

PIPING HANDBOOK

CONTENTS

	Pages
1. DIMENSION TABLES	8~148
1.1 GENERAL	9~10
1.2 UNIT CONVERSION TABLE	11~19
1.3 PIPE FITTING AND VALVE DIMENSION CHART & WEIGHT	20~93
1.4 BOLT/NUT DIMENSION CHART	94~102
1.5 LINE SPACING (HORIZONTAL)	103
1.6 LINE SPACING (SLANT)	104
1.7 LARGE DIAMETER FABRICATED FITTINGS	105~107
1.8 MITER ELBOWS (45 °)	108
1.9 MITER ELBOWS (90 °)	109
1.10 WELDOLET	110~114
1.11 STEAM TRAP	115~118
1.12 STRAINER	119~122
1.13 STUB END	123
1.14 RING JOINT W N FLANGES	124
1.15 FIGURE-8 BLANKS, PADDLE SPACER AND BLANK	125~128
1.16 DRIP RINGS FOR RF AND FF FLANGES	129
1.17 JACK SCREWS SIZE SELECTION	130~131
1.18 BALL, PLUG AND BUTTERFLY VALVE	132~134
1.19 CONTROL VALVE & TYPICAL MANIFOLD	135~141
1.20 WELD FITTING OFFSETS	142
1.21 TRIGONOMETRIC FUNCTIONS	143~145
1.22 FORMULAS FOR ROLLED OFFSETS	146
1.23 DRAWING AREA CHART	147
1.24 WIRE AND SHEET METAL GAGES	148
2. PIPING DESIGN REFERENCES	155~254
PIPING	
2.1 ASME B31.3 OVERVIEW	156~159
2.2 SPRING SELECTION DWG.	160~163
2.3 ALLOWABLE PIPE SPAN	164~168
2.4 MAX. GUIDE SPAN	169
2.5 RACK PIPING LOOP ARM ANCHOR	170~171
2.6 STEAM TRAP AND DRIP POT PIPING	172~175

PIPING HANDBOOK

CONTENTS

		Pages
2.7	READY-MADE STEAM MANIFOLD	176
2.8	VALVE OPERATION HEIGHT	177~178
2.9	VALVE HANDWHEEL ORIENTATION	179
2.10	SPECIAL ITEMS	180~203
2.11	UTILITY BRANCH SELECTION	204~205
	INSTRUMENTS	
2.12	FLOW INSTRUMENT	209~219
2.13	ORIFICE FLANGE TAP PIPING	220~221
2.14	PRESSURE GAGE	222
2.15	TEMPERATURE INSTRUMENT	223
2.16	LEVEL GAGE	224~225
	EQUIPMENT	
2.17	ELLIPTICAL AND DISHED HEAD DWG.	229
2.18	PIPE DAVIT	230
2.19	PLATFORM	231
2.20	LADDER	232
2.21	STEEL SADDLES	233~236
2.22	SUPPORT LUG FOR VERTICAL VESSEL	237~238
2.23	SUPPORT LEG FOR VERTICAL VESSEL	239~240
2.24	NOZZLE LENGTH	241~242
2.25	SHELL NOZZLE	243
2.26	DRAIN NOZZLE	244
2.27	CIRCUMFERENTIAL STAIRWAY & PLATFORM FOR C.R.T	245~246
	CIVIL & STRUCTURE	
2.28	형강 DATA	249~253
2.29	형강 DATA CONVERSION TABLE	254
3.	PIPING STRESS ANALYSIS	261~275
3.1	배관 응력 해석 기준	262
3.2	배관 응력 간략 계산법	263~264
3.3	ALLOWABLE FORCE & MOMENT (PUMP, VESSEL, HEATER, AIR FIN COOLER)	265~269
3.4	TOTAL THERMAL EXPANSION	270~275

	Pages
4. PIPING MATERIAL WORK	283~319
4.1 WALL THICKNESS CALL OUT AND UNIT WEIGHT TABLE	284~289
4.2 PRESSURE TEMPERATURE RATING	290~297
4.3 SHORT CODE LIST	298~301
4.4 VALVE TRIM TABLE	302
4.5 APPLICABLE ASTM SPECIFICATIONS	303~305
4.6 MATERIAL COMPARISON TABLE	306~312
4.7 규격재료 적용기준	313
4.8 CHEMICAL RESISTANCE OF METAL	314~317
4.9 WRAPPING MATERIAL & 산출기준	318~319
 5. CONSTRUCTION	 327~355
WELDING	
5.1 WELDING SYMBOLS	328~331
5.2 WELDING ROD SELECTION TABLE	332~334
5.3 WELDING ROD 산출기준	335~338
5.4 LETTER DESIGNATION OF WELDING	339
5.5 SPECIFICATION FOR ELECTRODE	340~341
5.6 용접 재료 일람	342~346
기타 REFERENCES	
5.7 REINFORCING PAD DETAIL	347~348
5.8 SLEEVED PIPING FOR ROAD CROSSING	349~350
5.9 PIPE FABRICATION TOLERANCES	351
5.10 TOLERANCES FOR VESSEL	352~353
5.11 BOLT TORQUE TABLE	354~355
 6. 기타자료	 363~378
6.1 STANDARD CODE LIST	364~378
 ATTACHMENT	 385~430
# 1 – DESIGN SPECIFICATION LDM-L002, PIPING SUPPORTS	385~430
 편집 후기	 432

