ASME SEC. VIII DIV.1

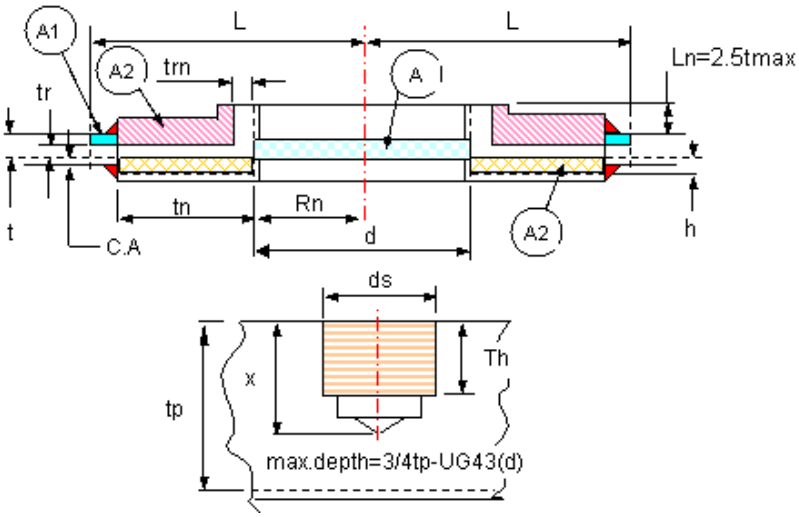
STUDDING OUTLET NOZZLE SIZING

AS PER UG-16.B, UG37, UG45.B.1~3, IN ASME SEC.VIII DIV.1

INPUT DATA 계산실행 ***V1.0***

< DESIGN DATA >

* DESCRIPTION	ITEM NO		* HEAD TYPE	2:1-E.Head	
* NOZZLE LOCATION	SHELL		* RATIO BASED ON INSIDE DIM. (L/r) for 10% Dished Head	10	mm
* DESIGN TEMPERATURE	A516-70	oC	* CORROSION ALLOWANCE, CA	2	mm
* SHELL MATERIAL	A516-70		* STUD NOZZLE MATERIAL	A105	
* SHELL ALLOWABLE STRESS & DESIGN TEMP	1380	Kg/cm^2	* STUD NOZZLE ALLOWABLE STRESS @ DESIGN TEMP	1270	Kg/cm^2
* SHELL ALLOWABLE STRESS & ROOM TEMP	1406.1	Kg/cm^2	*STUD NOZZLE ALLOWABLE STRESS @ ROOM TEMP	1300	Kg/cm^2
* DESIGN INTERNAL PRESSURE	7.1	Kg/cm^2	* NOZZLE USED THICKNESS	45	mm
* DESIGN EXTERNAL PRESSURE	1.05	Kg/cm^2	* NOZZLE TYPE (1,2,3)	No-Pad	
* SHELL or HEAD USED THICKNESS	18	mm	* 1) NOZZLE TO SHELL WELD LEG	8	mm
* SHEEL INSIDE RADIUS (CORRODED)	1524	mm	* SHELL SIDE JOINT EFFICIENCEY	1	
* NOZZLE INSIDE RADIUS (Corroded),Rn	75	mm	* 2) INSIDE NOZZLE TO SHELL/HEAD WELD LEG	8	mm
*BOLT SIZE,ds	5/8in		* 3) SHELL GROOVE WELD LEG	10	mm
*ANGLE OF PLANE, Factor-UG37), F	0		* INSIDE NOZZLE PROJECTION LENGTH	20	mm



