



DAFTAR PUSTAKA

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LAMPIRAN 1



Sifat-Sifat Material Baja Karbon Dan Baja Paduan Rendah

(Paul Buthod, Pressure Vessel Handbook, Seventh Edition. Publishing INC. P.O Box
35365, Tulsa, OK 74153)

PROPERTIES OF MATERIALS CARBON & LOW ALLOY STEEL *				
Form	Nominal Composition	Specification Number	Grade	APPLICATION
Plate	C	SA-283	C	Structural quality. For pressure vessel may be used with limitations see note:1
	C	SA-285	C	Boilers for stationary service and other pressure vessels
	C-Si	SA-515	55	Primarily for intermediate and high temperature service
	C-Si	SA-515	60	- " -
	C-Si	SA-515	65	- " -
	C-Si	SA-515	70	- " -
	C-Si	SA-516	55	For moderate and lower temperature service
	C-Si	SA-516	60	- " -
	C-Mn-Si	SA-516	65	- " -
	C-Mn-Si	SA-516	70	- " -
Flange and Fitting	C-Mn-Si	SA-105		For high temperature service
	C-Si	SA-181	1	For general service
	C-Mn	SA-350	LF1	For low temperature service
	C-Mn-Si		LF2	
Pipe	C-Mn	SA-53	B	For general service
	C-Mn	SA-106	B	For high temperature service
Bolting	1Cr-1/5 Mo.	SA-193	B7	For high temperature service Bolt 2 1/2 in. diam. or less
		SA-194	2H	For high temperature service nut
		SA-307	B	Machine bolt for general use

* Data of the most frequently used materials from ASME Code Section II and VIII.

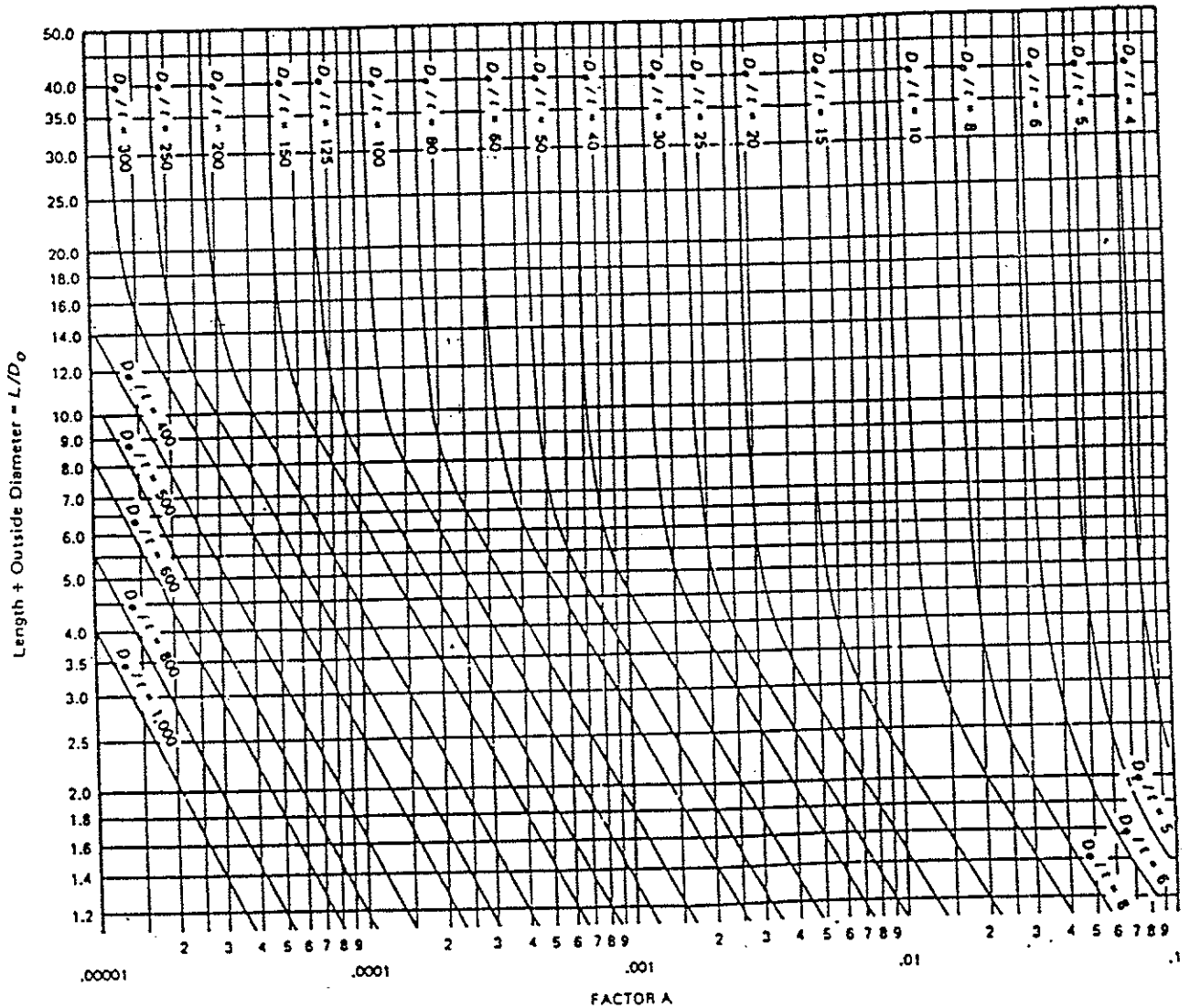


PROPERTIES OF MATERIAL (cont.)							
Form	Specification		P Number	Tensile Strength 1,000 psi.	Yield Point 1,000 psi.		See Notes
	Number	Grade					
PLATE	SA-283	C	1	55.0	30.0		1
	SA-285	C	1	55.0	30.0		2,6
	SA-515	55	1	55.0	30.0		3
	SA-515	60	1	60.0	32.0		3
	SA-515	65	1	65.0	35.0		3
	SA-515	70	1	70.0	38.0		3
	SA-516	55	1	55.0	30.0		3,8
	SA-516	60	1	60.0	32.0		3,8
	SA-516	65	1	65.0	35.0		3,8
	SA-516	70	1	70.0	38.0		3,8
FLANGE AND FITTING	SA-105		1	70.0	36.0		2,3
	SA-181	I	1	60.0	39.0		2,3
	SA-350	LF1 LF2	1	60.0 70.0	30.0 36.0		—
SEAMLESS PIPE	SA-53	B	1	60.0	35.0		2,3,4,7
	SA-106	B	1	60.0	35.0		3
BOLTING	SA-193	B7	—	125.0	105.0	DIAM > 2 1/4 in and < 4 in	—
	SA-194	2H	—	55.0	—		—
	SA-307	B	—	55.0	—		5

[illegible]



Nilai Faktor A Dan Faktor B Untuk Bejan Silindris Akibat Tekanan
(ASME Boiler And Pressure Vessel Code, Section VII, Rules For Contruction Of
Pressure Vessels, Devision 1, 1992 Edition)



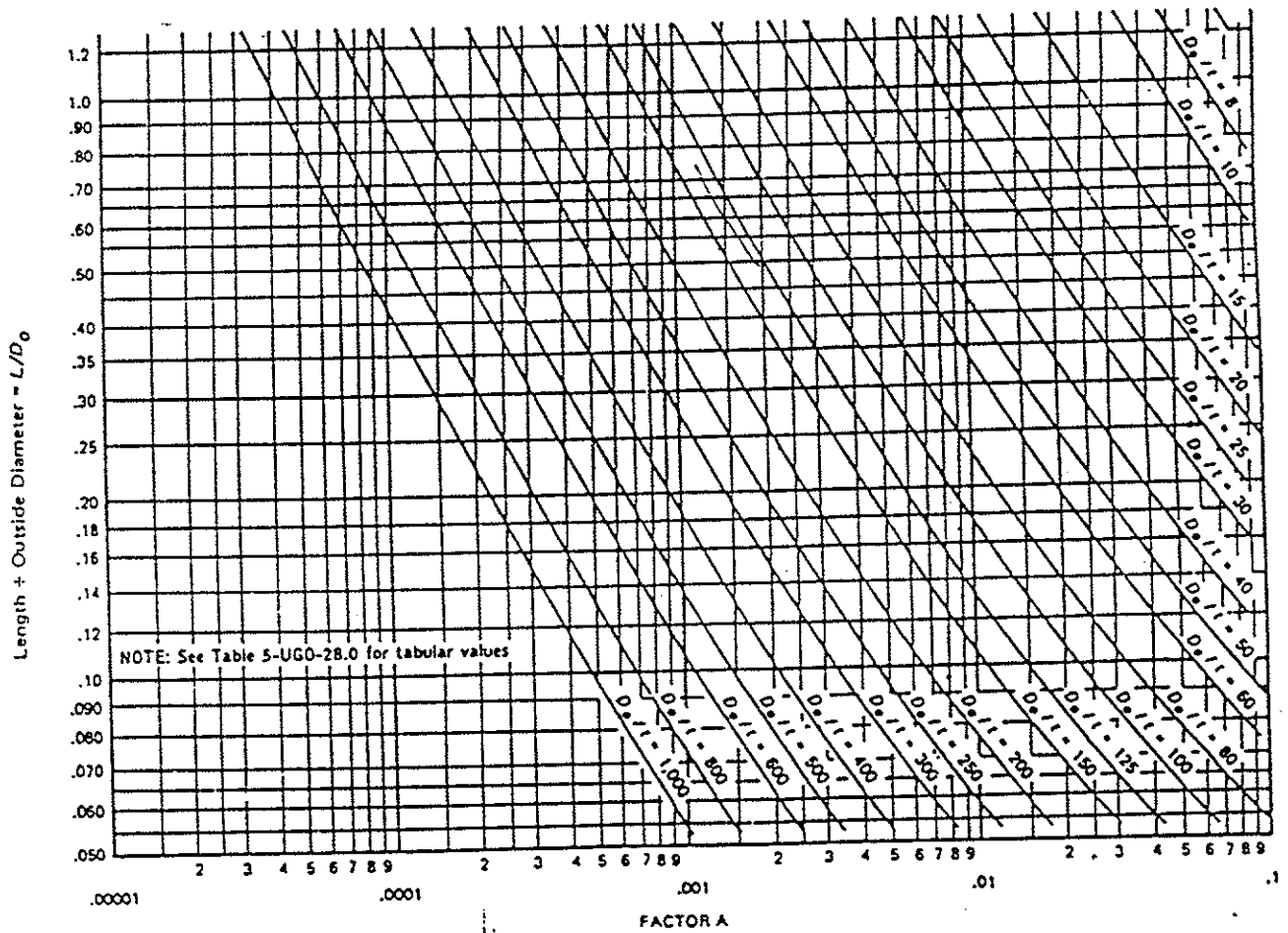


FIG. 5-UGO-28.0 GEOMETRIC CHART FOR CYLINDRICAL VESSELS UNDER EXTERNAL OR COMPRESSIVE LOADINGS (FOR ALL MATERIALS)



Lampiran 1

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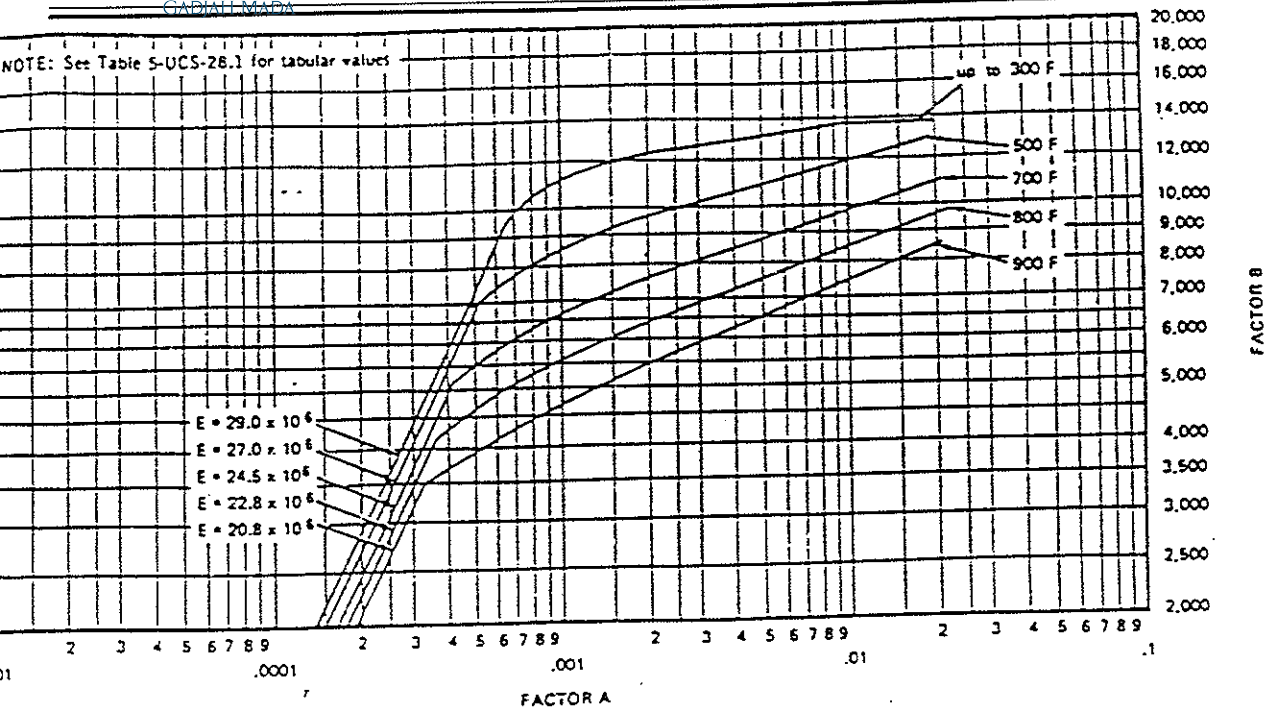


FIG. 5-UCS-28.1 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE WHEN CONSTRUCTED OF CARBON OR LOW ALLOY STEELS (SPECIFIED MINIMUM YIELD STRENGTH 24,000 psi TO, BUT NOT INCLUDING, 30,000 psi) [NOTE (1)]

