



管子制作质量控制指导书

Guideline of Quality Control for Piping Fabrication in Workshop

Q/STS-097-2020

SEATEC SHIPSERV

PIPE FABRICATION STANDARD

For Company Internal Use Only
内部资料

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Contains

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2. Steel pipe standard
3. Flange standard
4. Workshop pipe fabrication standard
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1. Steel pipe class

1.1 According to piping designed pressure and temperature, pipe has 3 classes.

	Class I	Class II	Class III
Steam or thermal oil	>1.6 MPA, >300 °C	≤1.6MPA, ≤300 °C	≤0.7MPA, ≤170 °C
Fuel oil	>1.6 MPA, >150 °C	≤1.6MPA, ≤150 °C	≤0.7MPA, ≤60 °C
Water, air, LO or other	>4.0 MPA, >300°C	≤4.0MPA, ≤300 °C	≤1.6MPA, ≤200 °C

Normally Sea water and ballast pipes are Class III pipe

1.2 According to pipe manufacturing method, pipe has Seamless pipe and Welded pipe.

For class I and class II pipe, must be used seamless pipe as per rule, but it is also possible to use welded pipe if manufacturer has been type approved by class and pipe welding is following welding standard. For class III pipe, it can be used welded pipe.

2. Steel pipe standard

In China ship building market, normally there are Chinese standard (GB) and Japanese standard (JIS)

通径		外径/mm	中国船用管材厚度							
			A级 SCH20		B级 SCH40		C级 SCH80		D级 SCH160	
A	B		壁厚	单位重量 kg/m	壁厚	单位重量 kg/m	壁厚	单位重量 kg/m	壁厚	单位重量 kg/m
6	1/8	10.0	2.00	0.3950	2.00	0.3950	*	*	*	*
8	1/4	14.0	2.00	0.5920	2.00	0.5920				
10	3/8	18.0	*	*	*	*	3.00	1.1090	*	*
15	1/2	22.0	3.00	1.4100	3.00	1.4100	4.00	1.7750		
20	3/4	27.0	3.00	1.7800	3.00	1.7800	4.00	2.2700		
25	1	34.0	3.50	2.6300	3.50	2.6300	4.50	3.2700		
32	1 1/4	42.0	3.50	3.3200	4.00	3.7500	5.00	4.5600	6.50	5.6880
40	1 1/2	48.0	4.00	4.3400	4.00	4.3400	5.50	5.7620	7.00	7.7074
50	2	60.5	4.00	5.5210	4.00	5.5210	5.50	8.7440	9.00	11.3140
65	2 1/2	76.0	4.00	7.1000	5.00	8.7500	7.00	11.9000	10.00	16.2680
80	3	89.0	4.50	9.3730	5.50	11.3300	8.00	15.9730	11.00	21.1490
100	4	114.0	5.00	12.4000	6.00	15.9730	9.00	23.2930	14.00	34.5090
125	5	140.0	6.00	19.8180	7.00	22.9480	10.00	32.0440	16.00	48.9040
150	6	168.0	6.00	23.9590	8.00	31.5510	11.00	42.5690	16.00	59.9460
200	8	219.0	7.00	36.5790	9.00	46.5870	13.00	66.0100	16.00	80.0600
250	10	273.0	7.00	45.8960	10.00	64.8270	13.00	83.3140	16.00	101.3570
300	12	325.0	8.00	62.5100	10.00	77.6440	13.00	99.9760	16.00	121.8650
350	14	377.0	*	*	10.00	90.4620	13.00	116.6390	16.00	142.3730
400	16	426.0	*	*	10.00	96.4620	13.00	124.6500	16.00	152.2320

