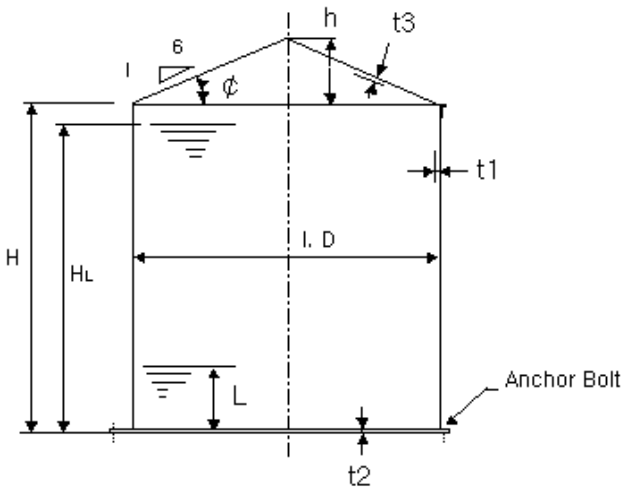
API 650 CONICAL TANK WEIGHT & FOUNDATION LOAD-ANCHORAGED

* DESIGN CODE : API 650 (9th Edition, Addendum 1 & 2)

INPUT DATA 계산실행 ***V1.0***

* DESCRIPTION	pes21	* ITEM NO.	E-1004

DESIGN DATA



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* DESIGN TEMPERATURE	0	oC	* LIQUID SPECIFIC GRAVITY	1	
* SHELL MATERIAL	A240-304		* CORROSION ALLOWANCE, SHELL & BOTTOM	3	mm
* INSIDE DIAMETER	4876.8	mm	* CORROSION ALLOWANCE, ROOF	1.5	mm
* DIMENSION "H"	5486	mm	* AMBIENT TEMPERATURE	20	oC
* DIMENSION "HL"	4389	mm	* INTERNAL PRESSURE	0	Kg/cm^2
* DIMENSION "LL"	690	mm	* ROOF SLOPE ANGLE	9	o
* USED SHELL THICKNESS @ 1'ST COURSE	8	mm	* ROOF THICKNESS	8	mm
* USED SHELL THICKNESS @2'ND COURSE	8	mm	* BOTTOM THICKNESS	14	mm
* SEISMIC ZONE FACTOR	0.05		* WIND VELOCITY	45	M/S
* SEISMIC IMPORTANCE FACTOR	1.25		* INSULATION THICKNESS	40	mm
			* ACCESSORIES		KG

* LIVE LOADS OF ROOF	120	kg/㎡	* PLATFORM & LADDER	700	KG

ANCHOR BOLT DATA

* MATERIAL	A307-B		* SIZE	24	M
* ALLOWABLE SHEAR STRESS	693	kg/㎠	* Q'TY	12	EA

EXTERNAL STIFFENER DATA

* SHELL STIFFENER DISTANCE	1219	mm	* BOTTOM STIFFENER DISTANCE	600	mm
* STIFFENER MATERIAL	SS400		* STIFFENER SIZE-BOTTOM	H150x75x5x7	
* STIFFENER SIZE-SHELL	ㄱ75x75x9				

NOZZLE & M/WAY COVER

* NOZZLE COVER SIZE-1	24"(600A)	150#	* NOZZLE COVER-QTY	2
* NOZZLE COVER SIZE-2	24"(600A)	150#	* NOZZLE COVER-QTY	0

NOZZLE & FLANGE DATA

NOZZLE SIZE	SCHEDULE	RATING	CON. TYPE	LENGTH	Q'TY
1"(25A)	SCH.160	150#	B/W	200	1
1"(25A)	SCH.160	150#	B/W	200	0
1"(25A)	SCH.160	150#	B/W	200	0
1"(25A)	SCH.160	150#	B/W	200	0
1"(25A)	SCH.160	150#	B/W	200	0
1"(25A)	SCH.160	150#	B/W	200	0
1"(25A)	SCH.160	150#	B/W	200	0

RESULT OF CALCULATION

** Sy : Yield strength at ambient temperature	2,109.2	Kg/cm^2	** St : Tensile strength at ambient temperature	5,273.0	Kg/cm^2
** NOMINAL CAPACITY,(π D2/4) H	102.5	㎥	** WORKING CAPACITY,(π D2/4) (HL - LL)	89.6	㎥

1. SHELL DESIN (Para. 3.6)

**Equ. Height due to internal pressure, Hp =	0	mm	** Reduction Factor (Table M-1) for max. operating temp. < 200 °F, F = 0.906	0.906	
** Allowable stress lesser of 3/4*Sy or 3/7*St	1,581.9	Kg/cm^2	** Allowable stress (Table 3-2), lesser of 2/3*Sy*F of 2/5*St	1,274.0	Kg/cm^2
** Shell course #1 width	3,292	mm	** Shell course #2 width	2,194	mm
** Required thickness #1 shell @ Desin+C.A	3.5	mm	** Required thickness #2 shell @ Desin+C.A	3.3	mm
** Required thickness #1			** Required		

shell @Test+C.A	3.5	mm	thickness #2 shell @ Test+C.A	3.3	mm

INERMEDIATE WIND GIRDER - Para. 3.9.7 (Stability of Tank shell against Wind)