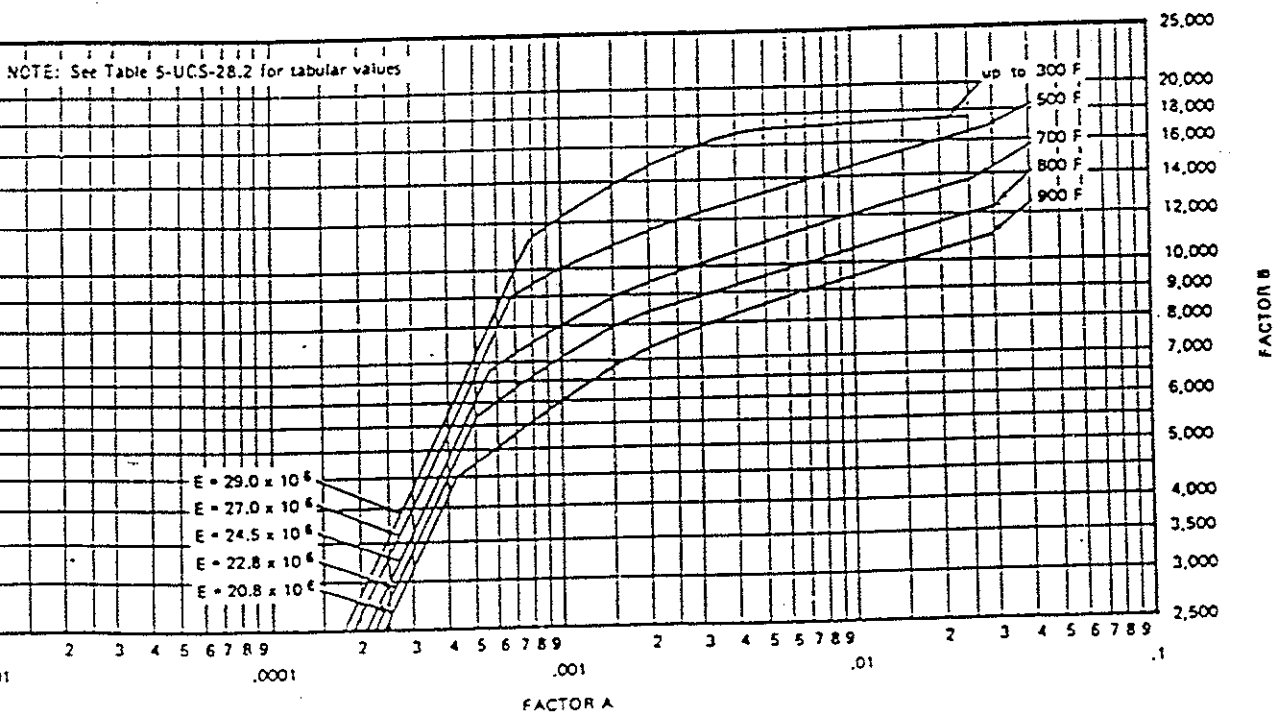


FIG. 5-UCS-28.2 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE WHEN CONSTRUCTED OF CARBON OR LOW ALLOY STEELS (SPECIFIED MINIMUM YIELD STRENGTH 30,000 psi AND OVER EXCEPT FOR MATERIALS WITHIN THIS RANGE WHERE OTHER SPECIFIC CHARTS ARE REFERENCED) AND TYPE 405 AND TYPE 410 STAINLESS STEELS [NOTE (2)]



Dimensi Dan Berat Dari Pipa Baja (Standar ANSI B36.10)

Dimension and Weight in ANSI B36.10 "Welded and

Size		Wall Thickness	Nominal Weight	Weight Class	Schedule No.
Nominal	Outside Diameter				
in.	in. (mm)	in. (mm)	lb/ft (kg/m)		
1/8	0.405 (10.3)	0.048 (1.2)	0.24 (0.37)	std	40
		0.095 (2.4)	0.51 (0.47)	XS	80
1/4	0.540 (13.7)	0.048 (2.2)	0.42 (0.63)	std	40
		0.119 (3.0)	0.54 (0.80)	XS	80
3/8	0.675 (17.1)	0.091 (2.3)	0.57 (0.84)	std	40
		0.126 (3.2)	0.74 (1.10)	XS	80
1/2	0.840 (21.3)	0.109 (2.8)	0.85 (1.27)	std	40
		0.147 (3.7)	1.09 (1.62)	XS	80
		0.294 (7.5)	1.71 (2.55)	XXS	...
3/4	1.050 (26.7)	0.113 (2.9)	1.13 (1.69)	std	40
		0.154 (3.9)	1.47 (2.20)	XS	80
		0.308 (7.8)	2.44 (3.64)	XXS	...
1	1.315 (33.4)	0.133 (3.4)	1.68 (2.50)	std	40
		0.179 (4.6)	2.17 (3.24)	XS	80
		0.358 (9.1)	3.66 (5.45)	XXS	...
1 1/8	1.660 (42.2)	0.140 (3.6)	2.27 (3.39)	std	40
		0.191 (4.9)	3.00 (4.47)	XS	80
		0.382 (9.7)	5.21 (7.77)	XXS	...
1 1/4	1.900 (48.3)	0.145 (3.7)	2.72 (4.05)	std	40
		0.200 (5.1)	3.63 (5.41)	XS	80
		0.300 (10.2)	6.41 (9.56)	XXS	...
2	2.375 (60.3)	0.154 (3.9)	3.65 (5.44)	std	40
		0.218 (5.5)	5.02 (7.48)	XS	80
		0.344 (8.7)	7.46 (11.11)	...	160
		0.436 (11.1)	9.03 (13.44)	XXS	...
2 1/2	2.875 (73.0)	0.203 (5.2)	5.79 (8.63)	std	40
		0.276 (7.0)	7.66 (11.41)	XS	80
		0.375 (9.5)	10.01 (14.92)	...	160
		0.552 (14.0)	13.09 (20.29)	XXS	...
3	3.500 (88.9)	0.216 (5.5)	7.58 (11.29)	std	40
		0.300 (7.6)	10.25 (15.27)	XS	80
		0.438 (11.1)	14.32 (21.35)	...	160
		0.600 (15.2)	18.58 (27.68)	XXS	...
3 1/2	4.000 (101.6)	0.226 (5.7)	9.11 (13.57)	std	40
		0.318 (8.1)	12.50 (18.63)	XS	80
4	4.500 (114.3)	0.227 (5.8)	10.79 (16.07)	std	40
		0.337 (8.6)	14.98 (22.32)	XS	80
		0.438 (11.1)	19.00 (28.32)	...	120
		0.531 (13.5)	22.51 (33.54)	...	160
		0.674 (17.1)	27.54 (41.03)	XXS	...
5	5.563 (141.3)	0.258 (6.6)	14.62 (21.77)	std	40
		0.375 (9.5)	20.78 (30.97)	XS	80
		0.500 (12.7)	27.04 (40.28)	...	120
		0.625 (15.9)	32.96 (49.11)	...	160
		0.750 (19.1)	38.55 (57.43)	XXS	...



Seamless Wrought Steel Pipe

Size		Wall Thickness	Nominal Weight	Weight Class	Schedule No.
Nominal	Outside Diameter				
in.	in. (mm)	in. (mm)	lb/ft (kg/m)		
6	6.625 (168.3)	0.280 (7.1)	18.97 (28.26)	std	40
		0.432 (11.0)	28.57 (42.56)	XS	80
		0.562 (14.3)	36.30 (54.20)	...	120
		0.719 (18.3)	45.15 (67.56)	...	160
		0.864 (22.0)	53.18 (79.22)	XXS	...
8	8.625 (219.1)	0.250 (6.4)	22.36 (33.31)	...	20
		0.277 (7.0)	24.70 (36.81)	...	30
		0.322 (8.2)	28.55 (42.55)	std	40
		0.406 (10.3)	35.64 (53.08)	...	60
		0.500 (12.7)	43.39 (64.64)	XS	80
		0.594 (15.1)	50.95 (75.92)	...	100
		0.719 (18.3)	60.71 (90.44)	...	120
		0.812 (20.6)	67.76 (100.92)	...	140
		0.875 (22.2)	72.42 (107.92)	XXS	...
		0.906 (23.0)	74.69 (111.27)	...	160
10	10.750 (273.1)	0.250 (6.4)	28.04 (41.77)	...	20
		0.279 (7.1)	31.20 (46.51)	...	...
		0.307 (7.8)	34.24 (51.03)	...	30
		0.365 (9.3)	40.48 (60.31)	std	40
		0.500 (12.7)	54.74 (81.55)	XS	80
		0.594 (15.1)	64.43 (96.01)	...	100
		0.719 (18.3)	77.09 (114.75)	...	120
		0.844 (21.4)	89.29 (133.08)	...	140
		1.000 (25.4)	104.13 (155.15)	XXS	160
		1.125 (28.6)	115.64 (172.35)	...	...
12	12.750 (323.9)	0.250 (6.4)	33.38 (49.73)	...	20
		0.330 (8.4)	43.77 (65.20)	...	30
		0.375 (9.5)	49.56 (73.88)	std	...
		0.406 (10.3)	53.52 (79.73)	...	40
		0.500 (12.7)	65.42 (97.48)	XS	...
		0.502 (12.7)	65.42 (97.48)	...	60
		0.502 (12.7)	65.42 (97.48)	...	80
		0.594 (15.1)	77.09 (114.75)	...	100
		0.844 (21.4)	107.32 (159.91)	...	120
		1.000 (25.4)	125.49 (186.97)	XXS	140
14	14.000 (355.6)	0.250 (6.4)	36.71 (54.69)	...	10
		0.312 (7.9)	45.81 (67.90)	...	20
		0.375 (9.5)	54.57 (81.33)	std	30
		0.438 (11.1)	63.44 (94.55)	...	40
		0.500 (12.7)	72.09 (107.39)	XS	...
		0.594 (15.1)	85.06 (126.71)	...	60
		0.750 (19.1)	106.13 (158.10)	...	80
		0.875 (22.2)	125.49 (186.97)	...	100
		1.004 (25.4)	150.79 (224.05)	...	120
		1.250 (31.8)	179.31 (263.56)	...	140
16	16.000 (406.4)	0.250 (6.4)	42.05 (62.84)	...	10
		0.312 (7.9)	52.27 (77.83)	...	20
		0.375 (9.5)	62.58 (93.27)	std	30
		0.500 (12.7)	82.77 (123.30)	XS	40
		0.656 (16.7)	107.50 (160.12)	...	60
		0.844 (21.4)	136.81 (203.53)	...	80
		1.031 (26.2)	164.82 (245.54)	...	100
		1.219 (31.0)	192.43 (286.64)	...	120



Size		Wall Thickness	Nominal Weight	Weight Class	Schedule No.
Nominal	Outside Diameter				
in.	in. (mm)	in. (mm)	lb/ft (kg/m)		
18	18.000 (457)	1.438 (36.5)	223.64 (333.19)	---	140
		1.594 (40.5)	245.25 (365.35)	---	160
		0.250 (6.4)	47.39 (70.57)	---	10
		0.312 (7.9)	58.94 (87.71)	---	20
		0.375 (9.5)	70.59 (105.16)	std	---
		0.438 (11.1)	82.15 (122.38)	---	30
		0.500 (12.7)	93.45 (139.15)	XS	---
		0.562 (14.3)	104.67 (155.80)	---	40
		0.750 (19.1)	138.17 (205.74)	---	60
		0.938 (23.8)	170.92 (254.55)	---	80
		1.156 (29.4)	207.96 (309.62)	---	100
		1.375 (34.9)	244.14 (363.56)	---	120
		1.562 (39.7)	274.22 (408.26)	---	140
		1.781 (45.2)	308.50 (459.37)	---	160
20	20.000 (508)	0.250 (6.4)	52.73 (78.55)	---	10
		0.375 (9.5)	78.60 (117.15)	std	20
		0.500 (12.7)	104.13 (155.12)	XS	30
		0.594 (15.1)	123.11 (183.42)	---	40
		0.812 (20.6)	166.40 (247.83)	---	60
		1.031 (26.2)	208.87 (311.17)	---	80
		1.281 (32.5)	256.10 (381.53)	---	100
		1.500 (38.1)	296.37 (441.49)	---	120
		1.750 (44.5)	341.09 (508.11)	---	140
		1.969 (50.0)	379.17 (564.81)	---	160
24	24.000 (610)	0.250 (6.4)	63.41 (94.53)	---	10
		0.375 (9.5)	94.62 (141.12)	std	20
		0.500 (12.7)	125.49 (187.06)	XS	---
		0.562 (14.3)	140.68 (209.64)	---	30
		0.688 (17.5)	171.29 (255.41)	---	40
		0.909 (23.0)	238.15 (355.20)	---	60
		1.219 (31.0)	296.58 (442.08)	---	80
		1.531 (38.9)	367.39 (547.71)	---	100
		1.812 (46.0)	429.19 (640.03)	---	120
		2.062 (52.4)	483.12 (720.15)	---	140
26	26.000 (660)	2.344 (59.5)	542.13 (808.22)	---	160
		0.250 (6.4)	68.75 (102.35)	---	---
		0.312 (7.9)	85.60 (127.36)	---	10
		0.375 (9.5)	102.63 (152.87)	std	---
		0.500 (12.7)	136.17 (202.72)	XS	20



Tabel-tabel Perhitungan *Base Block*

(Lloyd E. Brownell, Edwin H. Young, Process Equipment Design, John Wiley & Sons)

Table 10.1. Average Values of Properties of Three Concrete Mixes

Water Content U.S. Gallons per 94-lb Sack of Cement	f'_c 28-day Ultimate Compressive Strength, psi	n $30 \times \frac{10^6}{E_c}$	f_c Allowable Compressive Strength, psi
7 $\frac{1}{2}$	2000	15	800
6 $\frac{3}{4}$	2500	12	1000
6	3000	10	1200
5	3750	8	1400

Table 10.2. Values of Constants C_t , C_c , z , and j as a Function of k (156)

k	C_c	C_t	z	j
0.050	0.600	3.008	0.490	0.760
0.100	0.852	2.887	0.480	0.766
0.150	1.049	2.772	0.469	0.771
0.200	1.218	2.661	0.459	0.776
0.250	1.370	2.551	0.448	0.779
0.300	1.510	2.442	0.438	0.781
0.350	1.640	2.333	0.427	0.783
0.400	1.765	2.224	0.416	0.784
0.450	1.884	2.113	0.404	0.785
0.500	2.000	2.000	0.393	0.786
0.550	2.113	1.884	0.381	0.785
0.600	2.224	1.765	0.369	0.784



Tabel-tabel Perhitungan *Base Block*

(Lloyd E. Brownell, Edwin H. Young, *Process Equipment Design*, John Wiley & Sons)

Table 10.3. Maximum Bending Moments in a Bearing
Plate with Gussets (107)
(Courtesy of McGraw-Hill Book Co.)

l/b	$M_x \left(\begin{matrix} x = b/2 \\ y = l \end{matrix} \right)$	$M_y \left(\begin{matrix} x = b/2 \\ y = 0 \end{matrix} \right)$
0	0	$-0.500f_c l^2$
$\frac{1}{3}$	$0.0078f_c b^2$	$-0.428f_c l^2$
$\frac{1}{2}$	$0.0293f_c b^2$	$-0.319f_c l^2$
$\frac{2}{3}$	$0.0558f_c b^2$	$-0.227f_c l^2$
1	$0.0972f_c b^2$	$-0.119f_c l^2$
$\frac{3}{2}$	$0.123f_c b^2$	$-0.124f_c l^2$
2	$0.131f_c b^2$	$-0.125f_c l^2$
3	$0.133f_c b^2$	$-0.125f_c l^2$
∞	$0.133f_c b^2$	$-0.125f_c l^2$

b = gusset spacing (x direction) inches.

l = bearing-plate outside radius minus skirt outside radius (y direction) inches.

