

Stabilirea duratei remanente de viata.

- a) Se considera durata de functionare de T ani de la data de punere in functionare
 b) Se calculeaza viteza medie de coroziune anuala cu relatia:

$$V_m = (S_i - S_{om})/T, \text{ unde}$$

S_i – grosimea initiala a tablei ; S_{om} – grosimea minima masurata.

- c) Deoarece viteza de coroziune nu este o functie liniara , se determina durata remanenta de viata cu relatia:

$$T_{REM} = (S_{ir} - S_{om}) / (V_m * K_o), \text{ [ani]}$$

unde $K_o = 1.5$ un coeficient care tine cont de corozivitatea mediului.

S_{ir} = grosimea minima de rezistenta calculata

Durata remanenta de viata va fi valoarea minima determinata pe elemente. In cazul in care se considera neeconomica durata de viata determinata se poate alege inlocuirea celor mai restrictive elemente.

In lipsa documentelor din care sa cunoastem grosimea initiala a mantalei rezervorului si a unei monitorizari periodice a evolutiei in timp a grosimii elementelor utilajului se va proceda la utilizarea unei viteze de coroziune specifice fluidului de lucru, indicate de literatura de specialitate. Pentru acest lucru sa utilizat un program specializat asa cum este prezentat in continuare.

File Information Help

Liquids

GASOLINE Find

Name	Chemical Denomin.
GASOLINE, LEADED	
GASOLINE, REFINED	
GASOLINE, SOUR	
GASOLINE, UNLEADED	
GELATIN	
GENITHION	C ₁₀ H ₁₄ NO ₅ PS
GLAUBERS SALT	Na ₂ SO ₄
GLUCONIC ACID	C ₆ H ₁₂ O ₇
GLUCOSE	C ₆ H ₁₂ O ₆ *H ₂ O
GLUCURONIC ACID	C ₆ H ₁₂ O ₇

Chemical resistance table

Liquid: GASOLINE, REFINED Concentration: 100

Product:

Material	50 °F	68 °F	86 °F	104 °F	122 °F	140 °F	158 °F	176 °F	194 °F	212 °F
	10 °C	20 °C	30 °C	40 °C	50 °C	60 °C	70 °C	80 °C	90 °C	100 °C
CARBON STEEL	0	0	0	0	0	0	0	0	0	0

Products / Materials

Material Find

Material
ALUMINIUM
BRASS
BRASS, RED
ALUMINIUM BRONZE (Cu-Al-Ni)
CARBON STEEL
CAST IRON, GREY
CAST IRON, NODULAR
CAST IRON, MALLEABLE
CAST IRON, HIGH CHROMIUM
CAST IRON, NI-HARD
CAST IRON, SILICON
CAST IRON, NI-RESIST (20% Ni)
STAINLESS STEEL, ASTM CA 6-NM
STAINLESS STEEL, AISI 302/631
STAINLESS STEEL, AISI 431/420
STAINLESS STEEL, AISI 304/307
STAINLESS STEEL, AISI 316L
STAINLESS STEEL, AISI 329
STAINLESS STEEL, UNS S31803
STAINLESS STEEL, UNS N08904
STAINLESS STEEL, PROACID 60
STAINLESS STEEL, PROACID 254
MONEL (Ni-Cu)
INCONEL (Ni-Cr)
HASTELLOY C (Ni-Cr-Mo)
TITANIUM
SINTERED ALUMINIUM OXIDE

Estimarea vitezelor de coroziune este indicata mai jos.

Resistance levels for different types of materials.	
	<input type="checkbox"/> No data available.
Metals:	<input checked="" type="checkbox"/> Corrosion rate below 0.1 mm/year.
	<input type="checkbox"/> Corrosion rate 0.1 - 1.0 mm/year.
	<input type="checkbox"/> Corrosion rate above 1.0 mm/year.
Plastics and Ceramics:	<input checked="" type="checkbox"/> Satisfactory, no important attacks.
	<input type="checkbox"/> Questionable. Some attacks will occur, but often possible to use up to 12 month or more.
	<input type="checkbox"/> Not recommended. Heavy attacks.
Rubber:	<input checked="" type="checkbox"/> The change in volume and hardness are less than 10%. The effect on physical properties are low.
	<input type="checkbox"/> The change in volume and hardness are below 25%. The effect on physical properties are moderate.
	<input type="checkbox"/> Not recommended. High effect on the properties.