GB pipe standard



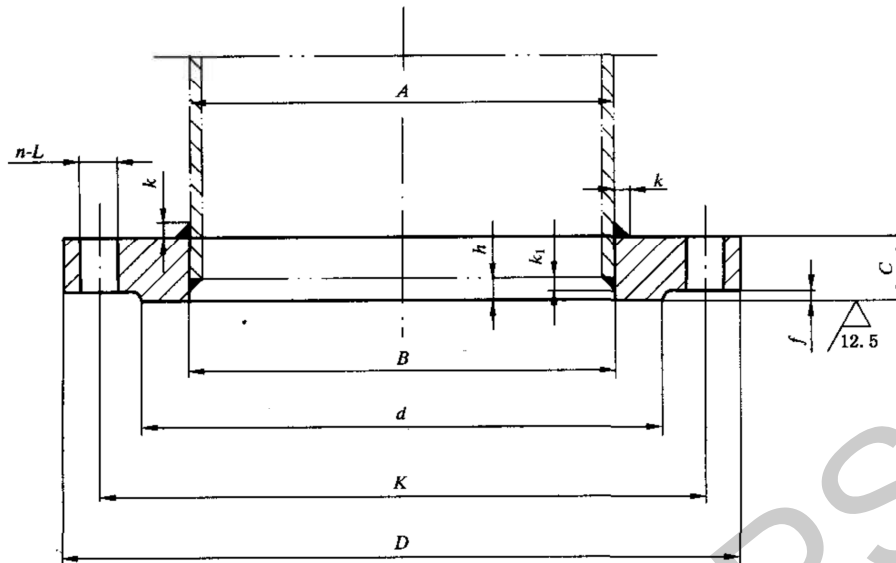
inch	DN	外径 D	壁厚											
			SGP	SCH5S	SCH10S	SCH10	SCH20	SCH30	SCH40S	STD	SCH40	SCH60	SCH80S	XS
1/2"	15	21.7	2.8	1.7	2.1				2.8	2.8	2.8		3.7	3.7
3/4"	20	27.2	2.8	1.7	2.1				2.9	2.9	2.9		3.9	3.9
1"	25	34	3.2	1.7	2.8				3.4	3.4	3.4		4.5	4.5
1 1/4"	32	42.7	3.5	1.7	2.8				3.6	3.6	3.6		4.9	4.9
1 1/2"	40	48.6	3.5	1.7	2.8				3.7	3.7	3.7		5.1	5.1
2"	50	60.5	3.8	1.7	2.8				3.9	3.9	3.9		5.5	5.5
2 1/2"	65	76.3	4.2	2.1	3.0				5.2	5.2	5.2		7.0	7.0
3"	80	89.1	4.2	2.1	3.0				5.5	5.5	5.5		7.6	7.6
3 1/2"	90	101.6	4.2	2.1	3.0				5.7	5.7	5.7		8.1	8.1
4"	100	114.3	4.5	2.1	3.0				6.0	6.0	6.0		8.6	8.6
5"	125	139.80	4.5	2.8	3.4				6.6	6.6	6.6		9.5	9.5
6"	150	165.20	5.0	2.8	3.4				7.1	7.1	7.1		11.0	11.0
8"	200	216.30	5.8	2.8	3.8		6.4	7.0	8.2	8.2	8.2	10.3	12.7	12.7
10"	250	267.40	6.6	3.4	4.2		6.4	7.8	9.3	9.3	9.3	12.7	12.7	12.7
12"	300	318.50	6.9	4.0	4.6		6.4	8.4	9.5	9.5	10.3	14.3	12.7	12.7
14"	350	355.60	7.9	4.0	4.8	6.4	7.9	9.5	9.5	9.5	11.1	15.1		12.7
16"	400	406.40	7.9	4.2	4.8	6.4	7.9	9.5	9.5	9.5	12.7	16.7		12.7
18"	450	457.20	7.9	4.2	4.8	6.4	7.9	11.1	9.5	9.5	14.3	19.0		12.7
20"	500	508.00	7.9	4.8	5.5	6.4	9.5	12.7	9.5	9.5	15.1	20.6		12.7
22"	550	558.00		4.8	5.5	6.4	9.5	12.7	9.5	9.5		22.2		12.7
24"	600	609.60		5.5	6.4	6.4	9.5	14.3	9.5	9.5	17.5	24.6		12.7
26"	650	660.40				7.9	12.7			9.5				12.7
28"	700	711.20				7.9	12.7	15.9		9.5				12.7
30"	750	762.00		6.4	7.9	7.9	12.7	15.9	9.5	9.5	17.5			12.7
32"	800	812.80				7.9	12.7	15.9		9.5	17.5			12.7