Table 10.6. Constants for Moment Calculation in
Compression Ring (107)
(Courtesy of McGraw-Hill Book Co.)

b/l	1.0	1.2	1.4	1.6	1.8	2.0	∞
γ_1	0.565	0.350	0.211	0.125	0.073	0.042	0
γ_2	0.135	0.115	0.085	0.057	0.037	0.023	0

Note: for a b/l less than 1.0 invert b/l and rotate axes 90° .



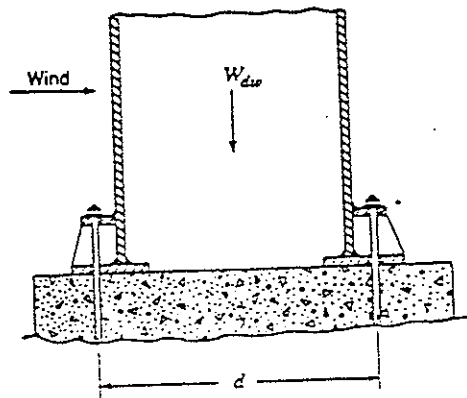
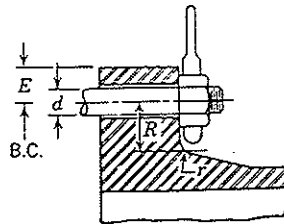
Data-Data Baut (Bolt)

(Lloyd E. Brownell, Edwin H. Young, *Process Equipment Design*, John Willey & Sons)

Table 10.4. Bolt Data (157)
(Courtesy of Taylor Forge & Pipe Works)

Standard Thread		8-thread Series		Bolt Spacing*		Minimum Radial Distance	Edge Distance	Nut Dimension (across flats)	Maximum Fillet Radius
No. of Threads	Root Area	No. of Threads	Root Area	Minimum B_s	Preferred	R	E		r
13	0.126	No. 8 thread series below 1"		$1\frac{1}{4}$ "	3"	$1\frac{3}{16}$ "	$\frac{5}{8}$ "	$\frac{7}{8}$ "	$\frac{1}{4}$ "
11	0.202			$1\frac{1}{2}$ "	3	$1\frac{5}{16}$ "	$\frac{3}{4}$ "	$1\frac{1}{16}$ "	$\frac{5}{16}$ "
10	0.302			$1\frac{3}{4}$ "	3	$1\frac{7}{8}$ "	$1\frac{3}{16}$ "	$1\frac{1}{4}$ "	$\frac{3}{8}$ "
9	0.419			$2\frac{1}{16}$ "	3	$1\frac{1}{4}$ "	$1\frac{5}{16}$ "	$1\frac{7}{16}$ "	$\frac{3}{8}$ "
8	0.551			$2\frac{1}{4}$ "	3	$1\frac{3}{8}$ "	$1\frac{1}{16}$ "	$1\frac{5}{8}$ "	$\frac{7}{16}$ "
7	0.693	8	0.728	$2\frac{1}{2}$ "	3	$1\frac{1}{2}$ "	$1\frac{1}{8}$ "	$1\frac{3}{16}$ "	$\frac{7}{16}$ "
7	0.890	8	0.929	$2\frac{3}{16}$ "	3	$1\frac{3}{4}$ "	$1\frac{1}{4}$ "	2"	$\frac{9}{16}$ "
6	1.054	8	1.155	$3\frac{1}{16}$ "		$1\frac{7}{8}$ "	$1\frac{3}{8}$ "	$2\frac{3}{16}$ "	$\frac{9}{16}$ "
6	1.294	8	1.405	$3\frac{1}{4}$ "		2"	$1\frac{1}{2}$ "	$2\frac{3}{8}$ "	$\frac{5}{8}$ "
$5\frac{1}{2}$	1.515	8	1.680	$3\frac{1}{2}$ "		$2\frac{1}{8}$ "	$1\frac{5}{8}$ "	$2\frac{9}{16}$ "	$\frac{5}{8}$ "
5	1.744	8	1.980	$3\frac{3}{4}$ "		$2\frac{1}{4}$ "	$1\frac{3}{4}$ "	$2\frac{3}{4}$ "	$\frac{5}{8}$ "
5	2.049	8	2.304	4"		$2\frac{3}{8}$ "	$1\frac{7}{8}$ "	$2\frac{5}{16}$ "	$\frac{5}{8}$ "
$4\frac{1}{2}$	2.300	8	2.652	$4\frac{1}{4}$ "		$2\frac{1}{2}$ "	2"	$3\frac{1}{8}$ "	$1\frac{1}{16}$ "
$4\frac{1}{2}$	3.020	8	3.423	$4\frac{3}{4}$ "		$2\frac{3}{4}$ "	$2\frac{1}{4}$ "	$3\frac{1}{2}$ "	$1\frac{1}{16}$ "
4	3.715	8	4.292	$5\frac{1}{4}$ "		$3\frac{1}{16}$ "	$2\frac{3}{8}$ "	$3\frac{7}{8}$ "	$1\frac{3}{16}$ "
4	4.618	8	5.259	$5\frac{3}{4}$ "		$3\frac{3}{8}$ "	$2\frac{5}{8}$ "	$4\frac{1}{4}$ "	$\frac{7}{8}$ "
4	5.621	8	6.324	$6\frac{1}{4}$ "		$3\frac{5}{8}$ "	$2\frac{7}{8}$ "	$4\frac{5}{8}$ "	$1\frac{5}{16}$ "

* B_s = center-to-center distance between bolts, inches





Berat Dari Pelat-Pelat Baja

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WEIGHT OF PLATES Pounds Per Linear Foot															
Width in.	Thickness, inches														
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{3}{4}$	2
33	21.0	28.1	35.1	42.1	49.1	56.1	63.1	70.1	77.1	84.2	91.2	98.2	105	112	119
34	21.7	28.9	36.1	43.4	50.6	57.8	65.0	72.3	79.5	86.7	93.9	101	108	116	122
35	22.3	29.8	37.2	44.6	52.1	59.5	66.9	74.4	81.8	89.3	96.1	104	112	119	126
36	23.0	30.6	38.3	45.9	53.6	61.2	68.9	76.5	84.2	91.8	99.5	107	115	123	130
37	23.6	31.5	39.3	47.2	55.0	62.9	70.8	78.6	86.5	94.4	102	110	118	126	133
38	24.2	32.3	40.4	48.5	56.5	64.6	72.7	80.8	88.8	96.9	105	113	121	129	136
39	24.9	33.2	41.4	49.7	58.0	66.3	74.6	82.9	91.2	99.5	108	116	124	133	140
40	25.5	34.0	42.5	51.0	59.5	68.0	76.5	85.0	93.5	102	111	119	128	136	145
41	26.1	34.9	43.6	52.3	61.0	69.7	78.4	87.1	95.8	105	113	122	131	139	148
42	26.8	35.7	44.6	53.6	62.5	71.4	80.3	89.3	98.2	107	116	125	134	143	152
43	27.4	36.6	45.7	54.8	64.0	73.1	82.2	91.4	101	110	119	128	137	146	155
44	28.1	37.4	46.8	56.1	65.5	74.8	84.2	93.5	103	112	122	131	140	150	159
45	28.7	38.3	47.8	57.4	66.9	76.5	86.1	95.6	105	115	124	134	143	153	162
46	29.3	39.1	48.9	58.7	68.4	78.2	88.0	97.8	108	117	127	137	147	156	166
47	30.0	40.0	49.9	59.9	69.9	79.9	89.9	99.9	110	120	130	140	150	160	170
48	30.6	40.8	51.0	61.2	71.4	81.6	91.8	102	112	122	133	143	153	163	173
49	31.2	41.7	52.1	62.5	72.9	83.3	93.7	104	115	125	135	146	156	167	177
50	31.9	42.5	53.1	63.8	74.4	85.0	95.6	106	117	128	138	149	159	170	180
51	32.5	43.4	54.2	65.0	75.9	86.7	97.5	108	119	130	141	152	163	173	184
52	33.2	44.2	55.3	66.3	77.4	88.4	99.5	111	122	133	144	155	166	177	188
53	33.8	45.1	56.3	67.6	78.8	90.1	101	113	124	135	146	158	169	180	191
54	34.4	45.9	57.4	68.9	80.3	91.8	103	115	126	138	149	161	172	184	195
55	35.1	46.8	58.4	70.1	81.8	93.5	105	117	129	140	152	164	175	187	199
56	35.7	47.6	59.5	71.4	83.3	95.2	107	119	131	143	155	167	179	190	202
57	36.3	48.5	60.6	72.7	84.8	96.9	109	121	133	145	158	170	182	194	207
58	37.0	49.3	61.6	74.0	86.3	98.6	111	123	136	148	160	173	185	197	210
59	37.6	50.2	62.7	75.2	87.8	100	113	125	138	151	163	176	188	201	214
60	38.3	51.0	63.8	76.5	89.3	102	115	128	140	153	166	179	191	204	218
61	38.9	51.9	64.8	77.8	90.7	104	117	130	143	156	169	182	194	207	221
62	39.5	52.7	65.9	79.1	92.2	106	119	132	145	158	171	185	198	211	224
63	40.2	53.6	66.9	80.3	93.7	107	121	134	147	161	174	187	201	214	228
64	40.8	54.4	68.0	81.6	95.2	109	122	136	150	163	177	190	204	218	231
65	41.4	55.3	69.1	82.9	96.7	111	124	138	152	166	180	193	207	221	235
66	42.1	56.1	70.1	84.2	98.2	112	126	140	154	168	182	196	210	224	238
67	42.7	57.0	71.2	85.4	99.7	114	128	142	157	171	185	199	214	228	242
68	43.4	57.8	72.3	86.7	101	116	130	145	159	173	188	202	217	231	245
69	44.0	58.7	73.3	88.0	103	117	132	147	161	176	191	205	220	235	249
70	44.6	59.5	74.4	89.3	105	119	134	149	164	179	193	208	223	238	253
71	45.3	60.4	75.4	90.5	106	121	136	151	166	181	196	211	226	241	256
72	45.9	61.2	76.5	91.8	107	122	138	153	168	184	199	214	230	245	261



Berat Dari Pelat-Pelat Baja

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WEIGHTS OF PLATES Pounds Per Linear Foot															
Width in.	Thickness, inches														
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{5}{8}$	2	3
73	46.5	62.1	77.6	93.1	109	124	140	155	171	186	202	217	233	248	262
74	47.2	62.9	78.6	94.4	110	126	142	157	173	189	204	220	236	252	265
75	47.8	63.8	79.7	95.6	112	128	143	159	175	191	207	223	239	255	269
76	48.5	64.6	80.8	96.9	113	129	145	162	178	194	210	226	242	258	272
77	49.1	65.3	81.8	98.2	115	131	147	164	180	196	213	229	245	262	275
78	49.7	66.3	82.9	99.5	116	133	149	166	182	199	216	232	249	265	279
79	50.4	67.2	83.9	101	118	134	151	168	185	202	218	235	252	269	282
80	51.0	68.0	85.0	102	119	136	153	170	187	204	221	238	255	272	286
81	51.6	68.9	86.1	103	121	138	155	172	189	207	224	241	258	275	289
82	52.3	69.7	87.1	105	122	139	157	174	192	209	227	244	261	279	292
83	52.9	70.6	88.2	106	124	141	159	176	194	212	229	247	265	282	296
84	53.6	71.4	89.3	107	125	143	161	179	196	214	232	250	268	286	299
85	54.2	72.3	90.3	108	126	145	163	181	199	217	235	253	271	289	303
86	54.8	73.1	91.4	110	128	146	165	183	201	219	238	256	274	292	306
87	55.5	74.0	92.4	111	129	148	166	185	203	222	240	259	277	296	310
88	56.1	74.8	93.5	112	131	150	168	187	206	224	243	262	281	299	313
89	56.7	75.7	94.6	114	132	151	170	189	208	227	246	265	284	303	317
90	57.4	76.5	95.6	115	134	153	172	191	210	230	249	268	287	306	320
91		77.4	96.7	116	135	155	174	193	213	232	251	271	290	309	323
92		78.2	97.8	117	137	156	176	196	215	235	254	274	293	313	327
93		79.1	98.8	119	138	158	178	198	217	237	257	277	296	316	330
94		79.9	99.9	120	140	160	180	200	220	240	260	280	300	320	334
95		80.8	101	121	141	162	182	202	222	242	262	283	303	323	337
96		81.6	102	122	143	163	184	204	224	245	265	286	306	326	340
98		83.3	104	125	146	167	187	208	229	250	271	292	312	333	347
100		85.0	106	128	149	170	191	213	234	255	276	298	319	340	354
102		86.7	108	130	152	173	195	217	238	260	282	304	325	347	361
104		88.4	111	133	155	177	199	221	243	265	287	309	332	354	368
106		90.1	113	135	158	180	203	225	248	270	293	315	338	360	374
108		91.8	115	138	161	184	207	230	253	275	298	321	344	367	381
110		93.5	117	140	164	187	210	234	257	281	304	327	351	374	388
112		95.2	119	143	167	190	214	238	262	286	309	333	357	381	395
114		96.9	121	145	170	194	218	242	267	291	315	339	363	388	402
116		98.6	123	148	173	197	222	247	271	296	321	345	370	394	408
118		100	125	151	176	201	226	251	276	301	326	351	376	401	415
120		102	128	153	179	204	230	255	281	306	332	357	383	408	422
122		104	130	156	182	207	233	259	285	311	337	363	389	415	429
124		105	132	158	185	211	237	264	290	316	343	369	395	422	436
126		107	134	161	187	214	241	268	295	321	348	375	402	428	442
128		109	136	163	190	218	245	272	299	326	354	381	408	435	449