Viteza de coroziune pentru acest rezervor este de 0,15mm/an datorita prezentei apei sarate. Estimarea duratei remanente de viata se poate face raportandu-ne la grosimea calculata conform API 650 sau grosimea adoptata conform API 650 si grosimea masurata.

Recomandari API650

Grosime minima conform API650 pentru corp –min.6mm, conform cap 5.6.1.1, diametru >15m

Grosime minima conform API650 pentru capac–min.5mm conform cap 5.10.2.2

Grosime minima conform API650 pentru racorduri –conform tab.5.6^a

Grosimea minima calculata este la limita de utilizare , adica fara adaosul de coroziune.

Rezultatele analizei se regasesc in tabelul de mai jos:

Tab.1

CORP	Elemente calculate/masurate	S1	S2	S3	S4	S5	S6	S7
	Grosimi minime de rezistenta calculate conform API 650 [mm]	8.1	6.9	6.0	4.9	3.9	2.8	1.8
	Grosimi minime masurate [mm]	9.0	8.0	7.0	6.4	5.3	5.2	4.1
	Adaosul de grosime peste grosimea minima calculata [mm]	0.9	1.1	1.0	1.5	1.2	2.4	2.3
	Durata de viata remanenta estimata in raport cu grosimea calculata (ani)	6	7	7	10	8	16	15

ESTIMAREA DURATEI DE VIATA REMANENTA

Rev.1/16.03.2012

Tab.1 CONTINUARE

CORP	Elemente calculate/masurate	S8	BOTTOM PLATE	ANNULAR	COLUMN	ROOF
	Grosimi minime de rezistenta calculate conform API 650 [mm]	0.8	8	8	-	5
	Grosimi minime masurate [mm]	4.0	4.8	6.8	10.8	3.5
	Adaosul de grosime peste grosimea minima calculata[mm]	2.0	-3.2	-1.2	-	-1.5
	Durata de viata remanenta estimata in raport cu grosimea calculata (ani)	14	0	0	-	0

Tab.2

RACORD	Elemente calculate/masurate	R7	R8	R9	R10	R11
	Grosimi minime de rezistenta [mm] , conf API	12.7	12.7	8.56	12.7	12.7
	Grosimi minime masurate [mm]	9.5	7.0	6.1	5.4	7.2
	Adaosul de grosime peste grosimea minima masurata [mm]	-2.2	-2.7	-2.5	-6.3	-5.3
	Durata de viata remanenta estimata [ani](conf.API650)	0	0	0	0	0

Tab.2 Continuare

RACORD	Elemente calculate/masurate	GV.1	GV.2	ROOF RING
	Grosimi minime de rezistenta [mm] , conf API	12.7	12.7	-
	Grosimi minime masurate [mm]	10.0	10.1	7.9
	Adaosul de grosime peste grosimea minima masurata [mm]	-2.7	-2.6	-
	Durata de viata remanenta estimata [ani](conf.API650)	0	0	-

CONCLUZII:

- Estimind in raport cu grosimile de rezistenta rezervorul(cu exceptia racordurilor) se poate utiliza max.6 ani cu conditia monitorizarii anuale a grosimii elementelor critice sau inlocuind aceste elemente critice .

