

Cladding and weld overlay management

NextGen supports automatic calculation of lining overthicknesses and can consider part of the cladding for the overall pressure resistance.

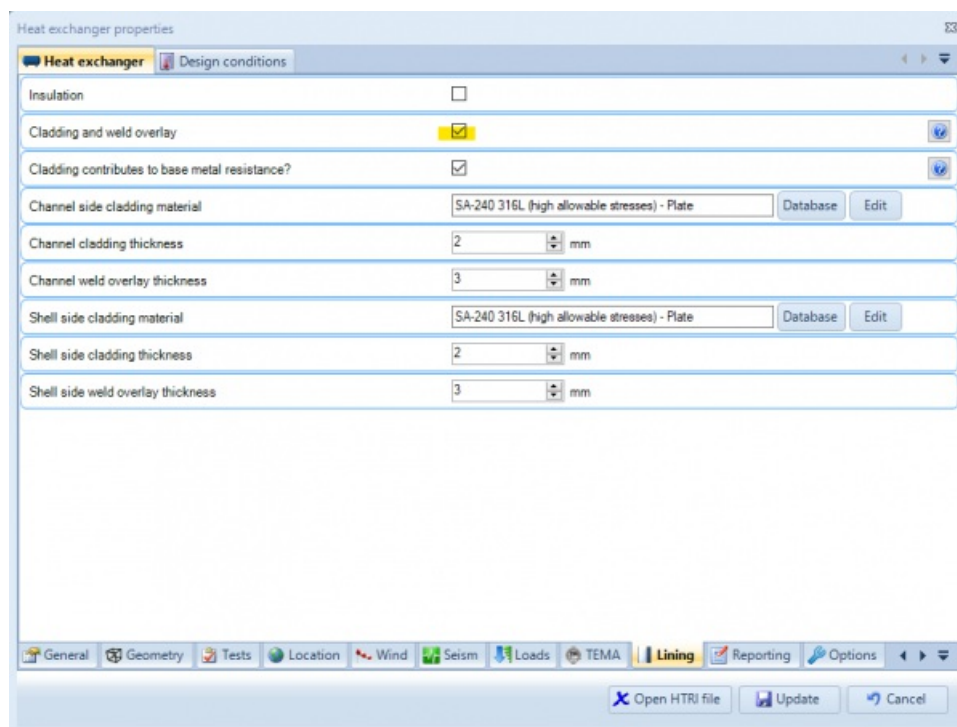
Online version: <https://nextgen.sant-ambrogio.it/KB312512>

Latest update: 26 giu 2020

Starting from the 2020.1 version, management of over-thicknesses related to cladding and weld overlay is available in NextGen. This option, initially available for the ASME VIII Div. 1 code, will be progressively extended to the various calculation codes supported by the program.

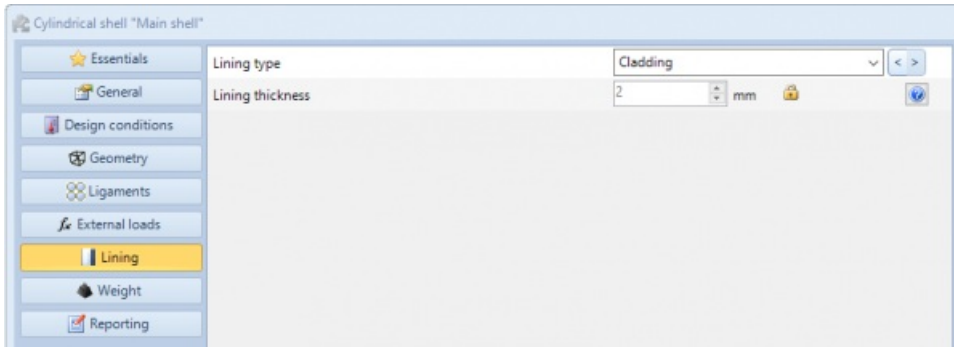
The option is located among the item properties (File> Item properties), under the "Lining" category. Depending on the type of appliance, vessel or heat exchanger, different input fields are available.