Berat Dari Shell Dan Head

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DIAM. VESSEL	WALL THICKNESS									
	5/8"					11/16"				
	SHELL		HEAD			SHELL		HEAD		
	I.S.	O.S.	ELLIP	F&D.	HEMIS	I.S.	O.S.	ELLIP	F&D.	HEMIS
12	84	76	58	40	55	93	83	64	44	61
14	97	89	70	50	73	108	98	79	55	81
16	111	103	87	61	95	122	112	95	67	105
18	124	116	101	74	119	137	127	113	83	132
20	137	129	121	86	146	152	142	133	97	162
22	151	143	138	101	176	166	156	154	113	194
24	164	156	161	121	208	181	171	177	133	230
26	177	169	180	138	243	196	186	198	151	269
28	191	183	201	156	281	211	201	221	171	311
30	204	196	228	175	322	225	215	251	195	355
32	218	210	257	201	365	240	230	283	221	403
34	231	223	288	223	411	255	245	317	245	454
36	244	236	326	245	460	269	259	353	270	508
38	258	250	355	275	512	284	274	390	302	565
40	271	263	391	300	566	299	289	430	330	625
42	284	276	428	327	623	313	303	471	360	688
48	324	316	552	421	811	357	347	607	458	895
54	364	356	691	526	1024	401	391	760	579	1129
60	404	396	846	643	1261	445	435	931	707	1390
66	444	436	1017	772	1523	489	479	1118	849	1677
72	484	476	1203	912	1810	533	523	1323	1003	1994
78	524	516	1405	1065	2121	577	567	1545	1171	2337
84	564	556	1622	1229	2458	621	611	1784	1352	2707
90	604	596	1855	1405	2818	665	655	2041	1545	3104
96	644	636	2104	1592	3204	710	700	2315	1751	3529
102	685	677	2368	1791	3614	754	744	2605	1970	3980
108	725	717	2648	2003	4049	798	788	2913	2203	4459
114	765	757	2944	2225	4509	842	832	3239	2448	4965
120	805	797	3213	2460	4993	886	876	3535	2706	5498
126	848	837	3578	2706	5502	930	920	3910	2977	6058
132	885	877	3980	2965	6036	974	964	4317	3261	6646
138	925	917	4325	3234	6595	1018	1008	4703	3557	7261
144	965	957	4720	3516	7178	1062	1052	5185	3868	7902



Berat Dari Shell Dan Head

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DIAM. VESSEL	WALL THICKNESS									
	3/4"					13/16"				
	SHELL		HEAD			SHELL		HEAD		
	I.S.	O.S.	ELLIP	F.&D.	HEMIS	I.S.	O.S.	ELLIP	F.&D.	HEMIS
12	102	90	70	48	67	111	97	76	53	73
14	118	106	88	60	90	128	114	95	67	98
16	134	122	104	74	116	146	132	113	82	126
18	150	138	126	92	145	163	149	136	100	153
20	166	154	145	108	177	180	166	157	117	193
22	182	170	171	126	213	198	184	185	137	232
24	198	186	193	145	252	215	201	209	160	275
26	214	202	216	165	295	233	219	234	182	321
28	230	218	241	187	340	250	236	261	412	370
30	246	234	274	216	389	267	253	304	234	423
32	262	250	309	241	442	285	271	335	261	480
34	278	266	345	267	497	302	288	378	289	541
36	294	282	393	294	556	319	305	425	323	605
38	310	298	425	330	618	337	323	470	357	672
40	326	314	469	361	684	354	340	508	391	743
42	342	330	514	393	753	371	357	567	425	818
48	390	378	662	505	979	423	409	729	547	1063
54	438	426	829	631	1234	475	461	911	683	1340
60	486	474	1015	772	1520	527	513	1107	836	1650
66	534	522	1220	926	1835	579	565	1337	1003	1991
72	582	570	1443	1095	2179	631	617	1564	1186	2365
78	630	618	1685	1277	2554	683	669	1835	1384	2771
84	678	666	1947	1475	2958	735	721	2120	1597	3209
90	726	714	2226	1685	3391	788	774	2433	1825	3679
96	775	763	2525	1911	3855	840	826	2757	2070	4181
102	823	811	2842	2150	4348	892	878	3103	2329	4716
108	871	859	3178	2403	4870	944	930	3457	2603	5282
114	919	907	3533	2671	5422	996	982	3854	2893	5881
120	967	955	3856	2952	6004	1048	1034	4204	3198	6511
126	1015	1003	4243	3248	6616	1100	1086	4614	3518	7174
132	1063	1051	4655	3558	7257	1152	1138	5059	3854	7869
138	1111	1099	5082	3881	7928	1204	1190	5522	4205	8596
144	1159	1147	5650	4219	8628	1256	1242	6067	4571	9356



LAMPIRAN 2

(vessel standard)

APPENDIX C

JOINT EFFICIENCIES (ASME CODE) [3]

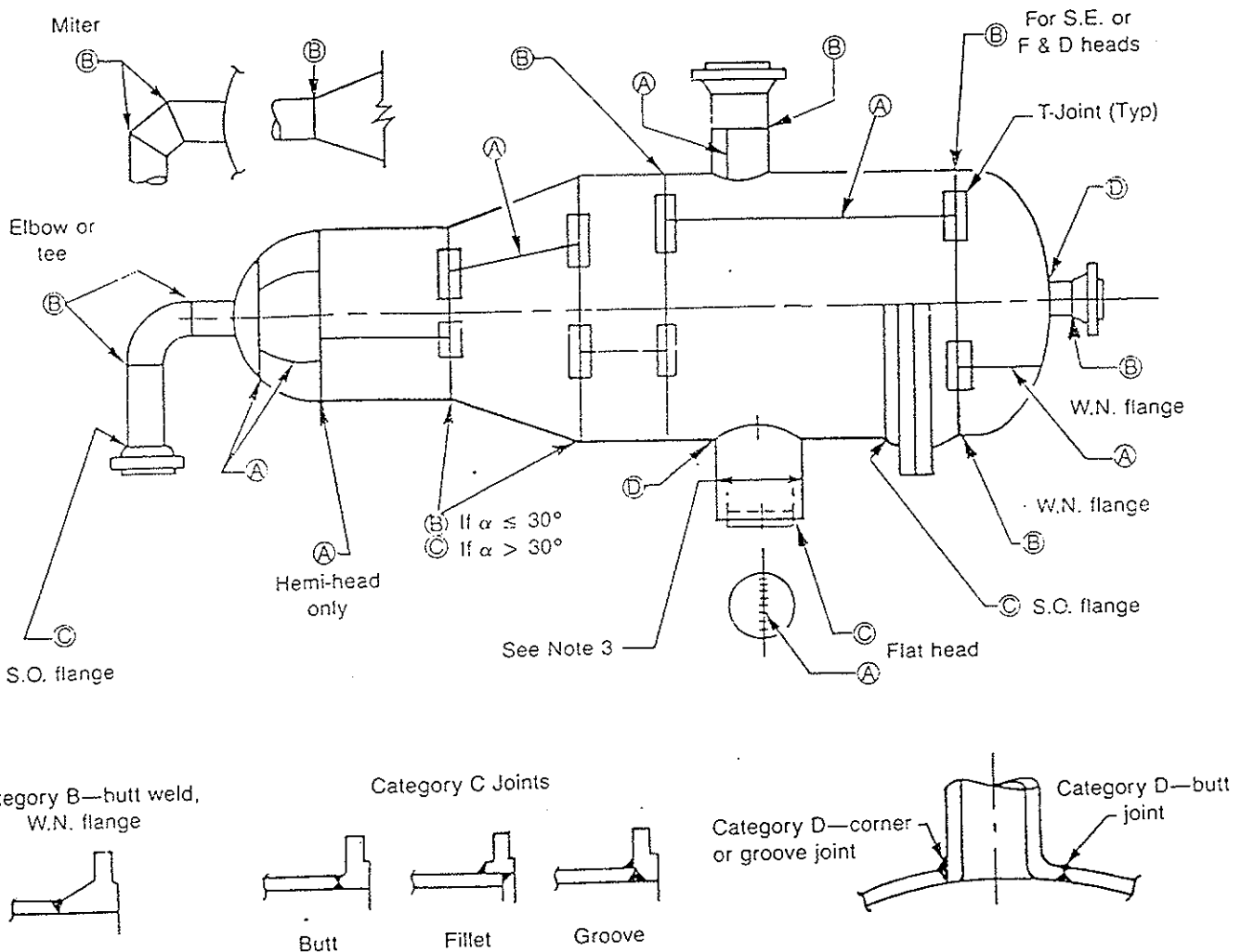


Figure C-1. Categories of welded joints in a pressure vessel.

Table C-1
Values of Joint Efficiency, E, and Allowable Stress, S

Extent of radiography	Case 1		Case 2		Case 3		Case 4	
	Seamless Head		Seamless Shell		Welded Head		Welded Shell	
	E	S	E	S	E	S	E	S
Full (RT-1)	1.0	100%	1.0	100%	1.0	100%	1.0	100%
Spot (RT-3)	1.0	85%	1.0	85%	.85	100%	.85	100%
Combination*	1.0	100%	1.0	100%	1.0	100%	1.0	100%
None	1.0	80%	1.0	80%	.7	100%	.7	100%

Table C-2
 Joint Efficiencies

Types of Joints		Full	X-Ray Spot	None
	Single and double butt joints	1.0	.85	.7
	Single butt joint with backing strip	.9	.8	.65
	Single butt joint without backing strip	~	~	.6
	Double full fillet lap joint	~	~	.55
	Single full fillet lap joint with plugs	~	~	.5
	Single full fillet lap joint	~	~	.45

Notes

Table C-1 joint efficiencies and allowable stresses
 shells are for longitudinal seams only! All joints

are assumed as Type 1 only! Where combination radiography is shown it is assumed that all requirements for full radiography have been met for head, and shell is spot R.T.

2. *Combination radiography*: Applies to vessels *not* fully radiographed where the designer wishes to apply a joint efficiency of 1.0 per ASME Code, Table UW-12, for only a specific part of a vessel. Specifically for any part to meet this requirement, you must perform the following:

- (ASME Code, Section UW-11(5)): Fully X-ray any Cat. A or D butt welds
- (ASME Code, Section UW-11(5)(b)): Spot X-ray any Category B or C butt welds attaching the part
- (ASME Code, Section UW-11(5)(a)): All butt joints must be Type 1

3. Any Category B or C butt weld in a nozzle or communicating chamber of a vessel or vessel part which is to have a joint efficiency of 1.0 and exceeds either 10 in. nominal pipe size or 1 1/8 in. in wall thickness shall be fully radiographed. See ASME Code, Sections UW-11(a)(4).

APPENDIX D

PROPERTIES OF HEADS

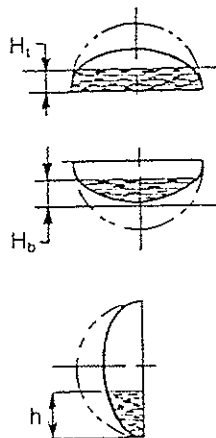
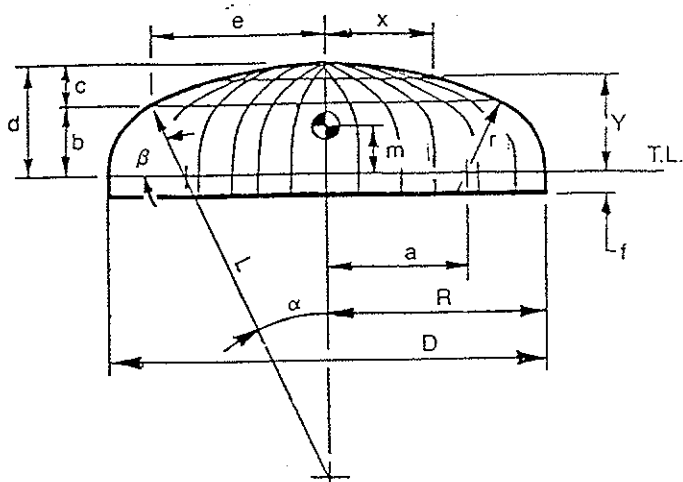


Figure D-1. Dimensions of heads.

DESCRIPTION OF MATERIALS

When describing various vessel components and parts on drawings and in bill of materials, it is advisable that a standard method be followed. For this purpose it is recommended the use of the widely accepted abbreviations in the sequences exemplified below. For ordering material the requirements of manufacturers should be observed.