Prepared		Checked	Approved		
Date	16.03.2012	Date	16.03.2012	Date	
Signature		Signature		Signature	

		STRENGTH CALCULATION		T-01.RV-206-00/BC	
NAME		REZ.305 , ANEXA 1		Pag.1...8	
SHELL COURSE CALCULATION				Rev.	
DESIGN CODE: API 650 , Ed.2007 , Add.2010 , 1-FOOT METHOD D < 61m					
Operating fluid : Comercial GASOLINE					
DESIGN PARAMETERS			Symbol	U.M.	Value
Tank diameter (I.D)			D	m	22.78
Design specific gravity			G		0.74
Design pressure (atmosferic)			P	kPa	0
Operating pressure (atmosferic)			P _L	kPa	0
Presiune de testare (full water)			P _t	kPa	0
Design temperature			T_c	°C	<93
Maximum operating temperature			T_{max}	°C	50
Minimum temperature			T_{min}	°C	15
Maximum fill level			H	m	11.73
Number courses of shell			-	-	
Tank roof (type)			FIX		YES
			MOBIL		NO
			CU CAPAC MOBIL		NO
			CU GRINZI RADIALE		YES
Roof sloap			α	grd	<10
Heat insulation thk.			-	mm	-
COURSE 8			Symbol	U.M.	Value
Safety coeficients			C ₁ =2/3	-	0.67
			C ₂ =2/5	-	0.4
			C ₃ =3/4	-	0.75
			C ₄ =3/7	-	0.43
Yield strenght to T ⁰ C		MATERIAL : OL37.4K / STAS 500-88	R _{p0.2T°}	N/mm ²	235.0
Tensile strenght to 20 ⁰ C			R _m ^{20°}	N/mm ²	363.0
Design stress to operating conditions			S _d	N/mm ²	145.2
Design stress to hydrostatic test conditions			S _t	N/mm ²	155.6
$S_d = \min \left(\frac{2}{3} R_{p0.2}; \frac{2}{5} R_m \right) \quad (5.6.2.2)$			(2/3)R _{p0.2}	N/mm ²	156.7
			(2/5)R _m	N/mm ²	145.2
			(3/4)R _{p0.2}	N/mm ²	176.3
			(3/7)R _m	N/mm ²	155.6
$S_t = \min \left(\frac{3}{4} R_{p0.2}; \frac{3}{7} R_m \right) \quad (5.6.2.3)$					
Height of the course			H _c	m	1.3800
Liquid Level from the bottom of the course(design conditions)			H _{ld}	m	1.08
Liquid Level from the bottom of the course(test conditions)			H _{lt}	m	1.38
Design liquid Level from the bottom of the course(design conditions)			H _d	m	1.080
Design liquid Level from the bottom of the course(test conditions)			H _t	m	1.380
$H_d = H_{ld} + 0.1 * (P / G) \qquad H_t = H_{lt} + 0.1 * P_t$					
Corossion allowance (checked condition)			CA	mm	0.00
Minimum design shell thickness (design conditions)			t _d	mm	0.44372
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA \quad (5.6.3.2)$					
Minimum design shell thickness (test conditions)			t _t	mm	0.7749
$t_t = \frac{4.9D(H_t - 0.3)}{S_t} \quad (5.6.3.2)$					
Minumum design thickness acc.to API 650 , 5.6.1.1			t	mm	6.0
Nominal design thickness ; max(t _d ; t _t)			t _n	mm	0.775
Shell thickness (minimum permitted thickness)			t _a	mm	6.0

STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness		t_m	mm 4.0
Allow. Stress to operating conditions	$max.260N/mm^2$	S_{dc}	N/mm ² 16.1
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$			
Allow. Stress to test conditions	$max.260N/mm^2$	S_{tc}	N/mm ² 30.1
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$			
COURSE 7			
Safety coefficients	C1=2/3	-	0.66667
	C2=2/5	-	0.4
	C3=3/4	-	0.75
	C4=3/7	-	0.42857
Yield strenght to T ⁰ C	MATERIAL : OL37.4K / STAS 500-88		R _{p0.2/T⁰} N/mm ² 235.0
Tensile strenght to 20 ⁰ C	R _m ^{20⁰}	N/mm ²	363.0
Design stress to operating conditions	S _d	N/mm ²	145.2
Design stress to hydrostatic test conditions	S _t	N/mm ²	155.6
$S_d = \min\left(\frac{2}{3}R_{p0.2}; \frac{2}{5}R_m\right)$ (5.6.2.2)	(2/3)R _{p0.2}	N/mm ²	156.7
	(2/5)R _m	N/mm ²	145.2
$S_t = \min\left(\frac{3}{4}R_{p0.2}; \frac{3}{7}R_m\right)$ (5.6.2.3)	(3/4)R _{p0.2}	N/mm ²	176.3
	(3/7)R _m	N/mm ²	155.6
Height of the course	H _c	m	1.43
Liquid Level from the bottom of the course(design conditions)	H _{ld}	m	2.51
Liquid Level from the bottom of the course(test conditions)	H _{lt}	m	2.81
Design liquid Level from the bottom of the course(design conditions)	H _d	m	2.510
Design liquid Level from the bottom of the course(test conditions)	H _t	m	2.810
$H_d = H_{ld} + 0.1*(P/G)$		$H_t = H_{lt} + 0.1*P_t$	
Corossion allowance (checked condition)	CA	mm	0.00
Minimum design shell thickness (design conditions)	t _d	mm	1.25721
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA$ (5.6.3.2)			
Minimum design shell thickness (test conditions)	t _t	mm	1.80092
$t_t = \frac{4.9D(H_t - 0.3)}{S_t}$ (5.6.3.2)			
Minumum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; max(t _d ; t _t)	t _n	mm	1.801
Shell thickness (minimum permitted thickness)	t _a	mm	6
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness		t_m	mm 4.1
Allow. Stress to operating conditions	$max.260N/mm^2$	S_{dc}	N/mm ² 44.5
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$			
Allow. Stress to test conditions	$max.260N/mm^2$	S_{tc}	N/mm ² 68.3
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$			
COURSE 6			
Safety coefficients	C1=2/3	-	0.66667
	C2=2/5	-	0.4
	C3=3/4	-	0.75

	$C_4=3/7$	-	0.42857
Yield strenght to $T^0 C$	MATERIAL : OL37.4K / STAS 500-88	$R_{p0,2T^0}$	N/mm ² 235.0
Tensile strenght to $20^0 C$		$R_m^{20^0}$	N/mm ² 363.0
Design stress to operating conditions		S_d	N/mm ² 145.2
Design stress to hydrostatic test conditions		S_t	N/mm ² 155.6
$S_d = \min\left(\frac{2}{3}R_{p0,2}; \frac{2}{5}R_m\right)$ (5.6.2.2)	$(2/3)R_{p0,2}$	N/mm ²	156.7
	$(2/5)R_m$	N/mm ²	145.2
	$(3/4)R_{p0,2}$	N/mm ²	176.3
$S_t = \min\left(\frac{3}{4}R_{p0,2}; \frac{3}{7}R_m\right)$ (5.6.2.3)	$(3/7)R_m$	N/mm ²	155.6
Height of the course	H_c	m	1.51
Liquid Level from the bottom of the course(design conditions)	H_{ld}	m	4.02
Liquid Level from the bottom of the course(test conditions)	H_{lt}	m	4.32
Design liquid Level from the bottom of the course(design conditions)	H_d	m	4.020
Design liquid Level from the bottom of the course(test conditions)	H_t	m	4.320
$H_d = H_{ld} + 0.1 * (P / G)$		$H_t = H_{lt} + 0.1 * P_t$	
Corossion allowance (checked condition)	CA	mm	0.00
Minimum design shell thickness (design conditions)	t_d	mm	2.11621
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA$ (5.6.3.2)			
Minimum design shell thickness (test conditions)	t_t	mm	2.88434
$t_t = \frac{4.9D(H_t - 0.3)}{S_t}$ (5.6.3.2)			
Minumum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; $\max(t_d ; t_t)$	t_n	mm	2.884
Shell thickness (minimum permitted thickness)	t_a	mm	6
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness	t_m	mm	5.2
Allow. Stress to operating conditions	S_{dc}	N/mm ²	59.1
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$			
Allow. Stress to test conditions	S_{tc}	N/mm ²	86.3
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$			
COURSE 5			
Safety coefficients	$C_1=2/3$	-	0.66667
	$C_2=2/5$	-	0.4
	$C_3=3/4$	-	0.75
	$C_4=3/7$	-	0.42857
Yield strenght to $T^0 C$	MATERIAL : OL37.4K / STAS 500-88	$R_{p0,2T^0}$	N/mm ² 235.0
Tensile strenght to $20^0 C$		$R_m^{20^0}$	N/mm ² 363.0
Design stress to operating conditions		S_d	N/mm ² 145.2
Design stress to hydrostatic test conditions		S_t	N/mm ² 155.6
$S_d = \min\left(\frac{2}{3}R_{p0,2}; \frac{2}{5}R_m\right)$ (5.6.2.2)	$(2/3)R_{p0,2}$	N/mm ²	156.7
	$(2/5)R_m$	N/mm ²	145.2
	$(3/4)R_{p0,2}$	N/mm ²	176.3
$S_t = \min\left(\frac{3}{4}R_{p0,2}; \frac{3}{7}R_m\right)$ (5.6.2.3)	$(3/7)R_m$	N/mm ²	155.6
Height of the course	H_c	m	1.43