1. Scope

This dimension tables cover dimensions for pipes, fittings, flanges, bolts/nuts valves in size NPS 1/2 through NPS 72 and miscellaneous piping components.

2. Pipe

Pipe dimensions conform to the following codes:

2.1 KS : D3562, D3564, D3573, D3576

2.2 JIS : G3454, G3456, G3458, G3459

2.3 ASME : B36.10, B36.19

3. Fitting

Fitting dimensions conform to the following codes:

3.1 Socket weld : ASME B16.11

3.2 Butt weld : ASME B16.9

3.3 Swage nipple and boss : BS3799

4. Flange

4.1 Heights of raised face flanges are based on the following :

4.1.1 Class 150 and 300 : 0.06" (1.6mm)

4.1.2 Class 600 and above : 0.25" (6.4mm)

4.2 Ring joint grooves conform to the groove depth listed in table 5 of ASME B16.5.

4.3 Flange dimensions are based on the following codes :

4.3.1 KS : KS

4.3.2 JIS : JIS B2220

4.3.3 ASME : ASME B16.5 and B16.47 Series A/B

4.3.4 AWWA : AWWA C207

4.3.5 TAYLOR FORGE : Modern Flange Design(Taylor Forge Bulletin 722)

5. Valve

5.1 Dimensions of API 602 valve conform to the largest dimension of manufacturer's standard.

These dimensions may be changed in accordance with manufacturer's standard.

5.2 Hand wheel dimension "W" and stem height dimension "R" conforms to manufacturer's standard. These dimensions may be changed in accordance with manufacturer's standard. Review the final vendor print.

6. Abbreviation

A	: AMERICAN NATIONAL STANDARD INSTITUTE
API	: AMERICAN PETROLEUM INSTITUTE
AWWA	: AMERICAN WATER WORK ASSOCIATION
CPL' G	: COUPLING
ELL	: ELBOW(L : LONG, S : SHORT)
J	: JAPANESE INDUSTRIAL STANDARD
JPI	: JAPANESE PETROLEUM INSTITUTE
K	: KOREAN INDUSTRIAL STANDARD
MSS	: MANUFACTURERS STANDARDIZATION SOCIETY
PC	: MIN. PIECE
SCRD	: SCREWED
SO	: SLIP-ON
SW	: SOCKET WELD
WN	: WELD NECK

7. Exception

7.1 Welding clearance is not included in this dimension chart.

7.2 All dimensions given in this dimension chart are minimum.

PIPING HANDBOOK

1. DIMENSION TABLES

1.2 UNIT CONVERSION TABLE

1. Prefix Names of Multiples and Submultiples of Units

Prefix	Measure	Decimal equivalent	Exponential expression
Alto (a)	One-quintillionth	0.000 000 000 000 000 001	E-18
Femto(f)	One-quadrillionth	0.000 000 000 000 001	E-15
Pico(p)	One-trillionth	0.000 000 000 001	E-12
Nano(n)	One-billionth	0.000 000 001	E-9
Micro(μ)	One-millionth	0.000 001	E-6
Milli(m)	One-thousandth	0.001	E-3
Centi(c)	One-hundredth	0.01	E-2
Deci(d)	One-tenth	0.1	E-1
Uni(u)	One	1.0	E 0
Deka(D)	Ten	10.0	E+1
Hecto(H)	One hundred	100.0	E+2
Kilo(K)	One thousand	1 000.0	E+3
Mega(M)	One million	1 000 000.0	E+6
Giga(G)	One billion	1 000 000 000.0	E+9
Tera(T)	One trillion	1 000 000 000 000.0	E+12