	PART	DESCRIPTION	MATERIAL SPECIFICATION
	BAR	Bar 2 x 1/4 x 3'-6 Bar 3/4 ϕ x 2'-0 Bar 1 ϕ x 3'-0	SA-7
	BOLT	3/4 ϕ x 2-1/2 H. Hd. M. B. w/ (1) sq. nut 1 ϕ x 5-1/2 stud w/ (2) h. nuts	SA-193 B7 bolt SA-194 2H nut
	CAP	8" Std. Cap	
	Screwed COUPLING	1" - 6000 # Cplg. 2" - 3000 # Cplg. 1" - 6000 # Half Cplg. 1" - 6000 # 4-1/2 Lg. Cplg.	SA-105
	Welding ELBOW	6" - Std. 90° L. R. Ell. 4" - X Stg. 45° S. R. Ell. 6" x 4" Std. L. R. Red. Eli	SA-234 WPB
	FLANGE	4" - 300 # RF. So. Flg. 6" - 150 # RF. Wn. Flg. Std. Bore 6" - 600 # RTJ. Wn. Flg. X Stg. Bore 3" - 150 # FF. So. Flg. 8" - 150 # R.F. Bld. Flg.	SA-181 1
  	Screwed Socket Welding FORGED FITTING	1" - 6000 # 90° Scr'd. Ell. 1" - 3000 # 90° Scr'd. Street Ell. 2" - 3000 # S.W. Cplg. 1" - 3000 # Sq. Hd. Plug 2" - 6000 # Scr'd. Tee 2" - 3000 # 45° S. W. Ell.	SA-105
	GASKET	18 - 150 # 1/16" Serv. Sht. Gasket 18 - 300 # Spiral Wound ASB. Filled	ASB.
	HEAD	48" ID x 0.375 min. 2:1 ellip. head 2" S.F. 48" OD x 0.500" min. ASME F & D Head 2 S.F. L = 48" r = 3" 54" ID x 0.375" min. Hemis. Head	SA-285 C SA-515-70 SA-516-70



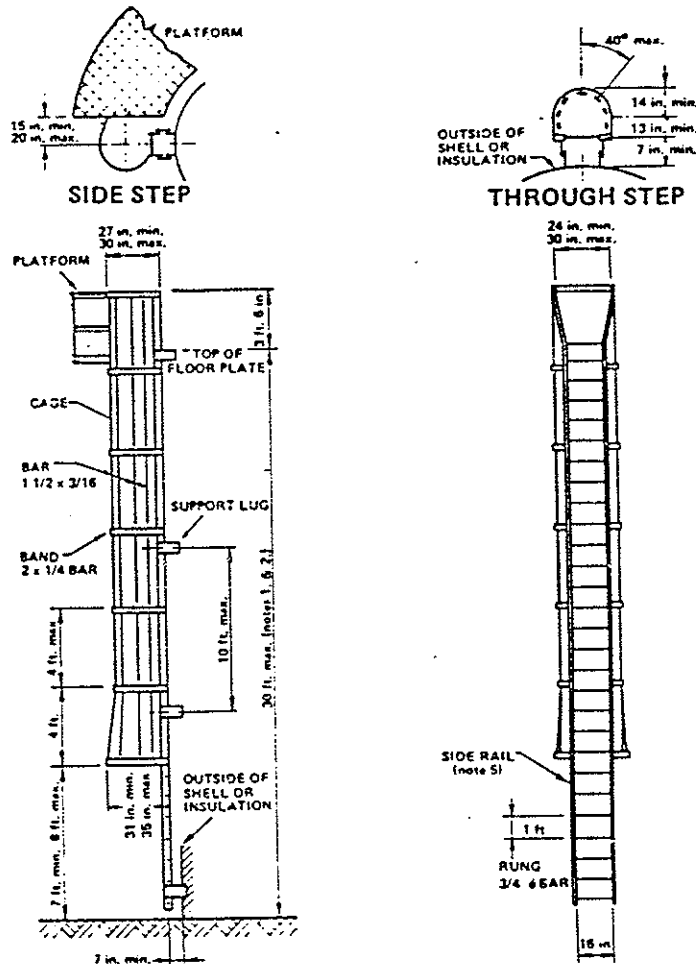
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I Made Sastrayanta, Ir. Subarmono, MT

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LADDER

Conforms to the requirements of
STANDARD ANSI A14.3-1974 SAFETY REQUIREMENTS FOR FIXED LADDERS.



NOTES

1. Cage is not required where the length of climb is 20 feet or less above ground level.
2. Horizontally offset landing platform shall be provided at least every 30 ft. of climbing length. Where safety devices are used, rest platforms shall be provided at maximum intervals of 250 feet.
3. All material: steel conforming to ASTM A 36
4. Instead of the above specified structural shapes any other structural steel of equivalent strength may be used. To avoid damages during shipping or galvanizing, structural angles are widely used for side rail and vertical members of the cage.
5. The recommended minimum size of side rails under normal atmospheric condition 2 1/2 x 3/8 in. flat bar, although 2 x 1/4 bars are frequently used in practice.
6. All burrs and sharp edges shall be removed.
7. Protective Coating: one shop coat primer and one field coat of paint or hot dip galvanizing.



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Perancangan Bejana Urea Hydrolyzer Di PT Pupuk Iskandar Muda
I Made Sastrayanta, Ir. Subarmono, MT.

Universitas Gadjah Mada, 2002 | Diunduh dari <http://etd.repository.ugm.ac.id/>

NAME PLATE

Pressure vessels built in accordance with the requirements of the Code may be stamped with the official symbol "U" to denote The American Society of Mechanical Engineers' standard.

Pressure vessels stamped with the Code-symbol shall be marked with the following:

1. manufacturer's name; preceded by the words "certified by"
maximum allowable working pressure (MAWP), psi at the design temperature, F ;
manufacturer's serial number;
year built
2. the appropriate abbreviations indicating the type of construction, service, etc.
as tabulated:

When inspected by a user's inspector	USER
Arc or gas welded	W
Seamless	S
Lethal service	L
Unfired steam boiler	UB
Direct firing	DF
Fully radiographed	RT 1
With the exception of partially radiographed girth seams, flange joints, fully radiographed. [See Code UG-116 (f)(2)]	RT 2
Spot radiographed	RT 3
When RT1, RT2 or RT3 are not applicable	RT 4
Post weld heat treated	HT
Part of the vessel post weld heat treated	PHT
Impact tested	IT
Pressure vessels for human occupancy	PVHO

1. Symbol "UM" shall be used when the vessel is exempted from inspection [Code U-1 (k)]
2. Add "minimum allowable temperature" and initials IT when the vessel designed to operate at temperatures below -20°F and impact test is required.
When no impact test is performed, the vessel shall be marked for the maximum allowable working pressure for coincident temperatures of -20°F and above and in addition for the operating pressure at the lowest coincident temperature below -20°F. Such markings to be followed by lettering UCS-66 or UHA-51.



USER
W-L RT 1
HT

CERTIFIED BY

OMEGA TANK CO.

SERIAL NO: 35365

MAWP: 250 psi at 300 F

BUILT: 1981

NAME PLATE

EXAMPLE

(The vessel was inspected by user's inspector, arc welded, used in lethal service, fully radiographed and post weld heat treated.)

Additional data shall be below the Code required marking.

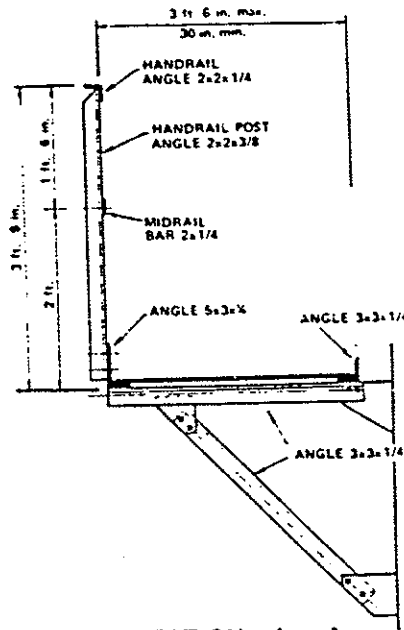
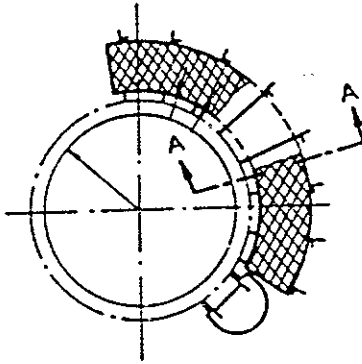
The name plate shall be affixed directly to the shell. If additional name plate is used on skirts, supports, etc., it shall be marked: "Duplicate".

Lettering size shall be not less than 5/32 in. high. The Code-symbol and serial number shall be stamped, the other data may be stamped, etched, cast or impressed.

Commonly used material for name plate 0.32 in. stainless steel or 1/8 in. carbon steel. The name plate shall be seal welded to uninsulated vessel or mounted on bracket if the vessel is insulated, and located in some conspicuous place; near manways, liquid level control, level gage, about 5 ft above ground etc.

PLATFORM

Conforms to the requirements of
OCCUPATIONAL SAFETY AND HEALTH (OSHA) STANDARDS



Platforms shall be fabricated in sections if necessary suitable for shipping and field erection.

Platforms fabricated in sections shall be shop fitted, marked and knocked down for shipping.

All field connections are to be bolted. Manufacturer shall furnish 10% extra bolts of each sizes for spare.

All burrs and sharp edges shall be removed.

Paint: one shop coat primer, except walking surfaces.

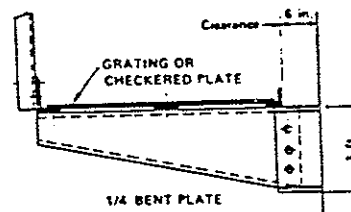
Max. spacing of supports 6 ft.

Max. spacing of handrail posts 6 ft.

Drill one 9/16 ϕ drain hole in checkered plate for each 10 sq. ft. area of floor.

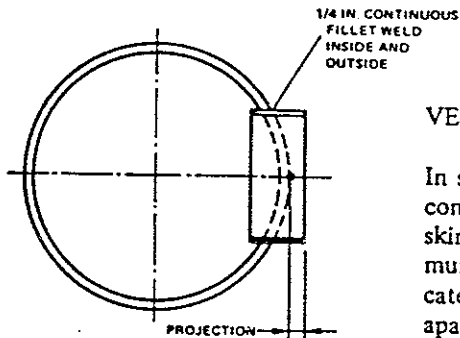
Bolts 1/2 ϕ

Bolt holes 9/16 ϕ



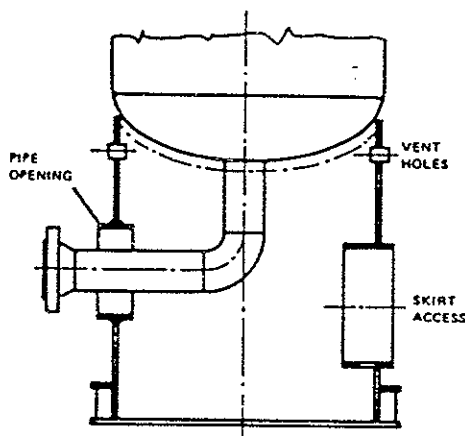
ALTERNATIVE SUPPORTS

SKIRT OPENINGS



VENT HOLES

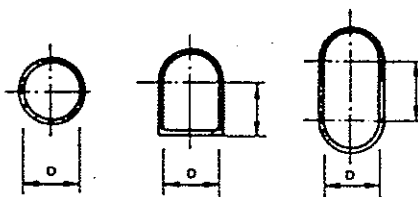
In service of hydrocarbons or other combustible liquids or gases the skirts shall be provided with minimum of two 2 inch vent holes located as high as possible 180 degrees apart. The vent holes shall clear head insulation. For sleeve may be used coupling or pipe.



ACCESS OPENINGS

The shape of access openings may be circular or any other shapes. Circular access openings are used most frequently with pipe or bent plate sleeves. The projection of sleeve equals to the thickness of fireproofing or minimum 2 inches. The projection of sleeves shall be increased when necessary for reinforcing the skirt under certain loading conditions.

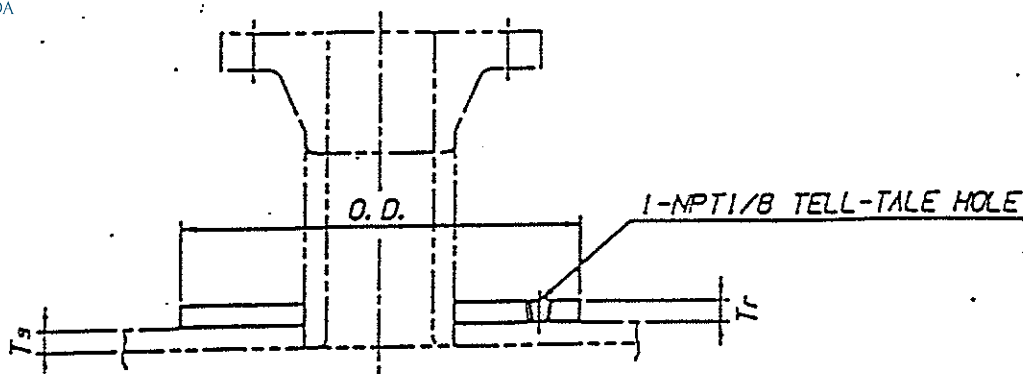
Diameter (D) = 16 - 24 inches



TYPES OF SKIRT ACCESSES

PIPE OPENINGS

The shape of pipe openings are circular with a diameter of 1 inch larger than the diameter of flange. Sleeves should be provided as for access openings.

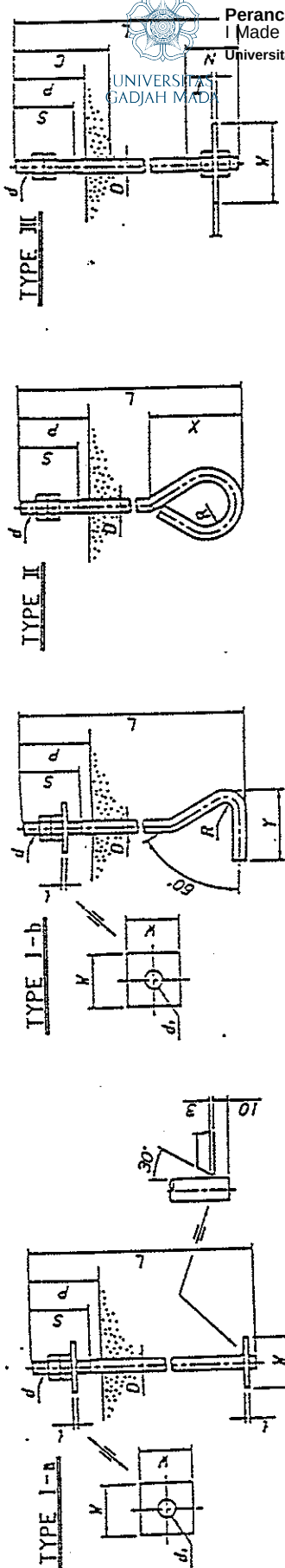


NOZZLE SIZE		REINFORCING PAD OUTSIDE DIA. (mm)
DN	NPS	
50	2	150
65	2 1/2	160
80	3	180
100	4	210
150	6	300
200	8	400
250	10	510
300	12	610
350	14	680
400	16	780
450	18	870
500	20	970
600	24	1150



REMARKS:

1. ALL DIMENSIONS ARE IN.MM.
2. 'Ts' MEANS THICKNESS OF SHELL OR HEAD PLATE.
3. UNLESS OTHERWISE SPECIFIED ON ENG'G Dwg. THICKNESS 'Tr' OF REINFORCING PAD SHALL BE THE SAME AS SHELL THICKNESS 'Ts'.
4. IN CASE OF NOZZLE SIZE EXCEEDS 600, THICKNESS 'Tr' AND 'O.D' OF REINFORCING PAD SHALL BE DESIGNED PER EACH NOZZLE BY VENDOR.
5. IN CASE OF RAINFORCING PAD SHALL BE INTERFERED WITH OTHER WELDING SEAMS OR EXTERNAL PARTS, ETC., REINFORCING PAD SHALL BE THICKENED, AND MAY BE DECREASED O.D.