Liquid Level from the bottom of the course(design conditions)	H_{ld}	m	5.45
Liquid Level from the bottom of the course(test conditions)	H_{lt}	m	5.75
Design liquid Level from the bottom of the course(design conditions)	H_d	m	5.450
Design liquid Level from the bottom of the course(test conditions)	H_t	m	5.750
$H_d = H_{ld} + 0.1 * (P / G) \qquad H_t = H_{lt} + 0.1 * P_t$			
Corossion allowance (checked condition)	CA	mm	0.00
Minimum design shell thickness (design conditions)	t_d	mm	2.92969
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA \qquad (5.6.3.2)$			
Minimum design shell thickness (test conditions)	t_t	mm	3.91036
$t_t = \frac{4.9D(H_t - 0.3)}{S_t} \qquad (5.6.3.2)$			
Minumum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; max(t_d ; t_t)	t_n	mm	3.910
Shell thickness (minimum permitted thickness)	t_a	mm	6
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness	t_m	mm	5.3
Allow. Stress to operating conditions	S_{dc}	N/mm ²	80.3
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$			
Allow. Stress to test conditions	S_{tc}	N/mm ²	114.8
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$			
COURSE 4			
Safety coeficients	$C_1=2/3$	-	0.66667
	$C_2=2/5$	-	0.4
	$C_3=3/4$	-	0.75
	$C_4=3/7$	-	0.42857
Yield strenght to $T^{0}C$	MATERIAL : OL37.4K / STAS 500-88		$R_{p0.2/T^0}$
			N/mm ² 235.0
Tensile strenght to $20^{0}C$	$R_m^{20^0}$	N/mm ²	363.0
Design stress to operating conditions	S_d	N/mm ²	145.2
Design stress to hydrostatic test conditions	S_t	N/mm ²	155.6
$S_d = \min \left(\frac{2}{3} R_{p0.2}; \frac{2}{5} R_m \right) \qquad (5.6.2.2)$	$(2/3)R_{p0.2}$	N/mm ²	156.7
	$(2/5)R_m$	N/mm ²	145.2
	$(3/4)R_{p0.2}$	N/mm ²	176.3
	$(3/7)R_m$	N/mm ²	155.6
$S_t = \min \left(\frac{3}{4} R_{p0.2}; \frac{3}{7} R_m \right) \qquad (5.6.2.3)$			
Height of the course	H_c	m	1.50
Liquid Level from the bottom of the course(design conditions)	H_{ld}	m	6.95
Liquid Level from the bottom of the course(test conditions)	H_{lt}	m	7.25
Design liquid Level from the bottom of the course(design conditions)	H_d	m	6.950
Design liquid Level from the bottom of the course(test conditions)	H_t	m	7.250
$H_d = H_{ld} + 0.1 * (P / G) \qquad H_t = H_{lt} + 0.1 * P_t$			
Corossion allowance (checked condition)	CA	mm	0.00
Minimum design shell thickness (design conditions)	t_d	mm	3.783
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA \qquad (5.6.3.2)$			
Minimum design shell thickness (test conditions)	t_t	mm	4.9866