2. Conversion Factors – Frequently Used U.S Customary Units to SI Standard Units

To convert	To	Multiply by	To convert	To	Multiply by
Acceleration			Power		
Feet per sq. second (ft/sec ²)	Meters per sq. Second (m/sec ²)	0.3048	Btu per second (Btu/sec)	Watt	1054.350
Area	Square feet (ft ²)	0.09290304	Foot pounds per second(ft· lb/sec)	Watt	1.355818
			Horsepower	Watt	746.
			Pressure		
Energy			Atmosphere	Newtons per sq. meter	101325.0
Btu	Joule	1055.06	Bar	Newtons per sq. meter	100000.
Calorie	Joule	4.19002	Kilogram per sq. cm(kg/cm ²)	Newtons per sq. meter	98066.50
Foot pound(ft· lb)	Joule	1.355818	Pounds per sq. in.(lb/in ²)	Newtons per sq. meter	6894.757
Watthour	Joule	3600.355818	Torr (mm Hg 0°C)	Newtons per sq. meter	133.322
Force			Viscosity		
Dyne	Newton	0.00001	Centipoise	Newton second per meter	0.001
Kilogram	Newton	9.80665	Pounds per foot Second(lb/ft· sec)	Newton second per meter	1.488164
Pound	Newton	4.448222	Volume		
Length			Cubic foot(ft ³)	Cubic meter	0.02831685
Foot	Meter	0.3048000	Gallon(U.S. liquid)	Cubic meter	0.003785412
Mile(U.S statute)	Meter	1609.344			
Mass					
Pound	Kilogram	0.4535924			
Slug	Kilogram	14.59390			
Ton(2000 lb)	Kilogram	907.1847			

PIPING HANDBOOK

1. DIMENSION TABLES

1.2 UNIT CONVERSION TABLE

3. Mass Equivalents

To obtain → Multiply ↓, by ↘	Pound (avdp)	Ounce (avdp)	Gram	Kilogram	Slug	Ton	Ton (short)*
lb (avdp)	1	16	453.6	0.4536	0.0310	4.536E-4	0.0005
oz(avdp) (oz)	0.0625	1	28.3495	0.02835	0.0019	2.835E-5	3.125E-5
g	0.0022	0.0353	1	0.001	68.5E-5	0.001E-3	1.102E-6
kg	2.2046	35.274	1000	1	0.0685	0.001	0.0011
Slug	32.174	514.784	1.459E+4	14.5939	1	1.459E-2	0.01608
t	2204.6	35270	1000E+3	1000	68.5218	1	1.10231
US t(short)*	2000	32000	9.071E+5	907.185	62.162	0.9072	1

* 1 short ton (US)= 0.8926 long tons (UK). 1 short ton (US)= 0.9072 metric tons.

Slug : 1lb 의 힘에 의해 1 ft/s²의 가속도가 생기는 질량.

Avdp(avoirdupois) : 귀금속, 보석, 약품을 제외한 모든 것에 쓰이는 형량(상형)

4. Length Equivalents

To obtain → Multiply ↓, by ↘	Inch	Foot	Miles (statute)	Millimeter	Centimeter	Meter	Kilometer
in	1	0.08333		25.4	2.54	0.0254	
ft	12	1		304.8	30.48	0.3048	
mi(statute)	63360	5280	1			1609.344	1.609344
mm	0.03937	0.003281		1	0.1	0.001	
cm	0.3937	0.032808		10	1	0.01	
m	39.3701	3.28084		1000	100	1	0.001
km	39,370	3280.8	0.62137		100,000	1000	1

5. Area Equivalents

To obtain → Multiply ↓, by ↘	Square inch	Square foot	Acre	Square millimeter	Square centimeter	Square meter
in ²	1	0.006944		645.16	6.4516	0.00064516
ft ²	144	1	2.2956 E-5	92903.04	929.0304	0.09290
ac		43560	1			4046.8564
mm ²	0.00155			1	0.01	1 E-6
cm ²	0.1550	0.001076	2.5 E-8	100	1	0.0001
m ²	1550.0031	10.76391	0.000247	1 E+6	10,000	1

PIPING HANDBOOK

1. DIMENSION TABLES

1.2 UNIT CONVERSION TABLE

6. Weight Conversion Factor

To obtain → Multiply ↓, by ↘	Milligram	Gram	Kilogram	Ton	Grain	Pound
mg	1	1.0000E+3	1.0000E+6	1.0000E+9	64.7900E+0	453.5920E+3
g	1.0000E-3	1	1.0000E+3	1.0000E+6	64.7900E-3	453.5920E+0
kg	1.0000E-6	1.0000E-3	1	1.0000E+3	64.7900E-6	453.5920E-3
t	1.0000E-9	1.0000E-6	1.0000E-3	1	64.7900E-9	453.5920E-6
gr	15.4320E-3	15.4320E+0	15.4320E+3	15.4320E+6	1	7.0000E+3
lb	2.2046E-6	2.2046E-3	2.2046E+0	2.2046E+3	140.0000E-6	1