The lining is enabled by selecting the appropriate "Cladding and overlay" checkbox: the insertion of the material used for cladding, the thickness of the cladding, the contribution of the cladding to the resistance of the base material and the thickness of the weld overlay will therefore be requested. As with other parameters in NextGen, the thickness values will be used as the default for the components created but will be overridable for each component. On heat exchangers, the input is replicated for the tube side and the shell side.

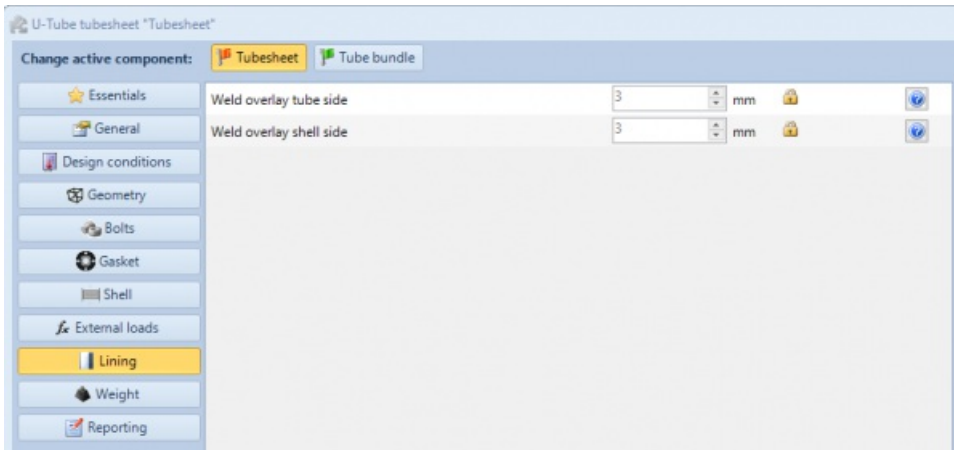


The contextual help of these properties contains information about each of them. Basically, the weld overlay is completely removed from the nominal thickness of the component as it is for corrosion, both in design conditions and in test conditions. The same happens for cladding, if the "cladding contributes to base metal resistance" option is not checked. If, on the other hand, this option is enabled, the calculation codes define the amount of the contribution given by the over-thickness. In general, this contribution is proportional to the ratio between the allowable of the base metal and the allowable of the cladding metal.


Once the properties for the item have been defined, the "Lining" category will be displayed in each component. From there it will be possible to choose if the component in question is equipped with lining, of which type and with what thickness.




For the tubesheets it is possible to choose the weld overlay over-thickness independently for the two sides.



In terms of calculation, and therefore of reports, cladding and weld overlay are calculated and added to corrosion: the corrosion value is redefined, adding the ineffective portion of cladding or the entire value of weld overlay. In the following examples it is possible to see the calculation report of a cylinder with cladding, in which the calculation of the effective and ineffective cladding thickness share, with the sum of the latter to corrosion, and a calculation report of a tubesheet with weld overlay applied on both sides.