** Max. Height of the unstiffened Shell @ 1'st	163.4	mm	** Max. Height of the unstiffened Shell @ 2'nd	163.4	mm
** Height of the transformed shell @1'st	2.2	mm	** Height of the transformed shell @2'nd	5.5	mm
			** Calculation results for WIND GIRDER	Not required	

2. BOTTOM PLATES (Para. 3.4)

** Min. required thickness, 1/4" +C.A	9.4	mm

3. ROOF DESIGN (Para. 3.10)

** Angle of the cone elements to the horizontal, θ < 20	Required	o	** Roof height, h = TAN (ang1*3.14159/180) *(id1/2)	386.2	mm
** Mi. required thickness, 3/16"+C.A	6.3	mm			

4. SEISMIC DESIGN (Appendix E) ; OPERATING CONDITION

OVERTURNING MOMENT

** Total weight of the tank contents	81,983	Kg	** D/H Ratio	1.111	
** Natural Period, T	40.434	Sec	** Lateral Force Coefficient for Sloshing Mode	0.028	
** W1 = (W1/WT)WT =	63,291	Kg	** W2 = (W2/WT)WT	19,676	Kg
** X1 = (X1/H)H	1,764	mm	** X2 = (X2/H)H	3,208	mm
** Seismic Factor, Cs = products of Z*I*C1 or Z*I*C2	0.00174		** Total weight of the tank shell, Ws	5,321	Kg
** Height from the bottom of the shell to the C.G of the shell, Xs	1,210.1	mm	** Total weight of the tank roof plus the live load portion, Wr	6,531	kg
** Total height of the tank shell, Ht	5,486	mm	** M = Z*I (C1*Ws*Xs + C1*Wr*Ht + C1*W1*X1 + C2*W2*X2)	5,094	kg-m

RESISTANCE TO OVERTURNING *WL : Maximum weight of the tank contents that may be used to resist the shell overturning moment, in pound per foot of shell circumference.

** Resistance to overturning	429	Kg/m

SHELL COMPRESSION (Para. E.5) ⇒ Anchored Tanks (Para. E.5.2)

* Max. Longitudinal Compressive Force at the bottom of the Shell, b

** Y = M/(D2 (Wt+WL))	0.0026		** b = Wt + 1.273*M/D2	82,256	Kg/m
		* Max. allowable Stress (Para. E.5.3), Fa			
** U = G*H*D2/t2	52,009,545		**Fa	22,144	Kg/cm^2
		* Max. Longitudinal Compressive Stress in the Shell			
** Fc = b/(12*t)	857	Kg/cm^2	**Judgement	O.K	
		* ANCHORAGE OF TANKS (Para. E.6)			
**Wt= (Ws+Wr)/(π*D)	0.0004	Kg/m	** Min. Ancharge Resistance, Fr = 1.273*M/D2-Wt	273	Kg/m
** Total up - Lift Force of Anchor, Fup = π*D*Fr	4,177	Kg/m	** Required Area of the Anchor Bolt, Ab=Fup/(N*Sa)	50	Kg/m
** Bolt Root area,	573	mm^2	**Judgement	O.K	

5. WIND LOAD (Para.E.3.11 & ASCE 7-88) ; OPERATING CONDITION

VELOCITY PRESSURE

** Qz = 0.00256 * Kz (I*V2)	4.7	Lb/sq ft	** Qz =	23.1	kg/㎡

WIND LOAD (Entire Area of the Tank)

** De : Effective diameter, (greater of 1.2*Do or Do + 0.6	5.9	m	** Fw = Qz*Gh*Cf*De*L	720	kg

OVERTURNING MOMENT due to WIND LOAD

** M = Fw*L/2	1,974.6	Kg-m	** Limition, 2/3*(W*D/2)	10,651	Kg-m
** D : Nominal Tank Diameter	4.893	m	**Judgement	O.K	

ANCHOR BOLT DESIGN

** Required Area of the Anchor Bolt, Ab = (4*M/Db-W)/(N*Sa)	3,518	mm^2	** Bolt Root area	573	mm^2
			**Judgement	O.K	

6. WEIGHT CALCULATION

** Shell	5,321	Kg	** Bottom	2,066	Kg
** Roof	1,210	Kg	** Nozzle & Flang	374	Kg
** Stiffener	1,519	Kg	** Ladder & Platfom	700	Kg
**Live Load of Roof	120	kg/㎡	** Insulation	430	Kg
** Contents	81,983	Kg	** Hydro Static Test Water	102,474	Kg

7. WEIGHT SUMMARY

** Erection Weight	10,490	Kg	** Empty Weight	11,620	Kg
**Operating Weight	93,723	Kg	** Test Weight	112,964	Kg

8. LOADING DATA SUMMARY

** LOAD	OPERATING	EMPTY+WIND	OPERATING+SEISMIC	HYDRO. TEST	UNIT
ON SHELL	0.39	0.50	0.67	0.39	Ton/m2
ON BOTTOM	4.50	0.96	6.68	5.60	Ton/m2
OVERTURING MOMENT		1.97	5.09		Ton/m2
SHEAR FORCE		0.72	4.18		Ton
UP-LIFTING FORCE			4.18		Ton
SLIDING FORCE		5.23			Ton

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