STD API650 STRENGTH CALCULATION

DOME ROOF THICKNESS AS PER API 650 & API 620

As per API 620 Fig.F-2, Detail "e"

INPUT DATA PGM RUN ***V1.0***

* Item Name	E-1004		* Description	PES21	
* Dome radius, Rs	6000	mm	* External Pressure, Ep	0.015	bar
* Roof used thickness, t	8	mm	* Roof Live Load, Lw	120	kg/m^2
* Top shell course thickness(Used), t_shell	8	mm	* Top and Stiffener : W	0	mm
* Corrosion Allowable, CA	3	mm	* Top and Stiffener : t	0	mm
* Jer = Roof Joint Efficiency	0.7		* Contributing Area due to roof plates, Aroof	0	cm^2
* Snow load, Sw	50	kgf/m^2	* Internal Pressure, P	509	mm
* Insulatui thickness	80	mm	* Allowable tensile stress per API 620 Table 5-1, Sts	1582	kgf/cm^2
* Insulation material density	120	kgf/m^3			

RESULT OF CALCULATION

* Dome roof height, h	803.8	mm	* Dome crown radius height, H=R-h	5,196.2	mm
* Cone Angle, Θ=Asin (H/R)*2	60.0	Deg	* Arc length, L=π*R*Θ/180	6,283.2	mm
* Surface area of roof, A	31.01	m^2	* Insulation load , Iw	9.60	kgf/m^2
* External Load, Ew	152.96	kgf/m^2	* Roof Weight (New), Dw	1,947	kgf
* Roof Dead Load (Corroded), Dw	39.3	kgf/m^2	* Roof Weight (Corroded), Dw	1,217	kgf

1. Total roof load pressure, Pr

* Pr=Sw+Iw+ Ew+Lw+Dw	371.8	kgf/m^2		0.037	kgf/cm^2
* Vertical roof projected area, h*R	4.82	m^2			

2. Actual participating Area of Roof of Roof-to-Shelll Junction,From API 620 5.12.4.2 Eqn. 25

* Outside diameter, OD	6,016.0	mm	* Rc = OD/2	3,008.0	mm
* Wc=0.6 SQURT{Rc * (t-CA)} for Top shell course	73.6	mm	* Aa=Cross sectional Area of top End Stiffener Detail, W*t, As per API 620 Fig.F-2, Detail "e" End stiffener Detail	0.0	cm^2
* Ashell= Contributing Area due to shell plates,= Wc*(t_shell - CA)	3.68	cm^2	* A=Actual part Area of Roof-to-Shell Juncture (Per API 620),'=Aa+Aroof+Ashelll	3.68	cm^2
* At=Cross-Sectional Area of Roof at Shell, π *Do^2/4	282,743	cm^2			

3. Internal Pressure - Top head Edge

* W=Weight of roof plates, New	1,947	kgf	* Corroded	1,217	kgf
* Pressure, W/At for New	-0.00689	kgf/cm^2	* Corroded	-0.00430	kgf/cm^2

4. Meridional and Latitudinal Forces at the Edge of Top head

* T1=Rs/2*(P+W/At)	900	kgf/mm	* T2=Rs*{P+W/At*SIN (Alpha)}-T1	984	kgf/mm

5. Minimum thickness(t) requirement as per 5.10.3.2 API 620

* T=MAX(T1, T2)	984	kgf/mm	* t= T/(Sts*E)+CA	3.1	mm

6. Internal Pressure - Top head Center

Required thickness of Top head center is shall not be more than Top head Edge. And, used thickness is same as Edge thickness, therefore, this calculation may not be necessary.

7. Enternal Pressure - Top head Edge

* W= -(Lw+Dw) * Roof Area	-4,933.2	kgf	* W/At at corroded	-0.01591	kgf/cm^2
			* External Pressure, P	-0.01530	kgf/cm^2

8. Meridional and Latitudinal Forces At the Edge of Top head

* T1=Rs/2*(P+W/At)	-604	kgf/mm	* T2=Rs*{P+W/At*SIN (Alpha)}-T1	-296	kgf/mm

9. Minimum thickness(t) requirement as per API 620

* Tp=MAX(ABS T1, ABS T2)	604	kgf/mm	* Tpp=MIN(ABS T1, ABS T2)	296	kgf/mm
* RP=R2	6,000	mm	* RPP=R1	6,000	mm
* t1=SQRT {(Tp+0.8*Tpp) *Rp}/1342+CA	5.48	mm	* t2=SQRT {(Tpp*Rpp)}/1000+CA	4.98	mm
* F1=t1-CA/Rp	0.0004		* F2=t2-CA/Rpp	0.0004	
* t-cal=MAX(t1,t2)	5.4849		* Ratio = (t-cal-CA/R)	0.0004	

10. Allowable compressive stress, Sca, as per API 620, para. 5.5.4.3

* Sca = 10^6*Ratio	29.1	kgf/cm^2	* Required thickness, t	5.48	mm

11. External Pressure - Top head Center

Required thickness of Top head center is shall not be more than Top head Edge. And, used thickness is same as Edge thickness, therefore, this calculation may not be necessary.

12. Roof thickness summary

* Required thickness, t	5.48	mm	* Used thickness, Tu	8.0	mm

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