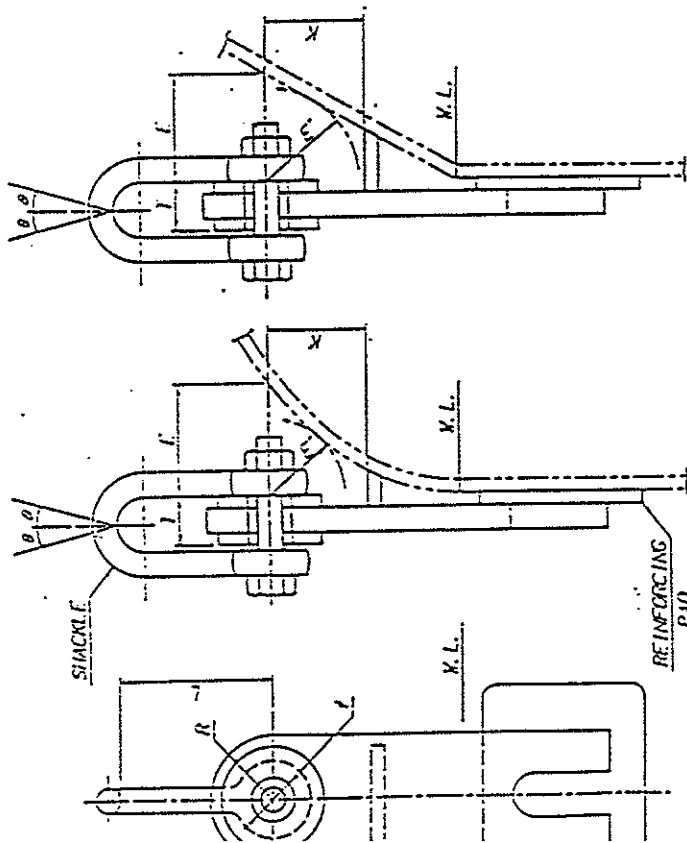
BOLT SIZE d	BOLT DATA			TYPE I-a						TYPE I-b						TYPE II						TYPE III						BOLT SIZE d	
	D	ROOT AREA (cm ²)	H.A.L. (kg)	L	S	P	d ₁	Y	t	L	S	P	Y	R	d ₁	Y	t	L	S	P	R	X	L	S	P	C	N		Y
H 16	16	1.50	2250	300	55	65	18	60	9	465	55	65	90	20	18	60	9												
H 20	20	2.35	3520	300	65	75	22	60	12	500	65	75	90	20	22	60	12												
H 24	24	3.38	5070	300	80	90	26	70	16	700	80	90	100	25	26	70	16	910	80	310	50	200							
H 30	30	5.40	8100	300	80	100	33	70	16	870	80	100	125	30	33	70	16	1080	110	330	60	200							
H 36	36	7.00	11000	350	100	120	39	80	19	1030	100	120	160	35	39	80	19	1290	130	390	70	240							
H 42	42	10.03	16200	400	110	130	45	90	19	1200	110	130	180	40	45	90	19	1450	150	400	90	320							
H 48	48	14.24	21300	450	120	140	52	110	19									1620	160	420	100	360							
H 56	56	19.67	29500	500	140	160	60	130	22									1880	180	480	120	400							
H 64	64	25.97	38900	600	150	175	68	150	22									2100	210	500	140	410							
H 72	75	33.70	50500																										
H 80	80	42.43	63600																										
H 90	90	54.77	82100																										
H100	100	68.67	103000																										

TABLE-1

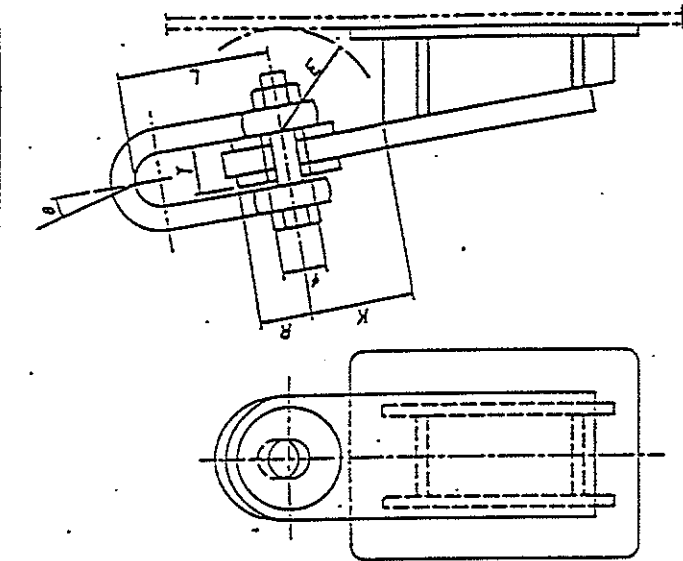
BOLT SIZE	SCREW THREAD STANDARD		DIMENSION OF NUT
	THREAD	TOLERANCE	
H16-H64	JIS B0205 (COARSE)	JIS B0209 (MEDIUM)	JIS B1101 (MEDIUM)
	ISO 261 (COARSE)	ISO 965/1 (MEDIUM)	TYPE 1 & 2
	JIS B0207 (PITCH 6)	JIS B0211 (MEDIUM)	ISO 272 (MEDIUM)
H72-H100	ISO 261 (PITCH 6)	ISO 965/1 (MEDIUM)	ISO 272 (MEDIUM)

REMARKS:

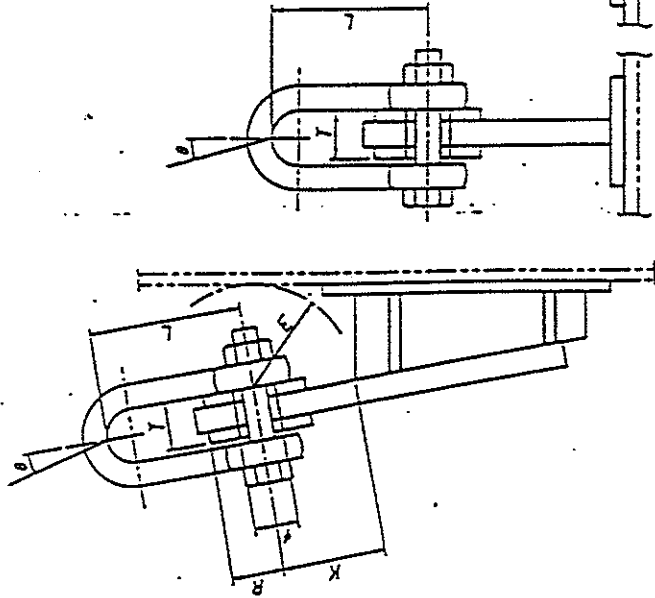
1. ALL DIMENSIONS ARE IN MM.
2. FOR BOLT TYPE AND MATERIAL, SEE ENG'G DWG.
3. FOR TYPE II AND TYPE III TEMPLATE SHALL BE REQUIRED.
4. H.A.L. (MAXIMUM ALLOWABLE LOAD) IN ABOVE TABLE IS DETERMINED BASED ON ALLOWABLE TENSILE STRESS OF 1500 KG/CM² FOR JIS B1178 MECHANICAL PROPERTY CLASS 4.6 BOLT, ASTM A307B OR EQUIVALENT.
5. 20-DAYS ULTIMATE COMPRESSIVE STRENGTH F_c OF CONCRETE SHALL BE 100 KG/CM² AND OVER.
6. IN CASE WOODEN PILLOW IS USED, DIMENSIONS, 'P' AND 'L' SHALL BE ADDED 150 MM TO PREVENT SHORTNESS OF BURIED LENGTH OF FOUNDATION BOLTS.
7. THREAD STANDARD SHALL BE AS SHOWN IN TABLE-1.
8. FOR TYPE I-b, TEMPLATE SHALL BE REQ'D. WHEN TENSION LOAD DUE TO OVER TURNING MOMENT IS WORKING INTO THE FOUNDATION BOLT.



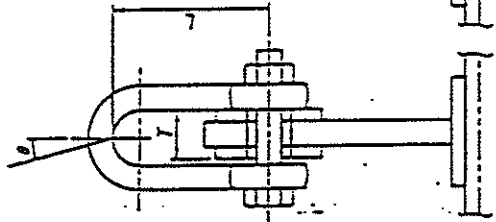
TYPE A



TYPE B



TYPE C



TYPE D

I (mm)	APPLICABLE SHACKLE ST'D				LIFTING LUG DIMENSION					
	ST'D NAME	NOMINAL SIZE	BOLT DIA.	L	Y2 (TOH)	T max.	R max.	t min.	E min.	K min.
3	JIS	SC16	H 10	64	1.5	19	30	24	60	55
4	JIS	SD20	H 24	80	2.5	23	40	30	70	60
5	JIS	SD30	H 36	120	5.4	33	60	45	90	80
5	JIS	SD40	H 48	160	10	45	80	60	115	100
6	JIS	SD50	H 56	200	15	55	100	75	135	115
6	JIS	SD60	H 64	240	22	65	120	85	150	130
6	JIS	SD70	H 80	280	30	75	140	100	170	150
7	JIS	SD80	H 90	320	40	90	160	110	190	165
7	JIS	SD90	H100	360	50	100	175	120	205	185
7	JIS	SD90	H100	360	50	100	175	120	205	185

Y1 : ALLOWABLE ERECTION WEIGHT

Y2 : ALLOWABLE LOAD OF 1-SHACKLE

REMARKS:

1. ALL DIMENSIONS ARE IN MM.

2. FOR ALLOWABLE ERECTION WEIGHT, FOLLOWING CONDITIONS SHALL BE CONSIDERED:

LIFTING HALF ANGLE ... $\theta = 15^\circ$

LIFTED BY ... 2-SHACKLES

IMPACT LOAD FACTOR ... 1.25

(ALLOWABLE ERECTION WEIGHT) $\leq$ (ALLOWABLE LOAD OF 1-SHACKLE) $\times \cos 1^\circ \times 2/1$ (Y2)

3. NO ALLOWANCE FOR INSULATION THICKNESS IS INCLUDED IN DIMENSION 'E', 'E'' AND 'K'.

4. LIFTING LUG SHALL BE DESIGNED IN ACCORDANCE WITH THE STANDARD SHACKLE OF CONSTRUCTED COUNTRY. APPLIED SHACKLE STANDARD IN THIS VESSEL : ANDAI-15 JIS B 2801, 1977.

5. TYPE OF LIFTING LUG, SEE ENG'G DWG.

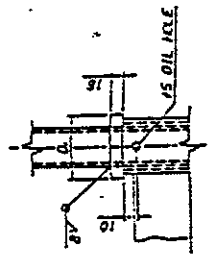
REMARKS:

1. ALL DIMENSIONS ARE IN IN.

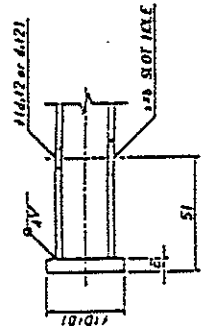
2. MATERIALS SHALL BE AS FOLLOWS:

DAVIT PIPE	... JIS STPC 30
SLEEVE PIPE	... JIS SGP
OTHERS	... JIS SS41
LUG	... SEE ENG'G DWG

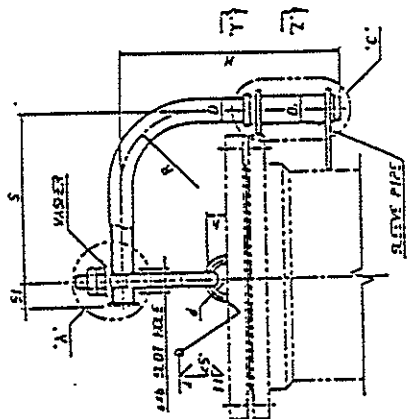
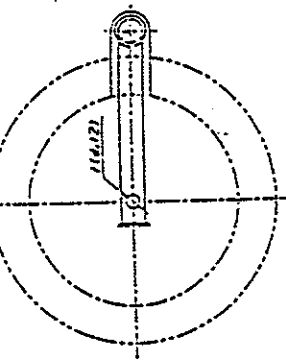
[illegible]



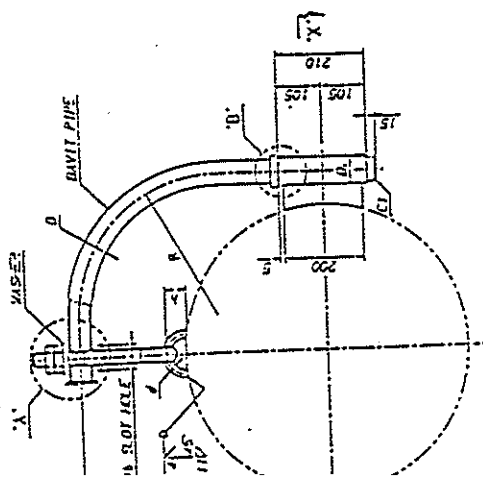
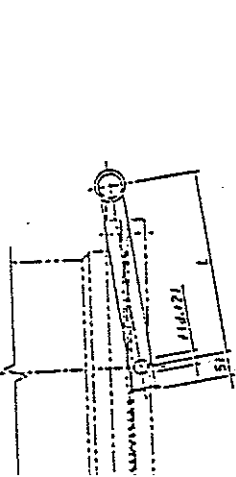
DETAIL 'D'



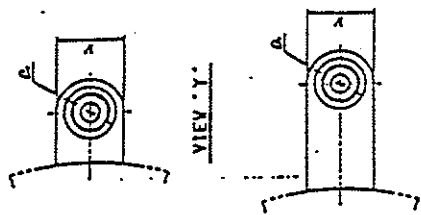
DETAIL 'A'