7. Density Equivalents

To obtain → Multiply ↓, by ↘	Grams per cubic Centimeter	Pounds per cubic inch	Pounds per cubic foot	Slugs per Cubic foot	Kilograms per cubic meter
gr/cm ³	1	0.03613	62.42806	1.9403	1000
lb/in ³	27.67991	1	1728	53.708	27679.905
lb/ft ³	0.01602	0.0005787	1	0.031081	16.01846
slug/ft ³	0.51538	0.0186	32.17	1	515.379
kg/m ³	0.001	3.6128 E-5	0.06243	0.00194	1

8. Volume Equivalents

To obtain → Multiply ↓, by ↘	U.S gallon	Imperial gallon	Cubic inch	Cubic foot	liter	Cubic meter	Barrel (oil)
U.S gal	1	0.83267	231	0.13368	3.7853	0.00378	0.02381
U.K gal	1.2009	1	277.42	0.16054	4.5459	0.00455	0.02859
in ³	0.004329	0.003604	1	0.000579	0.0164	0.000016	0.00010
ft ³	7.4805	6.2288	1728	1	28.316	0.02832	0.17813
l	0.26418	0.21997	61.025	0.0353	1	0.001	0.00629
m ³	264.17	219.97	61023.74	35.3147	1000	1	6.2899
bbl(oil) *	42	34.977	9702.00	5.614	158.983	0.15876	1

* The capacity of a barrel varies with industries as follows :

1 barrel of beer = 31 U.S. gallons

1 barrel of wine = 31.5 U.S. gallons

1 barrel of oil = 42 U.S. gallons

1 barrel of whiskey = 45 U.S. gallons

9. Pressure Equivalents

To obtain → Multiply ↓, by ↘	Pounds per square inch	Pounds per square foot	Atmos- phere	Kilograms per square centimeter	Kilograms per square meter	Inches water (68°F)	Foot water (68°F)	Inches mercury (68°F)	Milli- meters mercury (32°F)	Bar	Mega- Pascal (Mpa)
lb/in ² (psi)	1	144	0.068046	0.070307	703.070	27.7276	2.310636	2.03602	51.71497	0.068947	0.006895
lb/ft ² (psf)	0.006944	1	0.000473	0.000488	4.88242	0.1926	0.01605	0.014139	0.35913	0.000479	0.0000479
atm	14.696	2116.22	1	1.03323	10332.27	407.484	33.9570	29.9213	760	1.01325	0.101325
Kg/cm ² (ata)	14.2233	2048.155	0.96784	1	10000	394.38	32.8650	28.959	735.559	0.98067	0.098067
Kg/m ²	0.001422	0.204768	0.0000968	0.0001	1	0.03944	0.003287	0.002896	0.073556	0.000098	0.0000098
inAq (68°F)	0.036065	5.1972	0.002454	0.00253	25.375	1	0.08333	0.073430	1.8651	0.002466	0.000249
ftAq(68°F)	0.432781	62.3205	0.029449	0.03043	304.275	12	1	0.88115	22.3813	0.029839	0.0029839
inHg(68°F)	0.491154	70.7262	0.033421	0.03453	345.316	13.6185	1.1349	1	25.4	0.033864	0.0033864
mmHg(32°F) (torr)	0.0193368	2.78450	0.0013158	0.0013595	13.59509	0.53616	0.044680	0.03937	1	0.001333	0.0001333
bar	14.5038	2088.55	0.98692	1.01972	10197.2	402.156	33.5130	29.5300	750.062	1	0.10
Mpa	145.038	20885.5	9.8692	10.1972	101972.0	4021.56	335.130	295.300	7500.62	10.0	1

$$1\text{kgf/cm}^2 = 9.8 \times 10^5 \text{dyne/cm}^2 = 9.8\text{N/cm}^2$$

10. Energy Equivalents

To obtain → Multiply ↓, by ↘	Btu *	Calorie (gram) +	Foot pound	Horsepower hour	Joule	Kilowatt hour	Kilogram meter
Btu	1	251.8	778.169	0.000393	1055.06	0.000293	107.586
Cal (gram) +	0.00397	1	3.08596	1.56 E-6	4.184	1.16E-6	0.426649
Ft-lb	0.00129	0.32405	1	5.05 E-7	1.35582	3.77E-7	0.13825
Hp	2544.5	641616	1.98 E+6	1	2.68 E+6	0.7457	273745
J	0.00095	0.2390	0.73756	3.72 E-7	1	2.77E-7	0.102
Kwh	3412.97	860421	2.65 E+6	1.34102	3.6E+6	1	367098
Kgf·m(kp·m)	0.00929	2.344	7.233	3.65 E-6	9.807	2.72E-6	1

* Based on 1 Btu = 778.169ft · lb

+ Based on 1 Cal = 4.1840Joules

Btu (British thermal unit) : 1 lb 의 물을 63°F에서 64°F로 올리는데 필요한 열량.