JIS pipe standard

3. Flange standard

China standard, Eg: GB PN1.0 X DN200

Japanese standard, Eg: JIS 10K X DN200



GB/T 2506—2005

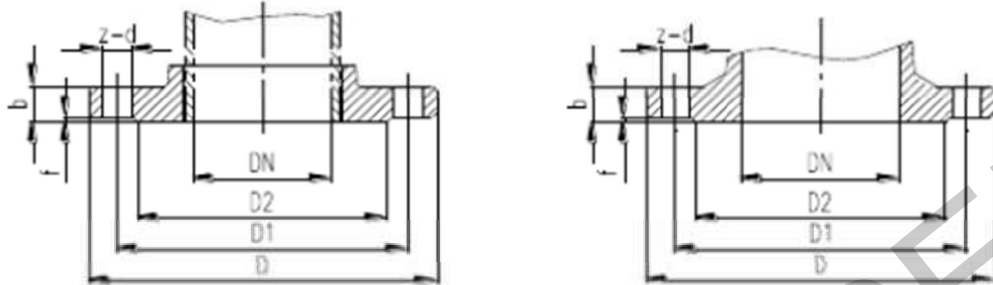
表 2(续)

单位为毫米

公称压力 PN/ MPa	公称 口径 DN	钢管外径 A		连接尺寸				密封面		端距 h	螺栓螺纹及通孔			质量/ kg	
		第一 系列	第二 系列	D	K	B	C	d	f		Th.	L	n		
1.0	200	219.1	219	340	295	221.5	24	266					8	8.53	
	225	—	245	370	325	248		295		6				9.73	
	250		273	395	350	276.5	26	319			M20	22	12	10.94	
	300	323.9	325	445	400	328.5	28	370		7				13.26	
	350	355.6	377	505	460	360	381	30	429				16	20.98	18.11
	400	406.5	426	565	515	410	430	32	480					26.72	23.40
	450	457	480	615	565	462	485	35	530		8	M24	26	31.61	26.91
	500	508	530	670	620	513	535	38	582				20	39.15	33.75
	600	610	630	780	725	615	635	42	682		9	M27	30	53.39	46.92

法兰尺寸

JIS 法兰 (JIS B 2238、JIS B 2239)


JIS 10K

单位: mm

口径 DN	适 用 的 钢管外径	法兰外 径 D	法兰各部分尺寸				螺栓孔			螺栓的 螺纹尺 寸	薄型法兰		
			b		f	直径 D2	中心圆 直径 D1	数量 z	直径 d		灰铸铁	螺栓的 孔径	螺栓的 尺寸
			灰铸铁以外	灰铸铁									
10	17.3	90	12	14	1	46	65	4	15	M12	12	12	M10
15	21.7	95	12	16	1	51	70	4	15	M12	12	12	M10
20	27.2	100	14	18	1	56	75	4	15	M12	14	12	M10
25	34.0	125	14	18	1	67	90	4	19	M16	16	15	M12
32	42.7	135	16	20	2	76	100	4	19	M16	18	15	M12
40	48.6	140	16	20	2	81	105	4	19	M16	18	15	M12
50	60.5	155	16	20	2	96	120	4	19	M16	18	15	M12
65	76.3	175	18	22	2	116	140	4	19	M16	18	15	M12
80	89.1	185	18	22	2	126	150	8	19	M16	18	15	M12
100	114.3	210	18	24	2	151	175	8	19	M16	20	15	M12
125	139.8	250	20	24	2	182	210	8	23	M20	22	19	M16
150	165.2	280	22	26	2	212	240	8	23	M20	22	19	M16
200	216.3	330	22	26	2	262	290	12	23	M20	24	19	M16
250	267.4	400	24	30	2	324	355	12	25	M22	26	23	M20
300	318.5	445	24	32	3	368	400	16	25	M22	28	23	M20
350	355.6	490	26	34	3	413	445	16	25	M22	28	23	M20
400	406.4	560	28	36	3	475	510	16	27	M24	30	25	M22
450	457.2	620	30	38	3	530	565	20	27	M24	—	—	—
500	508.0	675	30	40	3	585	620	20	27	M24	—	—	—
600	609.6	795	32	44	3	690	730	24	33	M30	—	—	—

