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UltraWT® wall thickness calculation (ISO 13628-5:2009/API 17E) - User's Manual

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Table of Contents

1	Introduction.....	3
2	References.....	3
3	User Guide.....	4
3.1	General.....	4
3.2	Input.....	5
3.3	Output.....	6



1 Introduction

This document gives a quick user guide for Ultra Deep's ISO wall thickness calculation software. This software implements ISO 13628-5, reference is made to [1].

2 References

- [1] ISO 13628-5,"Petroleum and natural gas industries — Design and operation of subsea production systems", Part 5:Subsea umbilicals, 2009-12-15
- [2] Doc. No. 00000-INT-UM-KNT-20071129-1, UmbiliCAD® - User's Manual (latest version)
- [3] Doc. No.: 00000-INT-UM-TRB-20140425-1, UltraWT® Code Check (ISO 13628-5/API 17E) – User's Manual (latest version)



3 User Guide

3.1 General

ISO Wall Thickness calculation is a plug-in to the Ultra Deep umbilical drawing tool UmbiliCAD. It is started from UmbiliCAD by right clicking on a tube element and selecting 'Tools -> UltraWT Wall Thickness'. Tube ID, wall-thickness and internal pressure will be loaded into UltraWT Wall Thickness. Any change in these properties done inside UltraWT Wall Thickness will be reflected in the drawing.

The following picture shows the screen layout of the plug-in:

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WALL THICKNESS CALCULATIONS

ISO 13628-5:2009, Pressure Containment, Pressure Only

INPUT			
Parameter	Symbol	Value	Unit
Inner Diameter	ID	12.70	[mm]
Permissible Variation in Wall Thickness	tfac	5.0	[%]
Corrosion allowance	tcorr	0.00	[mm]
Yield Limit	SMYS	650.0	[MPa]
Design Internal Working Pressure	DWP	10000	[Psi]
Test Pressure Factor	tf	1.5	[-]
		<i>Operation</i>	<i>Pressure Test</i>
Utilisation Factor	nqn/nqp	0.67	0.96 [-]

OUTPUT			
		Operation	Pressure Test
Internal Pressure Design/Test	DWP/TP	68.95	103.42 [MPa]
Minimum Wall Thickness	tnfo/tnfp	1.17	1.24 [mm]
Diameter to wall thickness ratio, ODnom/tnom-ratio		12.83	12.20 OK

OK Cancel



3.2 Input

Below all the inputs are explained:

Inner diameter [mm]:

Nominal inner diameter of tube

Permissible Variation in Wall Thickness [%]:

Recommended tube wall thickness tolerance according to ISO is 10%. Alternative tolerances may be agreed upon the manufacturer and the purchaser provided the criteria 7.5.2 in ISO [1] are satisfied. UmbiliCAD now allows the user to specify any value as a variable.

Corrosion allowance [mm]:

If design-life corrosion resistance is demonstrated, the corrosion allowance is not applicable.

Yield Limit [MPa]:

Specified minimum yield stress for the material.

Design Internal Working Pressure [Psi]:

Design working pressure for tube.

Test Pressure Factor [-]:

Tube shall be designed to withstand a minimum test pressure ratio of 1.5 times design working pressure according to ISO [1].

Utilization Factor [-]:

Utilization factors as specified in table 8 in ISO [1] shall be used for pressure containment calculations.



3.3 Output

Below all the outputs are explained:

Internal Pressure Design [MPa]:

Internal design pressure is equal to the design internal working pressure.

Internal Pressure Test [MPa]:

The internal test pressure in the tube is calculated as given: $p_i = p_{DW} \times 1.5$

Where

P_i = internal test pressure

P_{DW} = internal design pressure

Minimum Wall Thickness [mm]:

The umbilical tubes shall be designed such that the maximum equivalent stress satisfies the criterion of:

$$\sigma_e \leq \eta_\sigma \times \sigma_{SMYS}$$

Where

σ_e = Equivalent stress

η_σ = Utilization factor for the condition

σ_{SMYS} = Minimum specified yield stress

The wall thickness corresponds to the minimum values that satisfy the equivalent stress criterion.

Diameter to wall thickness ratio [-]:

The diameter to wall thickness ratio is calculated as information only. No requirements related to this factor are given in the standard. However, if this factor is very high (above 20), special considerations regarding buckling/collapse should be made.