11. Volumetric Flow Rate Equivalents

To obtain → Multiply ↓, by ↘	U.S. Gallons per minute	Imperial gallons per minute	U.S. million gallons per day	Cubic feet per second	Cubic meter Per hour	Liter per second	Barrel (42 gallons) per minute	Barrel (42 gallons) per day
U.S. gal/min	1	0.8327	0.00144	0.00223	0.2271	0.0631	0.0238	34.286
U.K. gal/min	1.201	1	0.00173	0.002676	0.2727	0.0758	0.02859	41.176
U.S. million gal/day	694.4	578.25	1	1.547	157.7	43.8	16.53	23810
ft ³ /sec	448.83	373.7	0.646	1	101.9	28.32	10.686	15388
m ³ /sec	15850	13199	22.83	35.315	3600	1000	377.4	543447
m ³ /min	264.2	220	0.3804	0.5886	60.0	16.667	6.290	9058
m ³ /h	4.403	3.67	0.00634	0.00982	1	0.2778	0.1048	151
l/sec	15.85	13.20	0.0228	0.0353	3.60	1	0.3773	543.3
l/min	0.2642	0.220	0.000380	0.000589	0.060	0.0167	0.00629	9.055
bbl(42 gallons)/min	42	34.97	0.0605	0.09357	9.5256	2.65	1	1440
bbl(42 gallons)/day	0.0292	0.0243	0.000042	0.000065	0.00662	0.00184	0.00069	1

12. Power Equivalents

To obtain → Multiply ↓, by ↘	Horse power	Foot pound per second	Watt	Btu per hour
hp	1	550	745.7	2544
ft-lb/sec	0.00182	1	1.3558	4.626
W	0.00134	0.7376	1	3.412
Btu/h	0.00039	0.2161	0.2931	1

* Based on 1 Btu = 778.169ft · lb

1Kw 의 정의 = 860Kcal/hr = 102kg · m/s = 1KJ/s

1 영국마력(영국마력,HP): 1초 동안 550 lb 의 물체를 1ft 움직이는 힘(746W)

1 미터마력(프랑스 마력,PS):1초 동안에 75 kg 의 물체를 1m 움직이는 힘=0.9858HP

13. Conversion Factors for Thermal Conductivity, k

To obtain → Multiply ↓, by ↘	Watt/ m · °K	Cal/ (s · cm · °K)	Btu/ (h · ft · °R)	Btu · in/ (h · ft ² · °R)
W/m · °K	1	0.0022901	0.57818	6.9381
W/cm · °K	100	0.23901	57.818	693.81
W/ft · °R	5.9055	0.014114	3.4144	40.973
W/in · °R	70.866	0.16937	40.973	491.68
Cal/(s · cm · °K)	418.4	1	241.91	2902.9
Cal/(s · in · °R)	296.50	0.70866	171.43	2057.2
kcal/(h · m · °K)	1.1622	0.0027778	0.67197	8.0636
Btu/(s · ft · °R)	6226.5	14.882	3600	43200
Btu/(s · in · °R)	74717 E+4	178.58	43200	5.184 E+5
Btu · in/(s · ft ² · °R)	518.87	1.2401	300	3600
Btu/(h · ft · °R)	1.7296	0.0041338	1	12
Btu/(h · in · °R)	20.755	0.049605	12	144
Btu · in/(h · ft ² · °R)	0.14413	0.00034448	0.083333	1
lb · ft/(h · ft · °R)	0.0022241	5.3157 E-6	0.0012859	0.015431

14. Temperature Conversion Formula

* °C (Degrees Celsius)

* °F (Degrees Fahrenheit)

* K (Kelvin)

* °R (Degrees Rankine)

$$1) ^\circ\text{C} = \text{K} - 273.15, \text{K} = ^\circ\text{C} + 273.15$$

$$2) ^\circ\text{C} = (^\circ\text{F} - 32) \times 5/9, ^\circ\text{F} = ^\circ\text{C} \times 9/5 + 32$$

$$3) ^\circ\text{C} = ^\circ\text{R} \times 5/9 - 273.15, ^\circ\text{R} = ^\circ\text{C} \times 9/5 + 491.67$$

$$4) ^\circ\text{R} = ^\circ\text{F} + 459.67, ^\circ\text{F} = ^\circ\text{R} - 459.67$$

$$5) \text{K} = (^\circ\text{F} - 32) \times 5/9 + 273.15, ^\circ\text{F} = (\text{K} - 273.15) \times 9/5 + 32$$

$$6) \text{K} = ^\circ\text{R} \times 5/9, ^\circ\text{R} = \text{K} \times 9/5$$