4. Workshop pipe fabrication standard

There are many standards of pipe fabrication in different class of pipe, countries, classes, shipyards, to avoid confusing, SEATEC SHIPSERV is following one standard:

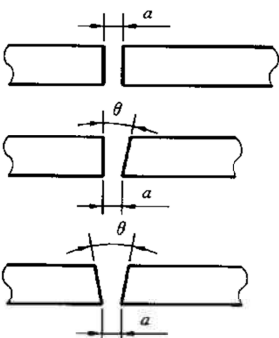
4.1 Pipe cut

Pipe shall be cut according to "Cutting length" of isometric drawing, after cutting, vertical tolerance (Δ) between pipe end and circumference surface outside to be under the limit listed. (unit mm)

公称通径 DN Nominal diameter	垂直公差 Δ Vertical tolerance
DN $\leq$ 100	$\Delta \leq 1$
100<DN $\leq$ 200	$\Delta \leq 2$
200<DN $\leq$ 300	$\Delta \leq 3$

4.2 Pipe joint bevel

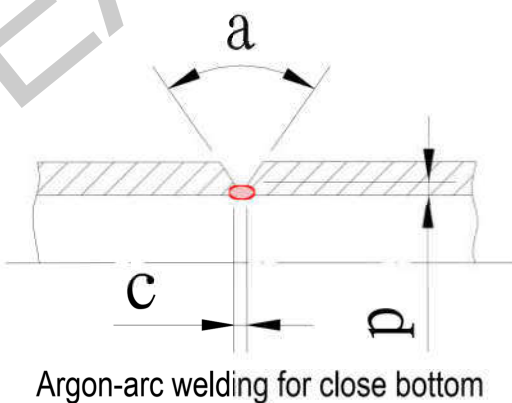
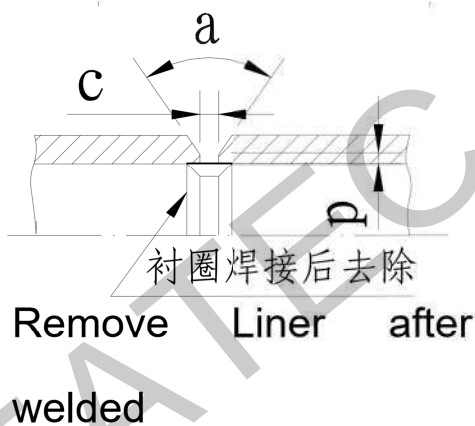
For all pipe wall thickness over than 3mm, the butt welding shall be **full penetration welding**, thus V-bevel shall be prepared before welding, flame cut NOT accepted, bevel cutting standard as follow:

Steel pipe butt joint bevel 	$t \leq 3$	a	< 1	< 3	t: pipe thickness
	$3 < t \leq 6$	a	< 2	≤ 3	
		θ	$> 30^\circ$	$\leq 40^\circ$	
	$T > 6$	a	2~2.5	—	
		θ	$\geq 50^\circ$	60°	



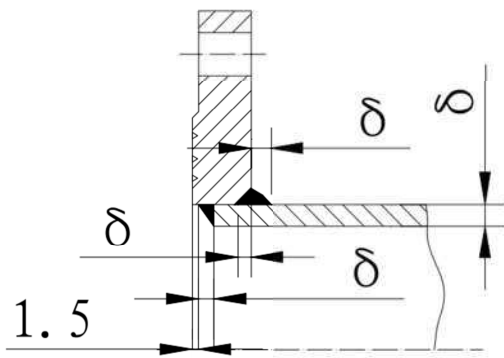
4.3 Pipe butt joint weld

- (1) Ceramic liner for close bottom, liner shall be removed after welding.
- (2) Argon-arc welding for close bottom
- (3) Clean V bevel surface and remove splash, start CO2 welding

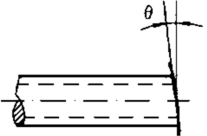


4.4 Flange fitting and welding

Pipe must be inserted into flange minimum 2/3 of flange length, Standard length of pipe end to flange surface: $1\delta + 1.5\text{mm}$, standard fillet welding leg: 1δ

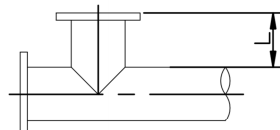
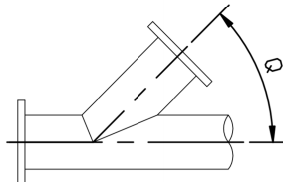


