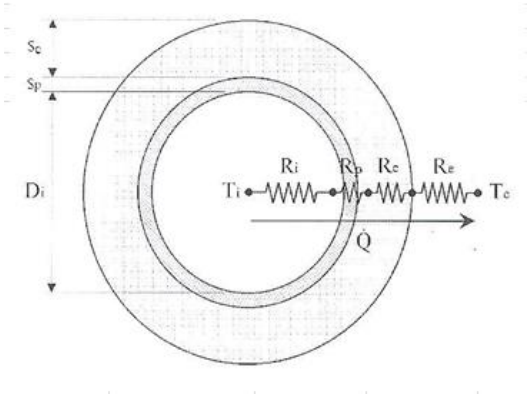

Table 1 – Analytical results insulation thickness equal to 8 mm

Outer diameter tank	**Do**	**(m)**	3.4
Inner diameter tank	**Di**	**(m)**	3.3916
Thickness wall tank	**Sp**	**(m)**	0.0040
Thermal conductivity tank	**λp**	**(W/m°C)**	54.0
Fluid temperature inner tank	**Ti**	**(°C)**	160
Inner convection coeff.	**hi**	**(W/m^2°C)**	1233.3
Temperature external air	**Te**	**(°C)**	15.0
External convection coeff.	**he**	**(W/m^2°C)**	11.5

Inner convection resistance	**Ri**	(°Cm/W)	0.000076117
Wall tank conduction resistance	**Rp**	(°Cm/W)	0.000007291
Insulation conducton resistance	**Rc**	(°Cm/W)	0.018680192
Outer convection resistance	**Re**	(°Cm/W)	0.008112286

Transmitted thermal power per square meter unit **WITH HPC**	**Q**	(Wh/m^2)	503.79
Transmitted thermal power per total area **WITH HPC**	**QT**	(KWh)	110.27
Transmitted thermal power per total area **NO insulation**	**QT'**	(KWh)	361.34
ENERGY SAVING		%	69.48
Inner temperature wall	**Ti/t**	(°C)	159.7
External temperature wall	**Te/t**	(°C)	159.6
External temperature Coating (calculated from the inside)	**Te/c**	(°C)	59
Coating thickness		(mm)	8.00
Length considered for treatment		(m)	18.63
#			1.00
Area		(m²)	217.85
dry volume coating		%	71.00
conversion mm to mil		mil	314.96
consumption per gallon		(m²/gal)	0.224
TOTAL NEED		(gal)	648

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Table 2 – Energy losses as function of the HPC thickness

Thickness of HPC	Energy losses per m^2	Energy losses for total length	SAVINGS	Surface temp.	Calculated consumption	
mm	Wh/m^2	KWh	%	°C	gal	# pails
0	1650.6	361.3	0	159	0	0
1	1284.9	281.3	22.1	127	81	17
2	1051.9	230.3	36.2	106	162	33
3	890.4	194.9	46.0	92	243	49
4	771.9	168.9	53.2	82	324	65
5	681.2	149.1	58.7	74	405	81
6	609.6	133.5	63.0	68	486	98
7	551.7	120.8	66.6	63	567	114
8	503.7	110.3	69.5	59	648	130
9	463.5	101.5	71.9	55	729	146
10	429.2	93.9	74.0	52	810	163
12	373.9	81.8	77.3	48	973	195
15	313.3	68.6	81.0	42	1217	244