PIPING HANDBOOK

1. DIMENSION TABLES

1.2 UNIT CONVERSION TABLE

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 7 OF 9
 DATE : DEC., 1995

15. 도량형 환산표

㉠ 부 피

단위	홉	되	말	cm ³	m ³	ℓ	in ³	ft ³	yd ³	gal(미)
홉	1	.01	0.01	180.39	0.00018	0.18039	11.0041	0.0066	0.00023	0.04765
되	10	1	0.1	1803.9	0.00180	1.8039	110.041	0.0637	0.00234	0.47656
말	100	10	1	18039	0.01803	18.039	1100.41	0.63707	0.02359	4.76567
cm ³	0.00554	0.00055	0.00005	1	0.000001	0.001	0.06102	0.00003	0.00001	0.00026
m ³	5543.52	554.325	55.4352	1000000	1	1000	61027	35.3165	1.30820	264.186
ℓ	5.51352	0.55435	0.05543	1000	0.001	1	61.027	0.03531	0.00130	0.26418
입방인치	0.09083	0.00908	0.0091	16.387	0.000016	0.01638	1	0.00057	0.00002	0.00432
입방피트	156.966	15.6666	1.56966	28316.8	0.02831	28.3169	1728	1	0.03703	7.48051
입방야드	4238.09	423.809	42.3809	764511	0.76451	764.511	46656	27	1	201.974
Gal(미)	20.9833	2.0983	0.20983	3785.43	0.00378	3.78543	231	0.16368	0.00495	1

㉡ 넓 이

단 위	평방자	평	단 보	정 보	평방미터	아 르	평방피트	평방야드	에 이 커
1 평방자	1	0.02778	0.00009	0.000009	0.09182	0.00091	0.98841	0.10982	
1 평	36	1	0.00333	0.00033	3.3058	0.03305	35.583	3.9537	0.00081
1 단보	10800	300	1	0.1	991.74	9.9174	10674.9	1186.1	0.24506
1 정보	108000	3000	10	1	9917.4	99.174	106794	11861	2.4506
1	10.89	0.3025	0.001008	0.0001	1	0.01	10.764	1.1958	0.00024
1a	1089	30.25	0.10083	0.01008	100	1	1076.4	119.58	0.02471
1ft ²	1.0117	0.0281	0.00009	0.000009	0.092903	0.000929	1	0.1111	0.000022
1yd ²	9.1055	0.25293	0.00084	0.00008	0.83613	0.00836	9	1	0.000207
1acre	44071.2	1224.2	4.0806	0.40806	4046.8	40.468	43560	4840	1

PIPING HANDBOOK

1. DIMENSION TABLES

1.2 UNIT CONVERSION TABLE

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 8 OF 9
 DATE : DEC., 1995

㉔ 길 이

단위	센티미터	미터	인치	피트	야드	마일	자	간	정	리
1 Cm	1	0.01	0.3937	0.0328	0.0109		0.033	0.0055	0.00009	
1 m	100	1	39.37	3.2808	1.0936	0.0006	3.3	0.55	0.00917	0.00025
1 인치	2.54	0.0254	1	0.0833	0.0278		0.0838	0.0140	0.0002	
1 피트	30.48	0.3048	12	1	0.3333	0.00019	1.0058	0.1676	0.0028	
1 야드	91.438	0.9144	36	3	1	0.0006	3.0175	0.5029	0.0083	0.002
1 마일	160930	1609.3	63360	5280	1760	1	5310.8	885.12	14.752	0.4098
1 尺	30.303	0.303	11.93	0.9942	0.3314	0.0002	1	0.1667	0.0028	0.00008
1 間	181.818	1.818	71.582	5.65	1.9884	0.0011	6	1	0.0167	0.0005
1 町	10909	109.091	4294.9	357.91	119.304	0.0678	360	60	1	0.0278
1 里	392727	3927.27	154619	12885	4295	2.4403	12960	2160	36	1