4.5 Vertical tolerance of flange

法兰与管子的偏角 θ 	$D_N < 150$	$30'$	
	$D_N \geq 150$	$20'$	

4.6 Stub-in branch pipe fitting and welding

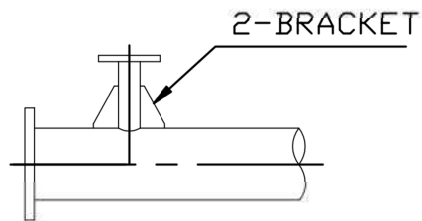
- (1) Branch pipe and main pipe must be same center line.



- (2) Branch pipe can't be inserted into main pipe
- (3) The saddle-shaped(马鞍口) should be matched correctly with hole of main pipe
- (4) Cutting hole on main pipe shall be done by plasma(arc)cutting after marking, or at least cutting edge shall be grounded smoothly without teeth or splash.



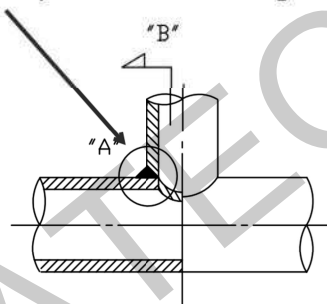
(5) For branch pipe ND<20mm, two brackets shall be added.



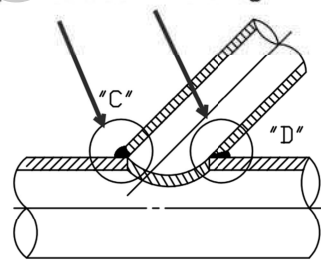
(6) Branch pipe welding to be full penetration welding, bevel joint to be prepared and closed bottom welding by Argon-arc welding.

(In case non-penetration and miss weld inside, covering weld shall be done from inside)

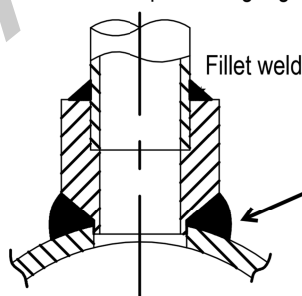
Full penetration welding



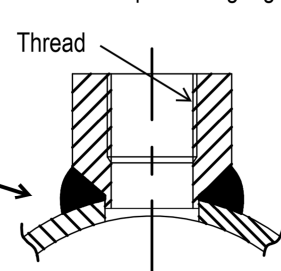
Full penetration welding



Pipe connector for pressure gauge or sensor

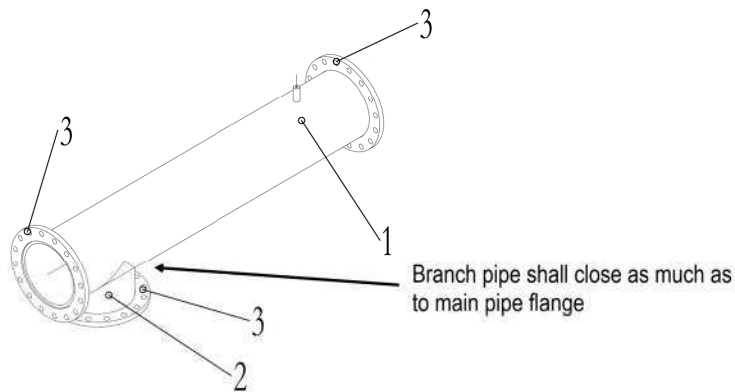


Pipe connector for pressure gauge or sensor



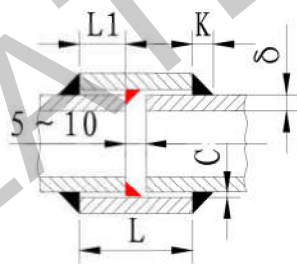
Penetration weld

(7) Branch pipe to be always as much as close to main pipe's flange in order to give access of grinding and welding inside, if no possible to reach inside, one additional flange on main pipe shall be considered..



4.7 Sleeve joint

For fresh water, air, steam or oil pipe, sleeve joint can be welded on pipe.