RESULT OF CALCULATION

1. STUDDING NOZZLE NECK SIZING

** Sv : Shell Allowable stress @ Design Temp	1,380.0	Kg/cm^2	** Sn : Nozzlel Allowable stress @ Design Temp	1,270.0	Kg/cm^2
** Sv' : Shell Allowable stress @ Room Temp	1,406.1	Kg/cm^2	** Sn' : Nozzlel Allowable stress @ Room Temp	1,300.0	Kg/cm^2
** f1=Sn/Sv	0.92		** f2=Sn/Sv	0.92	
** f3=1	1.00		** f4=Sp/Sv	1.00	
** Nozzle outside diameter, do	236.0	mm	** Thread Depth, Th=0.75ds(sb/sfo)	11.9	mm
** Required thickness of shell or Head ,tr					
=7.1*1524/(1,380.00*1-0.6*7.1)				7.87	mm
** Required thickness of nozzle, trn					
=7.1*118/(1,270.00-0.6*7.1)				0.66	mm
** Nozzle nominal thickness of Nozzle, t	45.00	mm	** Limitation, trn < ro/2	O.K	
** Nozzle outside radious, ro	118.0	mm	** Limitation, P < 0.385 Sn	O.K	
** Shell or Head used thickness, uth	18.00	mm			
** Smaller of tr or twm = trm	7.87	mm	** Min. thk of Nozzle (Nom. pipe= twm, BULT-UP=Nom. THK), tm	45.00	mm
** tn = tm - C.A	43.00	mm	** MIN. TH'K. UG - 16(b), tmin	1.24	mm
** tn >= trn	O.K		** tn >= trm	O.K	
** tn >= tmin	O.K				
** MAWP(New & Cold)					
=((1,300.00/100*45)/118+(0.6*45))*100				403.45	Kg/cm^2
** MAWP(Hot)					
=((1,270.00/100*45-2)/118+(0.6*45-2))*100				379.76	Kg/cm^2

** Note 1: ASSUME E = 1.0 PER UG-45 OF ASME SECTION VIII, DIV. 1 ** Note 2 : PER ANSI B 36.10 OR ANSI B 36.19

2. NOZZLE REINFORCEMENT CALCULATION - INTERNAL PRESSURE

** d	150	mm	** tn	43	mm
** trn	0.66	mm	** tr	7.87	mm
** t	16.00	mm	** Rn	75.00	mm
** Ln = 2.5t =	40	mm	** Tapped hole depth, x	28.2	mm
** Tapped hole area Loss,S	1,057.0	mm^2	** F,Angle of plane with Long.axis-UG37	1	o
** Outward Nozzle Limit; Smaller of (2.5t)				40	mm
** Shell Limit, La					
=LARGER OF(d or Rn+tn+t)				134	mm
** Ar = AREA OF REINFORCEMENT REQUIRED	=KxF(dxtr+2tnxtr(1-f1))+S				
=1*1*(150*7.87+2*43.00*7.87*(1-0.9))+1,057.0				2,291	mm^2
** A1 = AREA AVAILABLE IN SHELL/HEAD, = 2(L-Rn-tn)(t-tr)(1-f1))					
=2*((134.0-75.0-45.0)*(18.0-7.9))*(1-0.9)				23	mm^2
** A2 = AREA AVAILABLE IN NOZZLE PROJECTION OUTWARD, = 2 (tp-h-tr)(tn-trn)					
=2*((43.0-20.0-7.9)*(45.0-0.7))*0.9				1,235	mm^2
** A3 = AREA AVAILABLE IN NOZZLE PROJECTION INWARD, = 2 (htn)xf2					
=(2*20.0*45.0)*0.9				1,657	mm^2
** A5 = A51+A52+A53				128	mm^2
** Aav = A1 + A2 + A3 +A5 =	23 + 1,235 + 1,657 + 128			3,042	mm^2
				Satisfied	