㉔ 무 계

단위	그램	킬로그램	톤	그레인	온스	파운드	돈	근	관
1 g	1	0.001	0.000001	15.432	0.03527	0.0022	0.26666	0.00166	0.00026
1 kg	1000	1	0.001	15432	35.273	2.20459	266.666	1.6666	0.26666
1 t	1000000	1000	1		35273	2204.59	266666	1666.6	266.666
1 그레	0.06479	0.00006		1	0.00228	0.00014	0.01728	0.000108	0.00007
1 온스	28.3495	0.02835	0.000028	437.4	1	0.0625	7.56	0.0473	0.00756
1 파운드	453.592	0.45359	0.00045	7000	16	1	120.96	0.756	0.12096
1 돈	3.75	0.00375	0.000004	57.872	0.1323	0.00827	1	0.00625	0.001
1 근	600	0.6	0.0006	9259.556	21.1647	1.322799	160	1	0.16
1 관	3750	3.75	0.000375	57872	132.28	8.2672	1000	6.25	1

16. 석유제품 단위 환산표

KI	Drum	Gallon	Barrel
1	5	246.178	6.29
2	10	528.356	12.58
3	15	792.534	18.78
4	20	1,056.712	25.16
5	25	1,320.590	31.45

Drum	KI	Gallon	Barrel
1	0.2	52.835	1.25799
2	0.4	105.670	2.5160
3	0.6	158.505	3.774
4	0.8	211.340	5.032
5	1.0	264.175	6.290

Barrel	Drum	KI	Gallon
1	0.79492	0.15898	42
2	1.5898	0.3180	84
3	2.3848	0.4770	126
4	3.1797	0.6359	168
5	3.9746	0.7949	210

Gallon	Drum	KI	Barrel
1	0.18926	0.03785	0.238
2	0.3785	0.0757	0.476
3	0.5678	0.1136	0.714
4	0.7570	0.1514	0.952
5	0.9463	0.1893	1.190

* 제품별 환산사례

1) Propane(Ton-BPCD)

1kg = 1.9685Liter

Ton/Mon. x 1.9685 x 6.29/D-BPCD

12.38Ton/Mon. = 1BPCD

2) Butane(Ton-BPCD)

1kg = 1.7301Liter

Ton/Mon. x 1.7301 x 6.29/D-BPCD

10.88Ton/Mon. = 1BPCD

3) Mogas, Kero, Diesel, B-C(KI-BPCD)

1KI x 6.29/D = BPCD

1,000Dm/Mon.= 200KI/Mon. = 42BPCD

4) Asphalt 1kg = 0.96478Liter

(D : 해당월 일수)

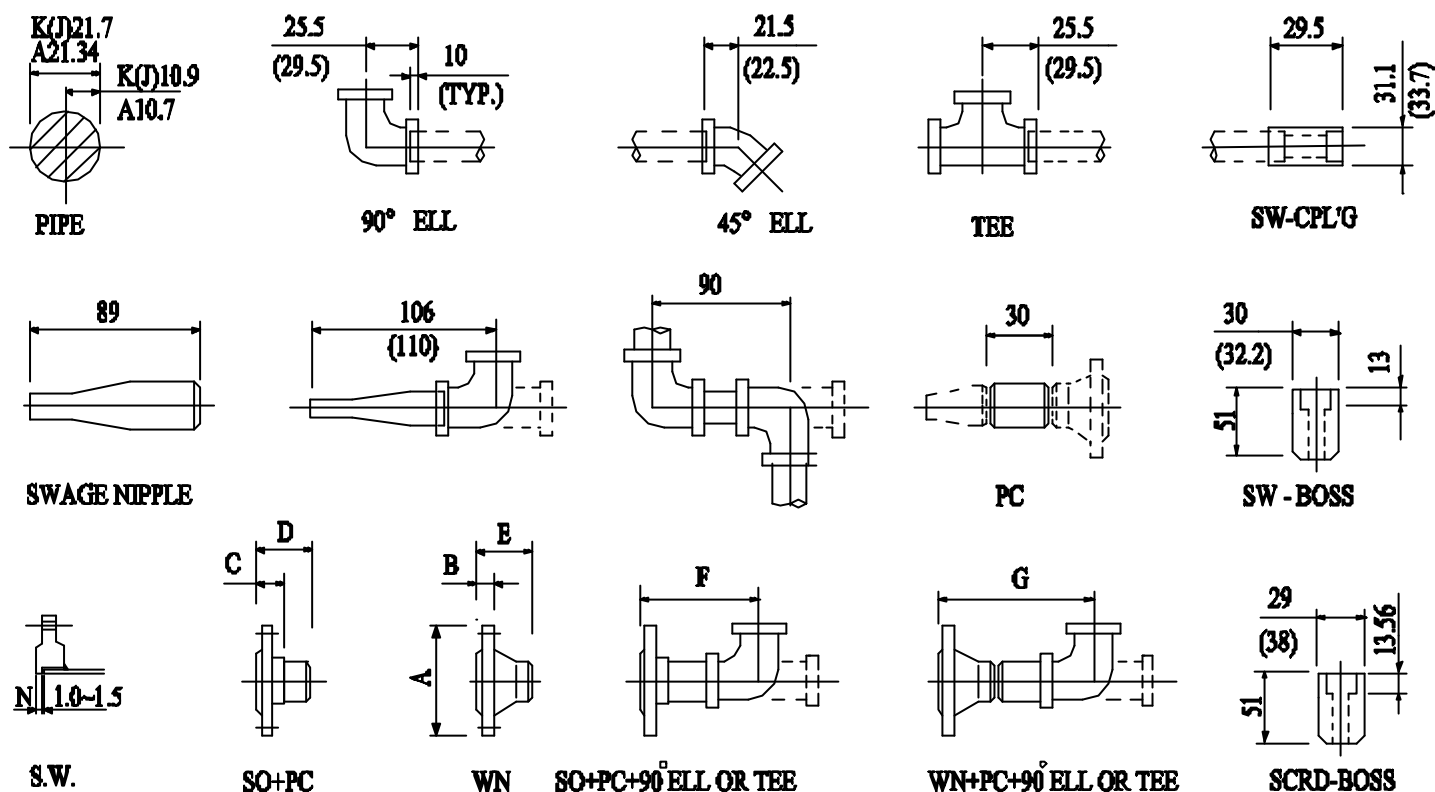
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
1/2"(15mm)-SW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 1 OF 74