ND<50, L= 30±10

ND>50, L1=50±10

C≤1±0.5

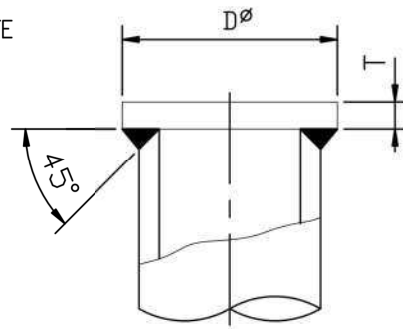
For ND<50, no need welding
inside sleeve

4.8 Blind plate

Blind plate can be only One Side Penetration Weld.

Blind plate thickness: T≥10mm or T ≥Pipe wall

BLIND PLATE



4.9 Pipe penetration piece

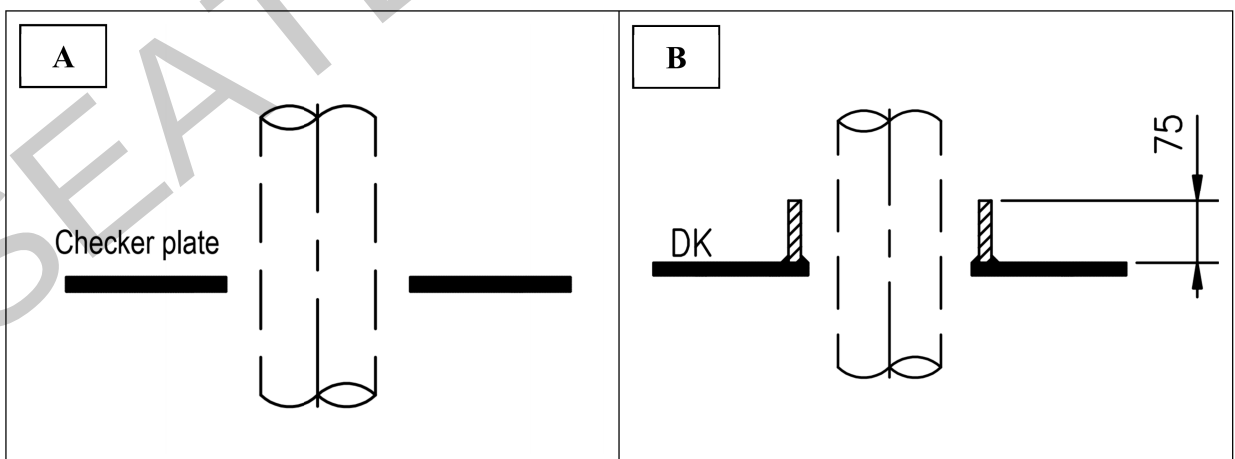
Normally there are 9 kinds of penetrations on ship:

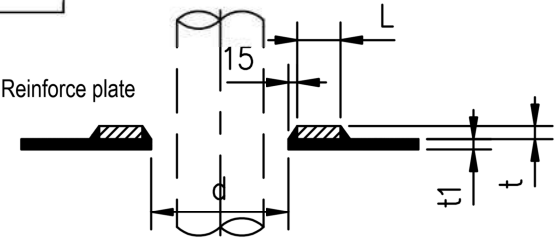
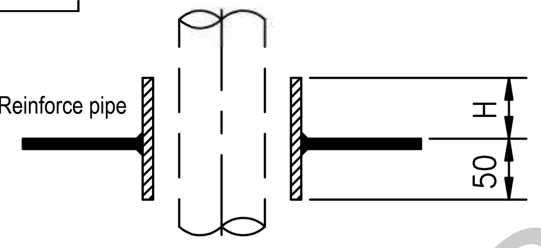
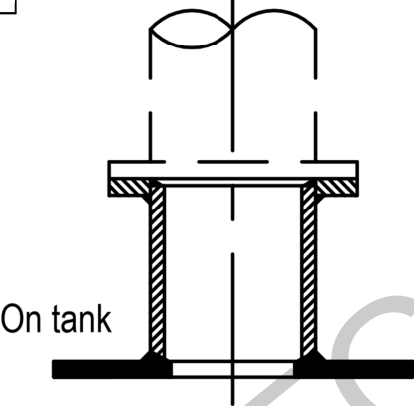
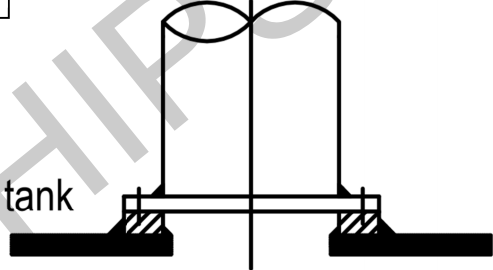
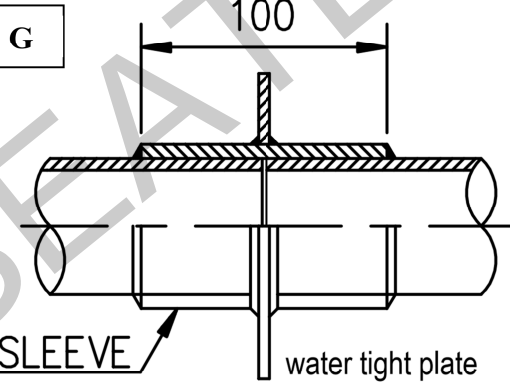
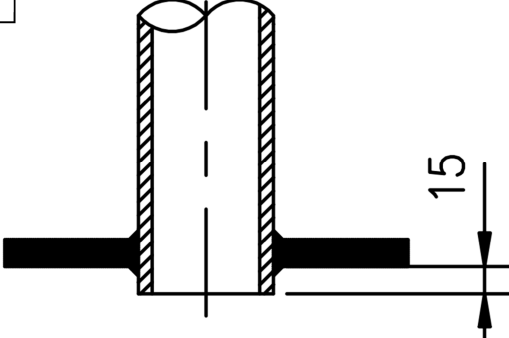
A: Pipe penetrating through floor checker plate or plat form, no strength or water tight requirement.

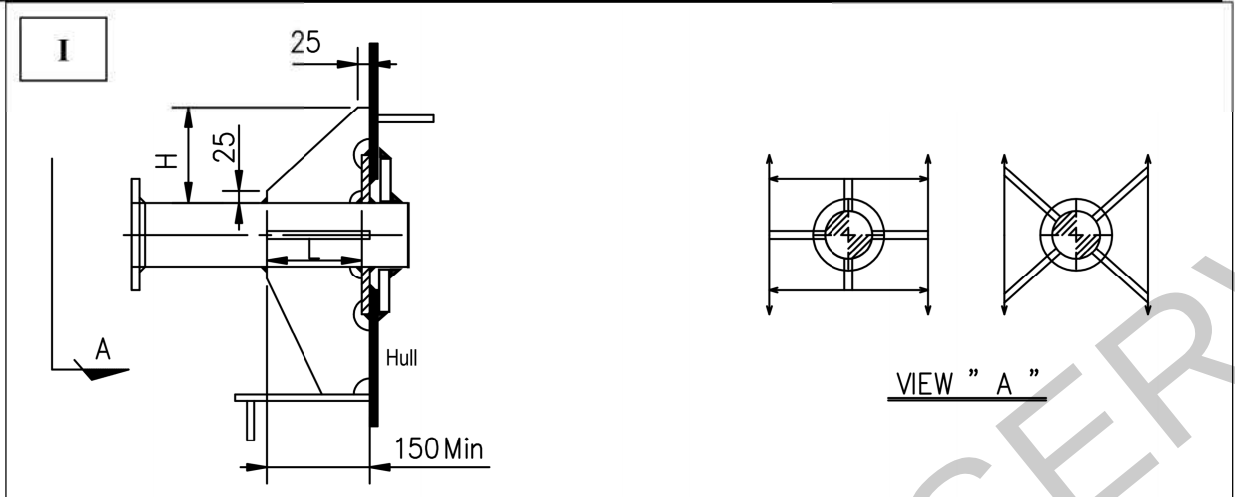
B, C, D: Pipe penetrating through deck plate but no water tight requirement, eg. engine room floor deck.

E, F, G, H: Pipe penetrating through water tight plate, eg. deck or tank.

I: Pipe penetrating through hull plate (overboard pipe), pipe shall be thick wall, class approved, doubler plate welded on hull, reinforce brackets welded on pipe, UT and PT checking for the welding seams.