$t_t = \frac{4.9D(H_t - 0.3)}{S_t} \quad (5.6.3.2)$			
Minimum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; max(t _d ; t _t)	t _n	mm	4.987
Shell thickness (minimum permitted thickness)	t _a	mm	6
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness	t _m	mm	6.4
Allow. Stress to operating conditions	max.260N/mm ²		
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$	S _{dc}	N/mm ²	85.8
Allow. Stress to test conditions	max.260N/mm ²		
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$	S _{tc}	N/mm ²	121.2
COURSE3			
Safety coeficients	C ₁ =2/3	-	0.67
	C ₂ =2/5	-	0.4
	C ₃ =3/4	-	0.75
	C ₄ =3/7	-	0.43
Yield strenght to T ⁰ C	MATERIAL : OL37.4.2K / STAS 500-88		R _{p0.2T⁰}
			N/mm ² 235.0
Tensile strenght to 20 ⁰ C			R _m ^{20⁰}
			N/mm ² 363.0
Design stress to operating conditions	S _d	N/mm ²	145.2
Design stress to hydrostatic test conditions	S _t	N/mm ²	155.6
$S_d = \min\left(\frac{2}{3}R_{p0.2}; \frac{2}{5}R_m\right) \quad (5.6.2.2)$	(2/3)R _{p0.2}	N/mm ²	156.7
	(2/5)R _m	N/mm ²	145.2
$S_t = \min\left(\frac{3}{4}R_{p0.2}; \frac{3}{7}R_m\right) \quad (5.6.2.3)$	(3/4)R _{p0.2}	N/mm ²	176.3
	(3/7)R _m	N/mm ²	155.6
Height of the course	H _c	m	1.48
Liquid Level from the bottom of the course(design conditions)	H _{ld}	m	8.43
Liquid Level from the bottom of the course(test conditions)	H _{lt}	m	8.73
Design liquid Level from the bottom of the course(design conditions)	H _d	m	8.430
Design liquid Level from the bottom of the course(test conditions)	H _t	m	8.730
$H_d = H_{ld} + 0.1*(P/G)$		$H_t = H_{lt} + 0.1*P_t$	
Corossion allowance (checked condition)	CA	mm	0.00
Minimum design shell thickness (design conditions)	t _d	mm	4.62493
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA \quad (5.6.3.2)$			
Minimum design shell thickness (test conditions)	t _t	mm	6.0485
$t_t = \frac{4.9D(H_t - 0.3)}{S_t} \quad (5.6.3.2)$			
Minimum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; max(t _d ; t _t)	t _n	mm	6.048
Shell thickness (minimum permitted thickness)	t _a	mm	8
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness	t _m	mm	7.0
Allow. Stress to operating conditions	max.260N/mm ²		
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$	S _{dc}	N/mm ²	95.9
Allow. Stress to test conditions	max.260N/mm ²		
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$	S _{tc}	N/mm ²	134.4