VERTICAL DAVIT



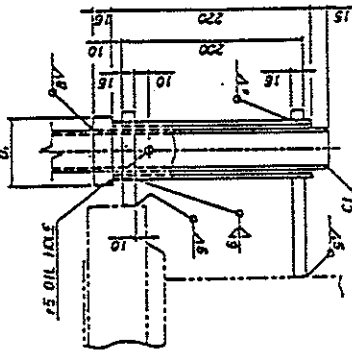
HORIZONTAL DAVIT



VIEW 'Y'

VIEW 'Z'

DETAIL 'C'



SIZE	SIZE		S	L		R		H		D		D ₁		D ₂	d	h	f	a x b	y	A	d ₁	f		WASHER O.D. x I.D. x THK				
	DN	NPS		PERI.	VERT.	PERI.	VERT.	SIZE	NPS	Sch.	DN	NPS	SIZE									NPS	PERI.		VERT.			
16	450	16	300	302	320	220	540	535	40	1-1/2	Sch. 40	50	2	Sch. 40	70	19	35	6	4	22 x 50	25	80	H20	20	260	280	37 x 22 x 3.2	2
	500	20	415	418	350	220	570	545	40	1-1/2	Sch. 80	50	2	Sch. 40	70	19	35	6	4	22 x 50	25	80	H20	20	260	290	37 x 22 x 3.2	
	600	24	480	483	410	250	660	580	50	2	Sch. 80	65	2-1/2	Sch. 40	85	19	45	6	4	28 x 60	32	85	H24	25	300	320	44 x 26 x 4.5	
	450	16	420	425	260	250	620	630	50	2	Sch. 80	65	2-1/2	Sch. 40	85	19	45	6	4	20 x 60	32	85	H24	25	310	350	44 x 26 x 4.5	
20	500	20	460	465	400	250	650	635	50	2	Sch. 80	65	2-1/2	Sch. 40	85	19	45	6	4	20 x 60	32	85	H24	25	310	350	44 x 26 x 4.5	2
	600	24	530	535	470	250	720	680	65	2-1/2	Sch. 40	80	3	Sch. 40	100	19	45	6	8	20 x 60	32	110	H24	25	370	390	44 x 26 x 4.5	
	450	16	445	456	410	250	660	710	50	2	Sch. 80	65	2-1/2	Sch. 40	85	22	50	6	6	20 x 60	32	85	H24	25	330	400	44 x 26 x 4.5	
	500	20	490	500	450	200	690	815	60	3	Sch. 80	100	4	Sch. 40	120	22	50	9	8	20 x 60	32	125	H24	25	340	480	44 x 26 x 4.5	
24	600	24	555	560	500	200	750	875	80	3	Sch. 80	100	4	Sch. 40	120	25	70	9	8	20 x 60	32	135	H24	25	320	500	44 x 26 x 4.5	2

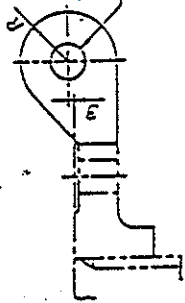
REMARKS:

1. ALL DIMENSIONS ARE IN MM.
2. MATERIALS SHALL BE AS FOLLOWS:
DAVIT PIPE ... JIS STPG 30 . ASTH A53 OR JIVALEN
SLEEVE PIPE ... JIS STPG 30 . ASTH A53 OR JIVALEN
OTHERS ... JIS SS41 . ASTH A36 OR JIVALEN
LUG ... SEE ENG'G DWG.

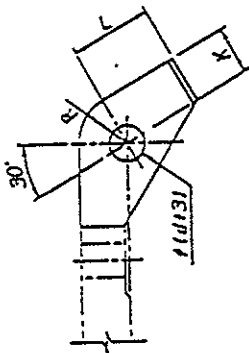


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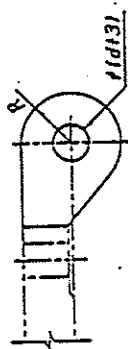
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MANHOLE HINGE

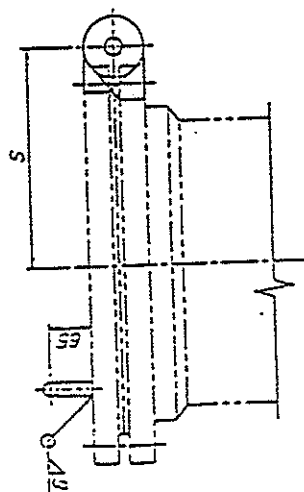
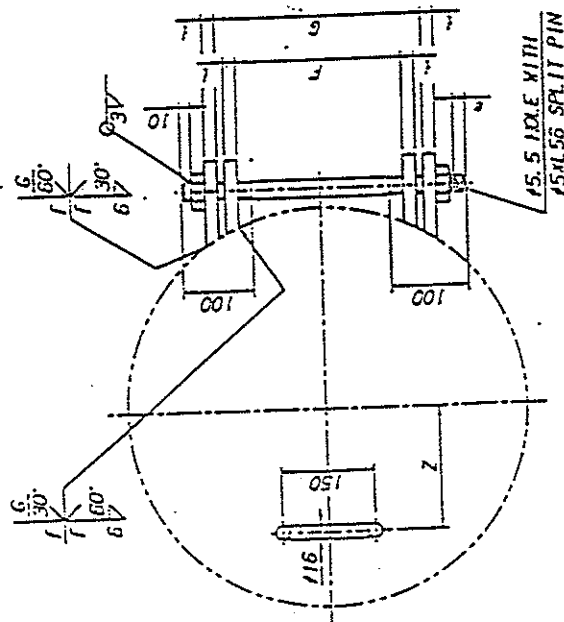


COVER HINGE
(FOR TOP PART)



COVER HINGE
(FOR SIDE & BOT. PART)

CLASS	SIZE		S	F	G	t	d	R	K	L	e	f	HINGS		Buk	Z
	DN	NPS											SIZE	ID		
5K	450	18	335	268	303	16	25	24	26	72	8	11	H22	4	17	
	500	20	360	293	320	16	25	24	26	76	8	11	H22	4	19	
	600	24	420	338	305	22	27	26	20	86	10	10	H24	5	23	
10K	450	18	345	263	310	22	27	30	32	76	10	10	H24	4	20	
	500	20	370	291	338	22	27	30	32	77	10	10	H24	4	22	
	600	24	430	351	398	22	27	30	34	85	10	10	H24	5	27	
16K	450	18	370	291	338	22	27	40	42	77	10	10	H24	4	20	
	500	20	400	318	365	22	27	40	44	83	10	10	H24	4	22	
	600	24	455	376	423	22	27	40	48	88	10	10	H24	5	27	
20K	450	18	370	291	338	22	27	40	50	77	10	10	H24	4	20	
	500	20	400	318	365	22	27	40	52	83	10	10	H24	4	22	
	600	24	460	370	423	25	33	50	56	93	10	11.5	H30	5	27	



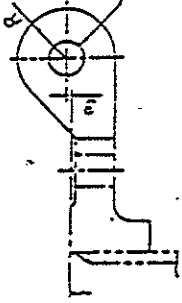
REMARKS:

1. ALL DIMENSIONS ARE IN MM.
2. MATERIALS SHALL BE AS FOLLOWS:
 - HINGES ... SEE ENG'G DWG.
 - BOLT & NUTS ... JIS SS41 , ASTH A36 OR EQUIVALENT
 - PIN ... JIS SS41 , ASTH A36 OR EQUIVALENT

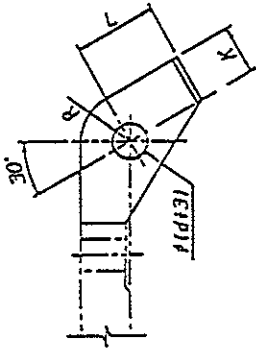


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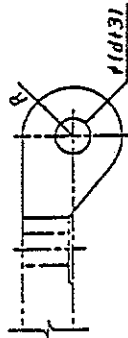
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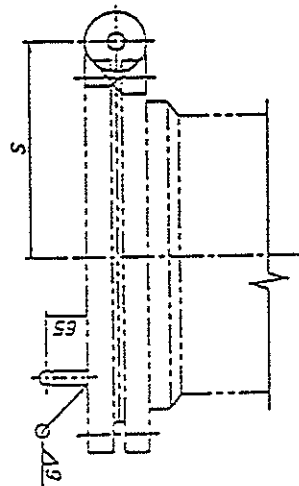
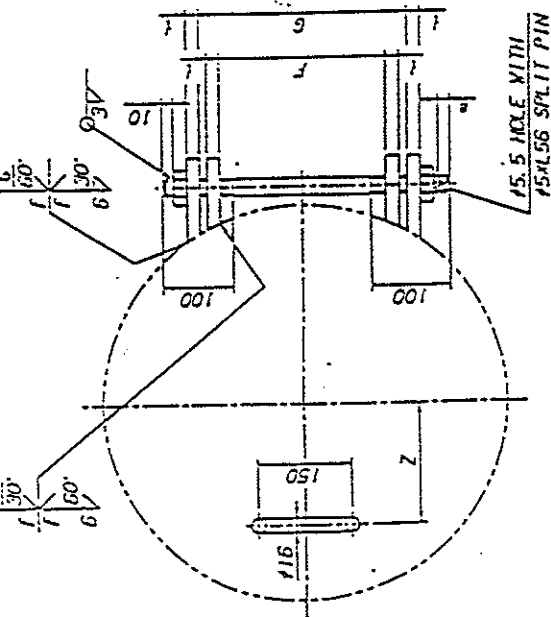
MANHOLE HINGE



COVER HINGE
(FOR TOP PART)



COVER HINGE
(FOR SIDE & BOTT. PART)



REMARKS:

1. ALL DIMENSIONS ARE IN MM.
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 BOLT & NUTS ... JIS SS41, ASTM A36 OR EQUIVALENT
 PIN ... JIS SS41, ASTM A36 OR EQUIVALENT

CLASS	SIZE		S	F	G	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
	DN	NPS																					
1501	450	18	350	265	312	22	27	40	41	74	10	10	M24	43	200								
	500	20	380	300	347	22	27	40	45	76	10	10	M24	46	220								
	600	24	440	355	402	22	27	40	50	86	10	10	M24	52	270								
3001	450	18	390	300	347	22	27	40	62	80	10	10	M24	46	200								
	500	20	420	340	387	22	27	40	65	84	10	10	M24	50	220								
	600	24	495	410	463	25	33	50	72	100	10	11.5	H30	60	270								



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TABLE-1 BASE DETAIL

BOLT SIZE	A	B*	C*	D*	E	F	G	H	I	J	K	L	M	N*	P	R	MIN. BOLT PITCH	BOLT SIZE
M16 x 2	-	-	22	-	-	-	-	-	-	-	19	-	-	50	-	-	-	M16
M20 x 2.5	-	-	22	-	-	-	-	-	-	-	24	-	-	50	-	-	-	M20
M24 x 3	250	16	22	125	100	70	12	80	140	40	25	110	55	70	25	160	-	M24
M30 x 3.5	250	16	25	130	110	75	14	80	150	50	53	120	60	75	30	170	-	M30
M36 x 4	300	19	25	135	120	80	14	80	180	60	59	120	65	85	30	180	-	M36
M42 x 4.5	300	22	28	145	140	100	16	105	180	70	65	140	75	100	35	190	-	M42
M48 x 5	300	25	32	160	150	110	18	115	180	80	72	150	80	110	40	200	-	M48
M54 x 5.5	350	28	32	170	160	115	19	130	210	90	82	170	85	115	45	210	-	M54
M64 x 6	400	36	40	180	150	140	22	145	240	100	78	180	95	140	50	220	-	M64
M80 x 6	450	40	45	220	200	145	25	170	270	120	88	220	105	145	60	260	-	M80
M90 x 6	450	45	50	240	220	165	25	180	280	130	98	230	115	165	65	300	-	M90
M100 x 6	450	50	50	260	240	165	25	190	290	140	107	240	125	160	70	340	-	M100

TABLE-2 SLEEVE OPENING

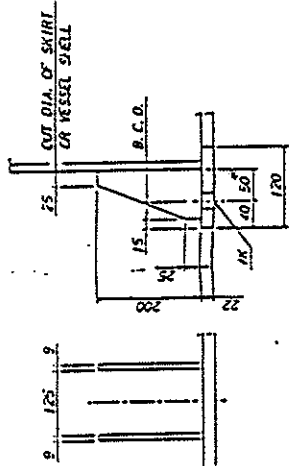
PIPE SIZE 1/4	V	PIPE SIZE 1/4	V
DN	NPS	DN	NPS
20	3/4	100	4
25	1	150	6
40	1 1/2	150	6
50	2	200	8
65	2 1/2	200	8
80	3	250	10
100	4	250	10
150	6	300	12
200	8	350	14
250	10	450	16

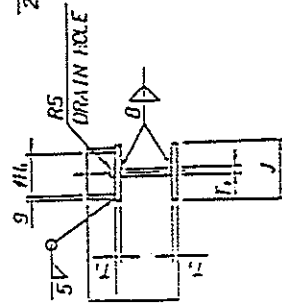
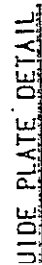
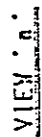
TABLE-3 ACCESS OPENING AND VENT