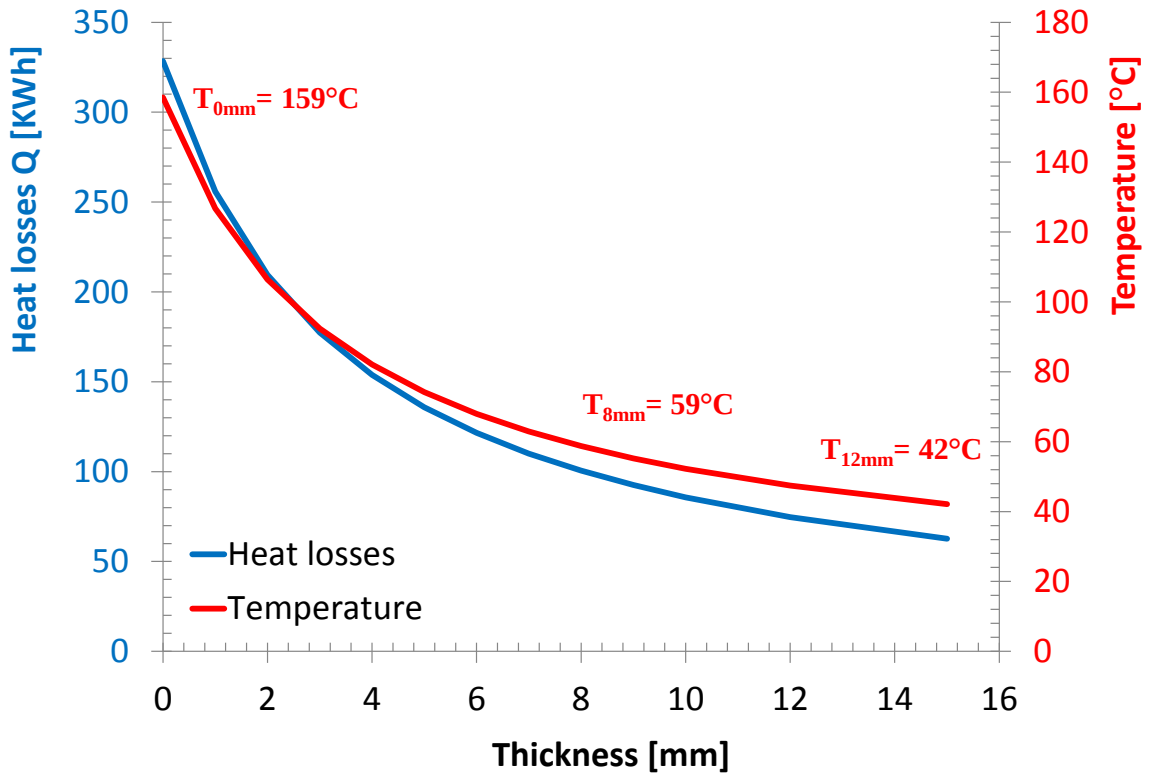

Figure 2 – Heat losses and external temperature as function of the HPC insulation thickness

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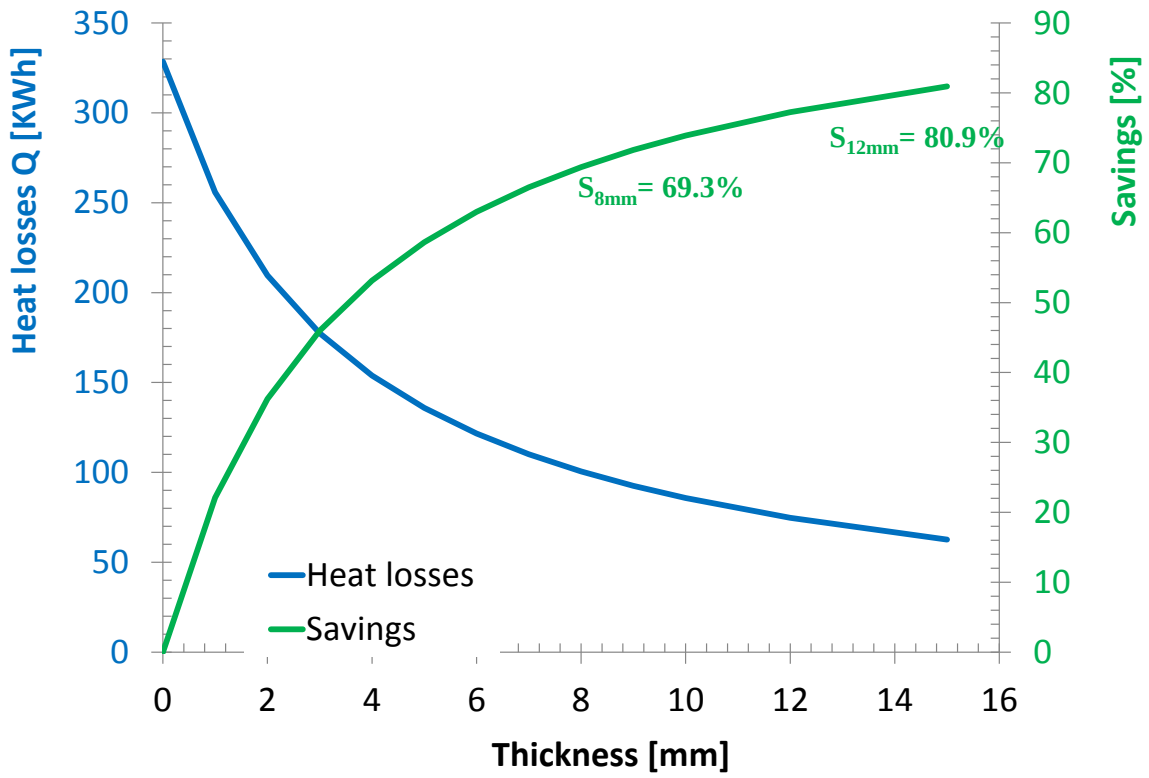

Figure 3 – Heat Losses and energy savings as function of the HPC insulation thickness

NOTE: *All calculations submitted by SPE are purely informative. All calculations are based on estimations and limited information that has been received from third parties, which to the best of our knowledge is reliable and accurate. All calculations, estimations, recommendations or suggestions relating to the use of the products, may in no way be considered binding. The products and information are designed for users having the requisite knowledge and industrial skills, and the end-user has the responsibility to determine the suitability of the product for its intended use.*

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