t_t			
COURSE2			
Safety coefficients	C ₁ =2/3	-	0.67
	C ₂ =2/5	-	0.4
	C ₃ =3/4	-	0.75
	C ₄ =3/7	-	0.43
Yield strenght to T ⁰ C	MATERIAL : OL37.4K / STAS 500-88		R _{p0,2T°} N/mm ² 235.0
Tensile strenght to 20 ⁰ C	R _m ^{20°}	N/mm ²	363.0
Design stress to operating conditions	S _d	N/mm ²	145.2
Design stress to hydrostatic test conditions	S _t	N/mm ²	155.6
$S_d = \min \left(\frac{2}{3} R_{p0.2}; \frac{2}{5} R_m \right) \quad (5.6.2.2)$ $S_t = \min \left(\frac{3}{4} R_{p0.2}; \frac{3}{7} R_m \right) \quad (5.6.2.3)$	(2/3)R _{p0.2}	N/mm ²	156.7
	(2/5)R _m	N/mm ²	145.2
	(3/4)R _{p0.2}	N/mm ²	176.3
	(3/7)R _m	N/mm ²	155.6
Height of the course	H _c	m	1.50
Liquid Level from the bottom of the course(design conditions)	H _{ld}	m	9.93
Liquid Level from the bottom of the course(test conditions)	H _{lt}	m	10.23
Design liquid Level from the bottom of the course(design conditions)	H _d	m	10.042
Design liquid Level from the bottom of the course(test conditions)	H _t	m	10.511
$H_d = H_{ld} + 0.1 * (P/G)$		$H_t = H_{lt} + 0.1 * P_t$	
Corossion allowance (checked condition)	CA	mm	
Minimum design shell thickness (design conditions)	t _d	mm	5.47824
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA \quad (5.6.3.2)$			
Minimum design shell thickness (test conditions)	t _t	mm	6.90949
$t_t = \frac{4.9D(H_t - 0.3)}{S_t} \quad (5.6.3.2)$			
Minumum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; max(t _d ; t _t)	t _n	mm	6.909
Shell thickness (minimum permitted thickness)	t _a	mm	8
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness	t _m	mm	8.0
Allow. Stress to operating conditions	$max. 260N/mm^2$		S_{dc} N/mm² 100.6
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$			
Allow. Stress to test conditions	$max. 260N/mm^2$		S_{tc} N/mm² 142.5
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$			
COURSE1			
Safety coefficients	C ₁ =2/3	-	0.67
	C ₂ =2/5	-	0.4
	C ₃ =3/4	-	0.75
	C ₄ =3/7	-	0.43
Yield strenght to T ⁰ C	MATERIAL : OL37.4K / STAS 500-88		R _{p0,2T°} N/mm ² 235.0
Tensile strenght to 20 ⁰ C	R _m ^{20°}	N/mm ²	363.0
Design stress to operating conditions	S _d	N/mm ²	145.2
Design stress to hydrostatic test conditions	S _t	N/mm ²	155.6
$S_d = \min \left(\frac{2}{3} R_{p0.2}; \frac{2}{5} R_m \right) \quad (5.6.2.2)$	(2/3)R _{p0.2}	N/mm ²	156.7
	(2/5)R _m	N/mm ²	145.2
	(3/4)R _{p0.2}	N/mm ²	176.3

$S_t = \min\left(\frac{3}{4}R_{p0.2}; \frac{3}{7}R_m\right)$ (5.6.2.3)	$(3/7)R_m$	N/mm ²	155.6
Height of the course	H_c	m	1.49
Liquid Level from the bottom of the course(design conditions)	H_{ld}	m	11.42
Liquid Level from the bottom of the course(test conditions)	H_{lt}	m	11.72
Design liquid Level from the bottom of the course(design conditions)	H_d	m	11.686
Design liquid Level from the bottom of the course(test conditions)	H_t	m	11.720
$H_d = H_{ld} + 0.1*(P/G)$ $H_t = H_{lt} + 0.1*P_t$			
Corrosion allowance (checked condition)	CA	mm	0.00
Minimum design shell thickness (design conditions)	t_d	mm	6.47731
$t_d = \frac{4.9D(H_d - 0.3)G}{S_d} + CA$ (5.6.3.2)			
Minimum design shell thickness (test conditions)	t_t	mm	8.19381
$t_t = \frac{4.9D(H_t - 0.3)}{S_t}$ (5.6.3.2)			
Minimum design thickness acc.to API 650 , 5.6.1.1	t	mm	6.0
Nominal design thickness ; $\max(t_d ; t_t)$	t_n	mm	8.194
Shell thickness (minimum permitted thickness)	t_a	mm	10
STRESS CHECKED (acc. to EN14015 , par.9.1)			
Minimum measurement thickness	t_m	mm	9.0
Allow. Stress to operating conditions	S_{dc}	N/mm ²	104.5
$S_{dc} = \frac{4.9D(H_d - 0.3)G}{t_d}$			
Allow. Stress to test conditions	S_{tc}	N/mm ²	141.6
$S_{tc} = \frac{4.9D(H_t - 0.3)}{t_t}$			