C  - $t \geq t1$ - $L = d/2$	D  - $H = 75$ as a coaming on deck
E  On tank	F  On tank
G  SLEEVE water tight plate	H  Water tight but no reinforcement required



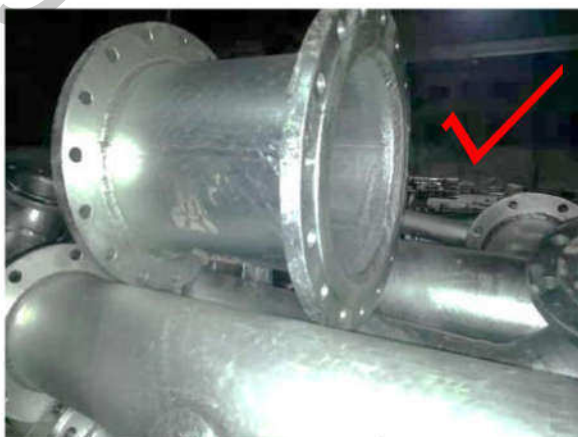
4.10 Pipe welding and grinding quality control

- (1) Welding and grinding are both important for pipe fabrication in workshop, poor welding cause big grinding.
- (2) Welder must be qualified and certified.
- (3) Welding material and welding tool must be good quality with factory certificate records.
- (4) For big size pipe welding shall be reinforced in order to avoid deformation.
- (5) Rust, mill scale, oil or water and other contaminations must be removed, pipe must be kept clean and dry before start welding.
- (6) Multilayer welding, each layer should be cleaned free of welding slag and spatters
- (7) The welding defects which are exposed should be repaired immediately.
- (8) Measurement of seam should use the welding gauge, ruler. The seam dimensions should be in compliance with the drawing requirements. Weld legs /throats are to be the same height. The surfaces of the welding seam should be smooth without sharp edges.
- (9) Using torch light to check the welding seams, the surfaces of the welds are to be free from cracks, overlaps, inclusions, porosity, undercuts and unfilled cavities. Internal surfaces of the pipes are to be free from unfilled cavities. In case of the above defects, they are to be repaired to meet the requirements.



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- (10) The welding seams surface deviation between the highest and the lowest should not exceed 2mm in every 25mm length
 - (11) For butt welds without fixed back rings and gas shield welding seals, the ridge is not allowed to exceed 2mm and the depression is not allowed to exceed 1mm on internal surfaces, otherwise it should be repaired and ground.
 - (12) For the bending pipe, bending machine shall be used as much as possible to instead of elbow joint, for pipe ND < 40mm, not allowed to use elbow.





4.11 Pipe testing

- (1) Pipe shall be carried out hydrostatic pressure test (X1.5 design pressure) after welding finished, pressure shall be kept for min 1 hours no dropping, pipe shall be carried out X 1 time working pressure on board after installation finished.



- (2) For the butt welding of Class I and Class II, it should be checked by X-ray or γ-ray according to rules. If none of the methods above mentioned can be used for checking, any other NDT methods equivalent subject to Class Society can be used.
- (3) For overboard pipe, it should be checked by UT and PT.



4.12 Pipe treatment.

- (1) Pipe after pressure testing, water shall be blown off by air and sent for acid washing, and then sent for galvanizing.
- (2) Galvanizing shall be hot dip galvanizing, the thickness of galvanizing shall be not less than 70um.
- (3) Galvanizing surface shall be smooth, no sharp edge, no missing part, no dirty and rust, no peeling off and no wrinkle.
- (4) For pipe not required galvanizing, it shall be acid washed, phosphating treated (磷化处理), paint on pipe out surface, normally Fresh water pipe does not required galvanizing.
- (5) Some pipes are required plastic coating or rubber coating, eg. S.W water pipe, Chemical dosing pipe.

4.13 Pipe packing and delivery

- (1) Pipes shall be marked according to drawing no. and ID no.
- (2) Pipes shall be packed on steel pallet or wooden pallet, tightened with steel band or tightening slings, covered with plastic sheet, each pallet shall be pasted with numbers and pipe list and weight, the pallet must be solid and easy lifted by folk lift.