3. NOZZLE REINFORCEMENT CALCULATION - EXTERNAL PRESSURE

** d	150	mm	** tn	43	mm
** trn	0.78	mm	** tr	8.79	mm
** t	43.00	mm	** Rn	75.00	mm
** Ln = 2.5t	108	mm	** Tapped hole depth, x	28.2	mm
** Tapped hole area Loss,S	1,057.0	mm^2	** F,Angle of plane with Long.axis-UG37	1	o
** Outward Nozzle Limit; Smaller of (2.5t)				108	mm
** Shell Limit, La	=LARGER OF(d or Rn+tn+t)			161	mm
** Ar = AREA OF REINFORCEMENT REQUIRED	=KxF(dxtr+2tnxtr(1-f1))+S				
=1*1*(150*8.79+2*43.00*8.79*(1-0.9))+1,057.0				2,435	mm^2
** A1 = AREA AVAILABLE IN SHELL/HEAD, = 2(L-Rn-tn)(t-tr)(1-f1))					
=2*((134.0-75.0-45.0)*(18.0-7.9))*(1-0.9)				23	mm^2
** A2 = AREA AVAILABLE IN NOZZLE PROJECTION OUTWARD, = 2 (tp-h-tr)(tn-trn)					
=2*((43.0-20.0-7.9)*(45.0-0.7))*0.9				1,235	mm^2
** A3 = AREA AVAILABLE IN NOZZLE PROJECTION INWARD, = 2 (htn)xf2					
=(2*20.0*45.0)*0.9				1,657	mm^2
** A5 = A51+A52+A53					mm^2

		128	
** Aav = A1 + A2 + A3 +A5 =	23 + 1,235 + 1,657 + 128		
	Satisfied	3,042	mm^2

4. STRENGTH OF WELDS, Refer to UG-41 and UW-15

* tmin : The smaller of 3/4 in.(19mm) or the thickness of the thinner of the parts jointed	18.00	mm
* tc : Not less than the smaller of 1/2in(6.35mm) or 0.7 tmin	6.4	mm
* 1/2 tmin : Weld leg of pad to vessel in UG-40, FIG.UW-16.1(a-1)	9.0	mm
* NOZZLE to VESSEL, Required fillet weld leg size for 1/2tmin, (1/2tmin/0.707)	13	mm

4-1) CHECK SIZE OF WELD (UW-16)

a) Inner fillet weld, tc

* tc = not less than the smaller of 6.35mm or 0.7tmin	12.6	mm	tc, Actual	5.6	mm

b) Outer fillet weld (reinforcing element)

* Throat (Required)= 0.5 x tmin =	0.0	mm	** Throat (Actual) = 0.7 x Weld size =	0.0	mm

c) Upper groove weld

* tw (Required)=	0.0	mm	** tw (Actual) =	0.0	mm

d) Lower groove weld

* tw (Required)=	12.6	mm	** tw (Actual) =	10.0	mm

4-2) REQUIRED WELD STRENGTH PER UG-41.1 SKETCH (a) OR (b)

** W total = [A-(d-2xtn)(E1xt-Fxtr)]xS		
=(2,290.72-(150-2*43.00)*(16-7.87))*1380	2,442,722	Kg
** W1-1 = (A2+A51+A42)xS		
=(1,235.12+64.00+0.00)x1380	1,792,788	Kg
** W2-2 = (A2+A3+A51+A53+2xtnxtxfr1)xS		
=(1,235.12+0.0+64.00+0.0+(2*43.00*16.00*0.9))*1380	3,540,308	Kg
** W3-3 = (A2+A3+A51+A52+A53+2xtnxtxfr1)xS		
=(1,235.12+0.0+64.00+0.00+0.0+(2*43.00*16.00*0.9))*1380	3,540,308	Kg

4-3)STRENGTH OF CONNECTION ELEMENTS

** a) Upper fillet or cover weld (Fa)		
=3.14159/2*236*0.49*8*1270	1,845,531	Kg
** b) Nozzle wall shear (Fb)		
=3.14159/2*(236+150)*0.5*0.7*43.00*1380	12,592,803	Kg
** c) Lower groove weld tension (Fc)		
=3.14159/2*236*0.74*10*1380	3,785,666	Kg
** e) Upper groove weld tension (Fe)		
=3.14159/2*236*0.74*10*1380	3,785,666	Kg

4-4) ALLLOWABLE STRENGTH PER POSSIBLE PATHS OF FAILURE

* Path 1-1= Fb	12,592,803	Kg	* Judgement	O.K
* Path 2-2= Fa+Fc+Fe	9,416,863	Kg	* Judgement	O.K
* Path 3-3= Fc	3,785,666	Kg	* Judgement	O.K