SC TUV AUSTRIA ROMANIA SRL	STRENGTH CALCULATION		T-01.RV-206-00/BC	
	Utilaj:	REZ.T1, ANEXA 1		Pag.8
BOTTOM PLATE THICKNESS			Rev.	
API 650 , Ed.2007 , Add.2010 , 1-FOOT METHOD D < 61m				
Operating fluid : Comercial GASOLINE				
PARAMETRII DE PROIECTARE		Simbol	U.M.	Valoare
Tank diameter (I.D)		D	m	22.78
Design specific gravity		G		0.74
Design pressure (atmosferic)		P	kPa	0
Operating pressure (atmosferic)		P _L	kPa	0
Presiune de testare (full water)		P _t	kPa	0
Design temperature		T _c	°C	<93
Maximum operating temperature		T _{max}	°C	50
Minimum temperature		T _{min}	°C	15
Maximum fill level		H	m	11.73
Safety coeficients		C ₁ =2/3	-	0.67
		C ₂ =2/5	-	0.4
		C ₃ =3/4	-	0.75
		C ₄ =3/7	-	0.43
Yield strenght to T ⁰ C	MATERIAL : OL37.4K / STAS 500-88	R _{p0.2T⁰}	N/mm ²	235.0
Tensile strenght to 20 ⁰ C		R _m ^{20⁰}	N/mm ²	363.0
Design stress to operating conditions		S _d	N/mm ²	145.2
Design stress to hydrostatic test conditions		S _t	N/mm ²	155.6
$S_d = \min \left(\frac{2}{3} R_{p0.2}; \frac{2}{5} R_m \right) \quad (5.6.2.2)$ $S_t = \min \left(\frac{3}{4} R_{p0.2}; \frac{3}{7} R_m \right) \quad (5.6.2.3)$		(2/3)R _{p0.2}	N/mm ²	156.7
		(2/5)R _m	N/mm ²	145.2
		(3/4)R _{p0.2}	N/mm ²	176.3
		(3/7)R _m	N/mm ²	155.6
Corosion allowance (checked condition)		CA	mm	0.0
Bottom plate thickness				
Minim. design thickness (design cond.), acc to API 650-5.4.1		t _{min}	mm	8
Minimum necessary thickness t _n =t _{min} +CA		t _n	mm	8.0
Bottom plate thickness(minim adopted)		t	mm	8
Annular bottom plate thickness				
Thickness of bottom shell course		t ₁	mm	10
Minimum thickness acc. to API 650 , Tab.5-1a		t _a	mm	8
Minimum necessary thickness t _{an} =t _a +CA		t _{an}	mm	8.0
Annular bottom plate thickness (final adopted)		t	mm	8
Radial width of the annular plate between the inside of the shell				
Lateral acceleration coeficient		A	%g	0.08
Vertical earthquake acceleration coeficient ; Av=0.7A		Av	%g	0.056
Design specific gravity , API 650 , E.2.2		Ge	-	0.72342
Ge = G(1-0.4Av)				
Radial width conditions				
1.) L>600mm				
2.)	$L > \frac{215t_a}{\sqrt{HG}} \quad (5.5.2)$	L>	mm	583.799
3.)	$L > 0.01723t_a \sqrt{\frac{R_{p0.2}^{20}}{GeH}} \quad E.6.2.1.1.2-1a$	L>	m	0.72538
4.) L< 0.035*D				
Latimea radiala minima adoptata		L	m	1000
Earthquake acceleration value in acc. to seismim map of Romanian country and seismic code of Romanian country P100-2006				