VESSEL INSIDE DIA.	REQ'D VENT NO.	ACC'D NO. REQ'D DIA.
~ 1500	2	2
1501 ~ 3000	4	2
3001 ~ 4500	4	4
4501 ~ 6000	4	4
6001 ~ 7500	6	4
7501 ~ 9000	6	4
9001 ~ 10500	6	4
10501 ~ 12000	6	4
12001 ~ 13500	6	4
13501 ~ 15000	6	4
15001 ~ 16500	6	4
16501 ~ 18000	6	4
18001 ~ 19500	6	4
19501 ~ 21000	6	4
21001 ~ 22500	6	4
22501 ~ 24000	6	4
24001 ~ 25500	6	4
25501 ~ 27000	6	4
27001 ~ 28500	6	4
28501 ~ 30000	6	4
30001 ~ 31500	6	4
31501 ~ 33000	6	4
33001 ~ 34500	6	4
34501 ~ 36000	6	4
36001 ~ 37500	6	4
37501 ~ 39000	6	4
39001 ~ 40500	6	4
40501 ~ 42000	6	4
42001 ~ 43500	6	4
43501 ~ 45000	6	4
45001 ~ 46500	6	4
46501 ~ 48000	6	4
48001 ~ 49500	6	4
49501 ~ 51000	6	4
51001 ~ 52500	6	4
52501 ~ 54000	6	4
54001 ~ 55500	6	4
55501 ~ 57000	6	4
57001 ~ 58500	6	4
58501 ~ 60000	6	4
60001 ~ 61500	6	4
61501 ~ 63000	6	4
63001 ~ 64500	6	4
64501 ~ 66000	6	4
66001 ~ 67500	6	4
67501 ~ 69000	6	4
69001 ~ 70500	6	4
70501 ~ 72000	6	4
72001 ~ 73500	6	4
73501 ~ 75000	6	4
75001 ~ 76500	6	4
76501 ~ 78000	6	4
78001 ~ 79500	6	4
79501 ~ 81000	6	4
81001 ~ 82500	6	4
82501 ~ 84000	6	4
84001 ~ 85500	6	4
85501 ~ 87000	6	4
87001 ~ 88500	6	4
88501 ~ 90000	6	4
90001 ~ 91500	6	4
91501 ~ 93000	6	4
93001 ~ 94500	6	4
94501 ~ 96000	6	4
96001 ~ 97500	6	4
97501 ~ 99000	6	4
99001 ~ 100500	6	4
100501 ~ 102000	6	4
102001 ~ 103500	6	4
103501 ~ 105000	6	4
105001 ~ 106500	6	4
106501 ~ 108000	6	4
108001 ~ 109500	6	4
109501 ~ 111000	6	4
111001 ~ 112500	6	4
112501 ~ 114000	6	4
114001 ~ 115500	6	4
115501 ~ 117000	6	4
117001 ~ 118500	6	4
118501 ~ 120000	6	4
120001 ~ 121500	6	4
121501 ~ 123000	6	4
123001 ~ 124500	6	4
124501 ~ 126000	6	4
126001 ~ 127500	6	4
127501 ~ 129000	6	4
129001 ~ 130500	6	4
130501 ~ 132000	6	4
132001 ~ 133500	6	4
133501 ~ 135000	6	4
135001 ~ 136500	6	4
136501 ~ 138000	6	4
138001 ~ 139500	6	4
139501 ~ 141000	6	4
141001 ~ 142500	6	4
142501 ~ 144000	6	4
144001 ~ 145500	6	4
145501 ~ 147000	6	4
147001 ~ 148500	6	4
148501 ~ 150000	6	4
150001 ~ 151500	6	4
151501 ~ 153000	6	4
153001 ~ 154500	6	4
154501 ~ 156000	6	4
156001 ~ 157500	6	4
157501 ~ 159000	6	4
159001 ~ 160500	6	4
160501 ~ 162000	6	4
162001 ~ 163500	6	4
163501 ~ 165000	6	4
165001 ~ 166500	6	4
166501 ~ 168000	6	4
168001 ~ 169500	6	4
169501 ~ 171000	6	4
171001 ~ 172500	6	4
172501 ~ 174000	6	4
174001 ~ 175500	6	4
175501 ~ 177000	6	4
177001 ~ 178500	6	4
178501 ~ 180000	6	4
180001 ~ 181500	6	4
181501 ~ 183000	6	4
183001 ~ 184500	6	4
184501 ~ 186000	6	4
186001 ~ 187500	6	4
187501 ~ 189000	6	4
189001 ~ 190500	6	4
190501 ~ 192000	6	4
192001 ~ 193500	6	4
193501 ~ 195000	6	4
195001 ~ 196500	6	4
196501 ~ 198000	6	4
198001 ~ 199500	6	4
199501 ~ 201000	6	4
201001 ~ 202500	6	4
202501 ~ 204000	6	4
204001 ~ 205500	6	4
205501 ~ 207000	6	4
207001 ~ 208500	6	4
208501 ~ 210000	6	4
210001 ~ 211500	6	4
211501 ~ 213000	6	4
213001 ~ 214500	6	4
214501 ~ 216000	6	4
216001 ~ 217500	6	4
217501 ~ 219000	6	4
219001 ~ 220500	6	4
220501 ~ 222000	6	4
222001 ~ 223500	6	4
223501 ~ 225000	6	4
225001 ~ 226500	6	4
226501 ~ 228000	6	4
228001 ~ 229500	6	4
229501 ~ 231000	6	4
231001 ~ 232500	6	4
232501 ~ 234000	6	4
234001 ~ 235500	6	4
235501 ~ 237000	6	4
237001 ~ 238500	6	4
238501 ~ 240000	6	4
240001 ~ 241500	6	4
241501 ~ 243000	6	4
243001 ~ 244500	6	4
244501 ~ 246000	6	4
246001 ~ 247500	6	4
247501 ~ 249000	6	4
249001 ~ 250500	6	4
250501 ~ 252000	6	4
252001 ~ 253500	6	4
253501 ~ 255000	6	4
255001 ~ 256500	6	4
256501 ~ 258000	6	4
258001 ~ 259500	6	4
259501 ~ 261000	6	4
261001 ~ 262500	6	4
262501 ~ 264000	6	4
264001 ~ 265500	6	4
265501 ~ 267000	6	4
267001 ~ 268500	6	4
268501 ~ 270000	6	4
270001 ~ 271500	6	4
271501 ~ 273000	6	4
273001 ~ 274500	6	4
274501 ~ 276000	6	4
276001 ~ 277500	6	4
277501 ~ 279000	6	4
279001 ~ 280500	6	4
280501 ~ 282000	6	4
282001 ~ 283500	6	4
283501 ~ 285000	6	4
285001 ~ 286500	6	4
286501 ~ 288000	6	4
288001 ~ 289500	6	4
289501 ~ 291000	6	4
291001 ~ 292500	6	4
292501 ~ 294000	6	4
294001 ~ 295500	6	4
295501 ~ 297000	6	4
297001 ~ 298500	6	4
298501 ~ 300000	6	4

REMARKS:

- ALL DIMENSIONS ARE IN FT.
- FOR ORIENTATION OF OPENING, MATERIAL OF SKIRT, BASE TYPE, B.C.D. (BOLT CIRCLE DIAMETER) FOUNDATION BOLT AND OUTSIDE DIAMETER OF VESSEL, SEE ENG'G DWG.
- VENDOR SHALL CHECK & ASTERISKED DIMENSIONS ON TABLE-1 AND INCREASE THEM.
- UNLESS OTHERWISE SPECIFIED, OUTSIDE DIAMETER OF SKIRT SHALL BE EQ. TO OUTSIDE DIAMETER OF VESSEL.
- SIZE OF FILLET WELD SHALL BE EQUAL TO THE SKIRT THICKNESS MIN. 5/16".
- IN CASE PITCH OF FOUNDATION BOLT IS 450MM AND UNDER, RINGED COMP. STITCH PLATE SHALL BE PROVIDED CONTINUOUSLY.
- MATERIAL AND MIN. THICKNESS OF OPENING SHALL BE AS FOLLOWS:
OPENING SIZE NPS 12 AND UNDER: JIS SCP OR ASTM A120 OR EQUIVALENT
OPENING SIZE NPS 14 AND OVER: JIS SS41 12TH OR ASTM A36 12TH (CUTTING)
IN CASE OPERATING TEMPERATURE OF VESSEL IS LOWER THAN -20°C, VENDOR SHALL BE PROVIDED FOR SLEEVE OPENING.
- MATERIAL OF WOODEN PILLOW: WHITE OAK OR APITON
CLEARANCE 0 BETWEEN PIPE SLEEVE AND RIB SHALL BE AS FOLLOWS:
0.2 L.S. AND 1.0 (IPH)
WHERE: L = COEFFICIENT OF THERMAL EXPANSION (1/IN/°C)
ΔT = TEMPERATURE DIFFERENCE (°C)
L = NOZZLE LENGTH FROM BOTTOM T.L. 12TH





X_i	d
500 KG	19
1000 KG	25

DISIZE)	A		B	C	D	E	F	G	H	J	T	K	N	O
	DN	NPS												
100	4	250	305	175	120	65	180	100	120	160	16	140	140	180
150	6	300	350	200	172	75	200	100	175	210	16	190	160	230
200	8	400	425	225	222	100	250	100	225	260	19	240	120	280
250	10	450	475	250	275	125	300	130	275	310	19	290	145	330

PORT BRACKET DETAIL.

D			R	LIFTING LOAD : Y ₁ ~ 500KG							LIFTING LOAD : Y ₂ ~ 1000KG			
				TYPE NO. Z	S (MAX.)	L (MAX.)	H	Y ₁ (KG)	TYPE NO. Z	S (MAX.)	L (MAX.)	H		
SIZE	Sch.													
DN	NPS													
100	4	Sch 80	500	501	700	4500	750 ~ 900	200	—	—	—	—	—	
150	6	Sch 40	750	502	1400	5500	900 ~ 1100	260	—	—	—	—	—	
150	6	Sch 80	750	503	2000	6500	1100 ~ 1400	280	1003	980	5560	750 ~ 900	Perancangan	
200	8	Sch 40	1000	504	3000	8000	1400 ~ 1550	290	1004	1400	6500	1100	Modifikasi	
200	8	Sch 80	1000	505	4000	9000	1500 ~ 2000	340	1005	2100	7500	1400	Universitas	
250	10	Sch 40	1300	506	5000	10000	2000 ~ 2500	340	1006	2500	9000	1550	Pa	

REMARKS:

1. ALL DIMENSIONS ARE IN MM.
2. FOR TYPE OF DAVIT, SEE ENG'G DWG.
3. MATERIALS SHALL BE AS FOLLOWS:

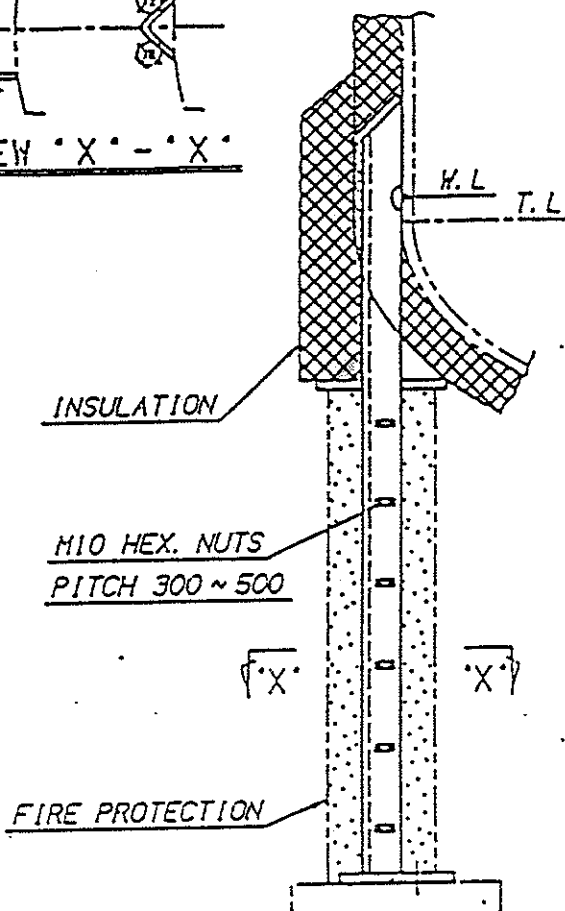
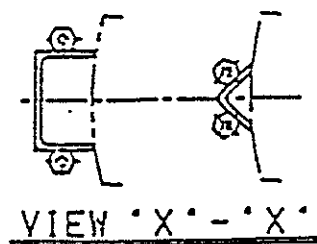
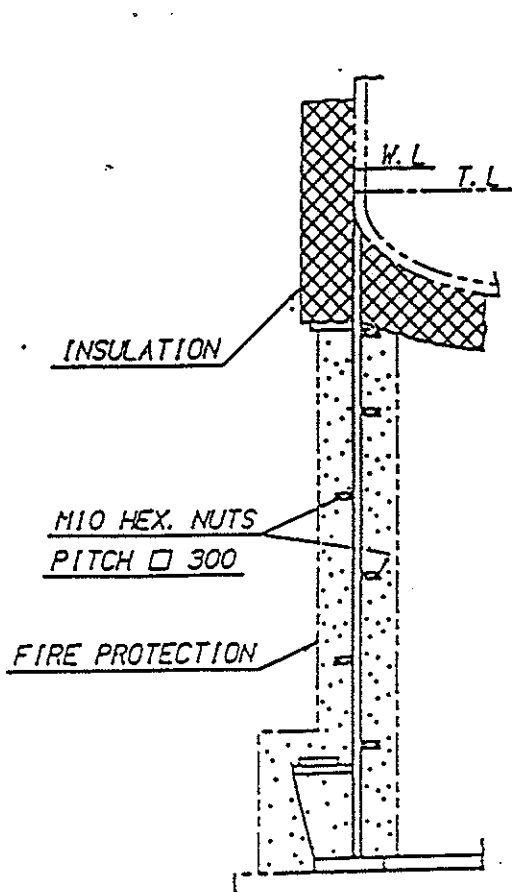
DAYVIT PIPE ... JIS STPG30 , ASTH A53 OR EQUIVALENT
NAME PLATE ... JIS SUS304 , ASTH 304SS OR EQUIVALENT
PAD PLATE ... SEE ENG'G DWG.
OTHERS ... JIS SS41 , ASTH A36 OR EQUIVALENT

4. WHEN DIMENSION "S" IS OVER THE DISTANCE BETWEEN DAVIT TO VESSEL CENTER LINE, ADDITIONAL HOOK SHALL BE PROVIDED AT LOCATION OF THE VESSEL CENTER LINE.
5. DIMENSION "S" AND "L" SHALL BE AS SPECIFIED ON HG-6 IN CASE LENGTH OF "S" AND/OR "L" EXCEED THE FUTURE OF THE ABOVE TABLE. DESIGN CALCULATION OF DAVIT PIPE SHALL BE CARRIED OUT BY VENDOR.

Perancangan Bejana Urea Hydrolyzer Di PT Pupuk Iskandar Muda
 Universitas Mayasrayanta, Ir. Subarmono, MT.
 Universitas Gadjah Mada, 2002 | Diunduh dari <http://repositori.stugm.ac.id/>

LUG FOR FIRE PROTECTION

YS-30-U



IN CASE VESSEL INSIDE DIAMETER
SHALL BE LESS THAN 1500, FIRE
PROTECTION SHALL BE REQUIRED
FOR ONLY OUTSIDE OF SKIRT.

TYPE-I
SKIRT TYPE

TYPE-II
LEG TYPE

REMARKS:

1. ALL DIMENSIONS ARE IN MM.
2. NUT MATERIAL : CARBON STEEL.