Software by SANT'AMBROGIO S.I. srl - Milano,Italy - EN Rev. 1.24-Jgv/aUs

CYLINDRICAL SHELL POS.: 1

According to EN 13445-3 Ed. 2002 up to issue 21 (Clause 7 - 8)

* Design temperature	T =	150.0	°C
* MATERIAL :(Rec.Nr 119) SA 516 Gr. 60 PMA REQUIRED			
* NOMINAL DESIGN STRESS-DESIGN	f =	129.91	MPa
* NOMINAL DESIGN STRESS-AT ROOM TEMPERATURE	fA =	147.33	MPa
* NOMINAL DESIGN STRESS-HYDRAULIC TEST	ftest=	210.48	MPa

---------- CHECK UNDER INTERNAL PRESSURE (EN 13445-3 Clause 7.4.2)----------

Design pressure	P' =	1.400	MPa
Test pressure	pt' =	2.350	MPa
Overpressure due to static head - Design	ph' =	0.000	MPa
Overpressure due to static head - test	pht' =	0.000	MPa
Calculation pressure - Design	p =ph'+p' =	1.400	MPa
calculation pressure - Test	pt = pht'+pt' =	2.350	MPa
Shell internal diameter	Di =	610.00	mm
Joint efficiency	z =	1.00	
Corrosion allowance	c =	3.00	mm
Wall undertolerance (δM + δE)	δ =	0.00	mm
Adopted thickness	en =	10.00	mm
* DESIGN : e= p*(Di+2c+2δ)/(2*f*z-P)+c+δ	=	6.337	mm
* TEST : e= pt*(Di+2δ)/(2*ftest-Pt)+δ	=	3.424	mm

------------------------------ PRESSURES ----------------------------------

MAX. DESIGN PRESSURE - INTERNAL	=	2.919	MPa
MAX. TEST PRESSURE - INTERNAL	=	6.790	MPa
- INTERNAL: 1.43*P'	=	2.002	MPa
SHELL - INTERNAL: 1.25*P'*fA/f	=	1.985	MPa

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OPENING REINFORCEMENT POS.: 12

According to EN 13445-3 Ed. 2002 up to issue 21 (Clause 9)

* Design temperature	T =	150.0	°C
* NOZZLE			
* MATERIAL :(Rec.Nr 168) SA 333 Gr. 6 PMA REQUIRED			
* NOMINAL DESIGN STRESS-DESIGN	fb=	142.57	MPa
* NOMINAL DESIGN STRESS-AT ROOM TEMPERATURE	fbA=	160.67	MPa
* NOMINAL DESIGN STRESS-HYDRAULIC TEST	fbTest=	229.52	MPa
* PAD			
* MATERIAL :(Rec.Nr 168) SA 333 Gr. 6 PMA REQUIRED			
* NOMINAL DESIGN STRESS-DESIGN	fp=	142.57	MPa
* NOMINAL DESIGN STRESS-HYDRAULIC TEST	fpTest=	229.52	MPa
* SHELL DATA			
Internal diameter	D =	610.00	mm
Thickness	en =	10.00	mm
Joint efficiency	z =	1.00	
Corrosion allowance	c =	3.00	mm
wall undertolerance	δ =	0.00	mm
* NOZZLE DATA			
Type of connection :		Protruding	
Outside diameter	deb=	168.30	mm
Thickness	eb=	14.27	mm
Joint efficiency	zb=	1.00	
Corrosion allowance	cb=	3.00	mm
Wall undertolerance	δb=	0.00	mm
Internal protruding	lbi=	0.00	mm
Pad thickness	ep=	10.00	mm
Pad width	lp=	75.85	mm
Useful length (Horizontal limit to nozzle OD)	ls=	300.00	mm
Useful length (Vertical limit to shell OD)	lb=	108.40	mm
Nozzle position:		Normal to the wall	
Angular coordinate of nozzle	γ =	0.00	°
Distance from line	Z =	300.00	mm
Weld areas	Afw =	237	mm²
Value from fig. EN 13445-3 9.4-14 (design)	Maxeb/en =	2.000	
Nozzle calculat.thk. eb*=MIN(eb-cb-δb,maxeb/en(en-c-δ))	=	11.27	mm
Value from fig. EN 13445-3 9.4-14 (test)	Maxeb/en =	2.000	
Nozzle calculat.thk. eb*=MIN(eb-δb,maxeb/en(en-δ))	=	14.27	mm

Opening is a critical area as defined in clause 17

---------- PRESSURES ----------

MAX. DESIGN PRESSURE - INTERNAL	=	4.892	MPa
MAX. TEST PRESSURE - INTERNAL	=	9.937	MPa
- INTERNAL: 1.43*P'	=	2.002	MPa
NOZZLE - INTERNAL: 1.25*P'*fbA/fb	=	1.972	MPa

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OPENING REINFORCEMENT POS.: 12

According to EN 13445-3 Ed. 2002 up to issue 21 (Clause 9)

---------- CHECK UNDER INTERNAL PRESSURE: DESIGN ----------

Pressure	p' =	1.400	MPa
Overpressure due to static head	p''=	0.000	MPa
Calculation pressure	p = p'+p''=	1.400	MPa
Shell internal diameter	Di = D+2*c +2*δ =	616.00	mm
ea,s = en - c - δ	=	7.00	mm
lso = SQR((Di+ea,s)(ea,s))	=	66.04	mm
ls'= MIN(lso,ls)	=	66.04	mm
Lp' = MIN(lso, lp)	=	66.04	mm
lbo = sqr((deb-eb*)(eb*))	=	42.07	mm
lb'= MIN(lbo , lb)	=	42.07	mm
lbi' = MIN(0.5*lbo, lbi)	=	0.00	mm
Aps = (Di/2)(ls'+deb/2)	=	46257.9	mm²
Afs = ls'(ea,s)	=	462.3	mm²
Afp = ep*Lp'	=	660.4	mm²
Apb = .5*(deb-2eb+2cb+2δb)*(lb'+ea,s)	=	3576.1	mm²
Afb = (lb'+en-cb)(eb*)	=	553.0	mm²
(Afs+Afw)(f -.5*p)+(Afp)(f -.5*p)+Afb(f -.5*p)	=	247130	N
(Aps+Apb)*p	=	69768	N

---------- CHECK UNDER INTERNAL PRESSURE: TEST ----------

Pressure	p' =	2.350	MPa
Overpressure due to static head	p''=	0.000	MPa
Calculation pressure	p = p'+p''=	2.350	MPa
Shell internal diameter	Di = D+2*δ =	610.00	mm
ea,s = en - δ	=	10.00	mm
lso = SQR((Di+ea,s)(ea,s))	=	78.74	mm
ls'= MIN(lso, ls)	=	78.74	mm
lbo = sqr((deb-eb*)(eb*))	=	46.88	mm
lb' = MIN(lbo, lb)	=	46.88	mm
lbi' = MIN(0.5*lbo, lbi)	=	0.00	mm
Aps = (Di/2)(ls'+deb/2)	=	49681.5	mm²
Afs = ls'(ea,s)	=	787.4	mm²
Afp = ep*Lp'	=	758.5	mm²
Apb = .5*(deb-2eb+2δb)*(lb'+ea,s)	=	3975.0	mm²
Afb = (lb'+en)(eb*)	=	811.7	mm²
(Afs+Afw)(ftest -.5*p)+(Afp)(ftest -.5*p)+Afb(fTest -.5*p)	=	543038	N
(Aps+Apb)*p	=	126093	N