 Sant'Ambrogio Address _____ City _____ Telephone, Fax _____ Website, Email address _____ Date _____ Calc. _____ Contr. _____ Appr. _____	Customer	
	Drawing	
	Revision	
Cylindrical shell - Main shell According to: Asme VIII Div. 1 Ed. 2019 UG-27, UG-28 - Metric Units		
Design data		
Internal design temperature	T =	150.00 °C 302.00 °F
Internal design pressure	P =	1.00 MPa 145.0 psi
Joint efficiency	E =	1.00
Material: SA-516 70 - Plate - UNS: K02700		
Allowable stress	S =	138.00 MPa 20 015.2 psi
Allowable stress at room temperature	ST =	138.00 MPa 20 015.2 psi
Cladding material: SA-240 316L (high allowable stresses) - Plate - UNS: S31603		
Allowable stress	Sc =	115.00 MPa 16 679.3 psi
Allowable stress at room temperature	ScT =	115.00 MPa 16 679.3 psi
Geometry		
Inside diameter	D =	500.00 mm 19.685 in
Outside diameter	Do =	508.00 mm 20.000 in
Length	L =	2 099.40 mm 82.654 in
Adopted thickness	t =	4.00 mm 0.157 in
Corrosion allowance	c =	0 mm 0 in
External corrosion allowance	ce =	0 mm 0 in
Wall undertolerance	c' =	0 mm 0 in
Cladding thickness	cl =	2.00 mm 0.079 in
Cladding contributes to base metal resistance? Yes		
Forming strain (cylinders formed from plate)	sf=50 t/(R+t/2) =	0.79365 %
Internal pressure		
Allowable stress	S =	138.00 MPa 20 015.2 psi
Internal pressure	Pi =	1.00 MPa 145.0 psi
Overpressure due to static head	Ph =	0 MPa 0 psi
Calculation pressure	P = Pi + Ph =	1.00 MPa 145.0 psi
Cladding effective thickness		
cle=cl·min(1,Sc/S) = 1.67 mm 0.066 in		
Cladding thickness reduction		
clr=c-cl·cle = 0.33 mm 0.013 in		
Corrosion allowance including cladding and/or weld overlay		
c+c·clr = 0.33 mm 0.013 in		
Reference diameter: Inside		
Calculation radius (inside)	R =	250.00 mm 9.843 in
Required thickness for circumferential stress, UG-27(c)(1)	$t_r = \frac{PR + c + d'}{SE - (0.6P)} + c + c_s + d'$	3.82 mm 0.150 in
Required thickness for longitudinal stress, UG-27(c)(2)	$t_r = \frac{PR + c + d'}{2SE + 0.4P} + c + c_s + d'$	2.91 mm 0.114 in
Minimum required thickness	tr=max{tr(circ),tr(long)}	3.82 mm 0.150 in
Item service	Service =	NotSpecified
Minimum required thickness according to UG-16(b), considering corrosion	tr UG-16(b) =	1.50 mm 0.059 in
t ≥ tr (4.00 mm ≥ 3.82 mm): Ok t ≥ tr UG-16(b): Ok		

 Sant'Ambrogio Address _____ City _____ Telephone, Fax _____ Website, Email address _____ Date _____ Calc. _____ Contr. _____ Appr. _____	Customer	
	Drawing	
	Revision	
Geometric data		
Tubesheet configuration: b) Integral with shell and gasketed with channel, extended as a flange		
Outside diameter of tubesheet	A =	590.00 mm 23.228 in
Bolt circle diameter	C =	558.00 mm 21.969 in
Shell corrosion allowance	cs =	0 mm 0 in
Shell undertolerance	c's =	0 mm 0 in
Shell thickness	$t_s = t_{shell} - c_s - c'_s =$	2.00 mm 0.079 in
Channel corrosion allowance	cc =	0 mm 0 in
Channel undertolerance	c'c =	0 mm 0 in
Channel thickness	$t_c = t_{channel} - c_c - c'_c =$	4.00 mm 0.157 in
Perimeter of the tube layout	Cp =	1 225.23 mm 48.237 in
Area enclosed by perimeter Cp	Ap =	119 459.1 mm² 185.162 in²
Tubeside corrosion allowance	c_ts =	0 mm 0 in
Shellside corrosion allowance	c_ss =	0 mm 0 in
Tubesheet undertolerance	c' =	0 mm 0 in
Tube side weld overlay	wo_ts =	3.00 mm 0.118 in
Shell side weld overlay	wo_ss =	3.00 mm 0.118 in
	c_ts=c_ts+wo_ts =	3.00 mm 0.118 in
	c_ss=c_ss+wo_ss =	3.00 mm 0.118 in
Tubesheet thickness	t_tubesheet =	34.00 mm 1.339 in
Tubesheet thickness for calculation	$h = t_{tubesheet} - c_{ts} - c_{ss} - c' =$	28.00 mm 1.102 in
Nominal outside diameter of tubes	dt =	10.00 mm 0.394 in
Tube hole diameter	dt(h) =	10.25 mm 0.404 in
Radius to outermost tube hole center	ro =	195.00 mm 7.677 in
Equivalent diameter of outer tube limit circle	$D_0 = 2r_0 + d_t =$	400.00 mm 15.748 in