DATE : DEC. 1995



* UPPER DIMENSION = SCH40,80 / 3000LB * () DIMENSION = SCH160 / 6000LB

(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	95	95	115	89	95.3	95.3	95.3	95.3	121	121	133
B	12	14	18	11.2	14.2	20.6	19.8	19.8	28.7	28.7	36.6
C	12	20	26	15.7	22.4	28.7					
D	42	50	56	46	52	59					
E			45	47.8	52.3	58.7	57.9	57.9	66.8	66.8	79.5
F	90	100	110	100	100	110					
G			130	130	140	140	140	140	150	150	160
N				6.1	12.7	19.1					
RING NO.							R11	R11	R12	R12	R13
FL'G SPACE							3.0	3.0	4.1	4.1	4.1

VALVE**API 602 (800 LB)****JPI - 7S - 36 - 75 (600 LB)****MANUFACTURER'S STD****BOLTED BONNET****SCREWED BONNET**

GATE	GLOBE	CHECK	GATE	GLOBE	CHECK	GATE	GLOBE	CHECK

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****1/2"(15mm)-SW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 2 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 21.34 mm OUTSIDE SURFACE = 0.07 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm)							
5S	1.65	18.03	1.02	0.498	0.70	0.465	0.82	0.26
10S	2.11	17.12	1.27	0.596	0.68	0.558	1.00	0.23
STD 40 40S	2.77	15.80	1.62	0.711	0.66	0.664	1.27	0.20
XS 80 80S	3.73	13.87	2.07	0.836	0.64	0.780	1.62	0.15
160	4.78	11.84	2.48	0.921	0.61	0.861	1.95	0.11
XXS	7.47	6.40	3.25	1.009	0.56	0.941	2.55	0.03

2. FITTING WEIGHT (Kg)-SW

LB.	90° ELL.	45° ELL.	TEE					SWG. NIPPLE	COUPL.	BOSS	CAP	
			FULL									
3000	0.23	0.28	0.17						0.12	0.24	0.10	
6000	0.43	0.40	0.62						0.17	0.45	0.16	
9000	0.51	0.88	0.78						0.27	-	0.26	

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	0.5	0.6	0.9	1.8	1.8	3.2
W.N	0.5	0.8	0.9	2.1	2.1	3.2
BLIND	0.5	0.6	0.9	1.9	1.9	3.2

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#FLGD	300#FLGD	600#		800#SW	1500#		2500#SW
			FLGD	SW		FLGD	SW	
GATE	2.9	3.6	3.8	2.1	2.1	7.8	3.8	3.9
GLOBE	3.1	3.9	3.9	2.3	2.0	8.4	4.4	4.1
BALL	2.1	2.7		0.2	0.5			1.8
CHECK	2.4	3	3.1	1.6	1.5	7.7	3.2	1.8

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL. SHEET (0.3t) (2699Kg/m²)

* WEIGHT IN () = COVER MATL. WEIGHT

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

UNIT : kg/m												
THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	
WEIGHT (Kg)	0.7 (0.3)	0.9 (0.3)	1.5 (0.4)	2.2 (0.4)	3.4 (0.5)	4.4 (0.6)	7.3	11	15.5	20.7	26.7	

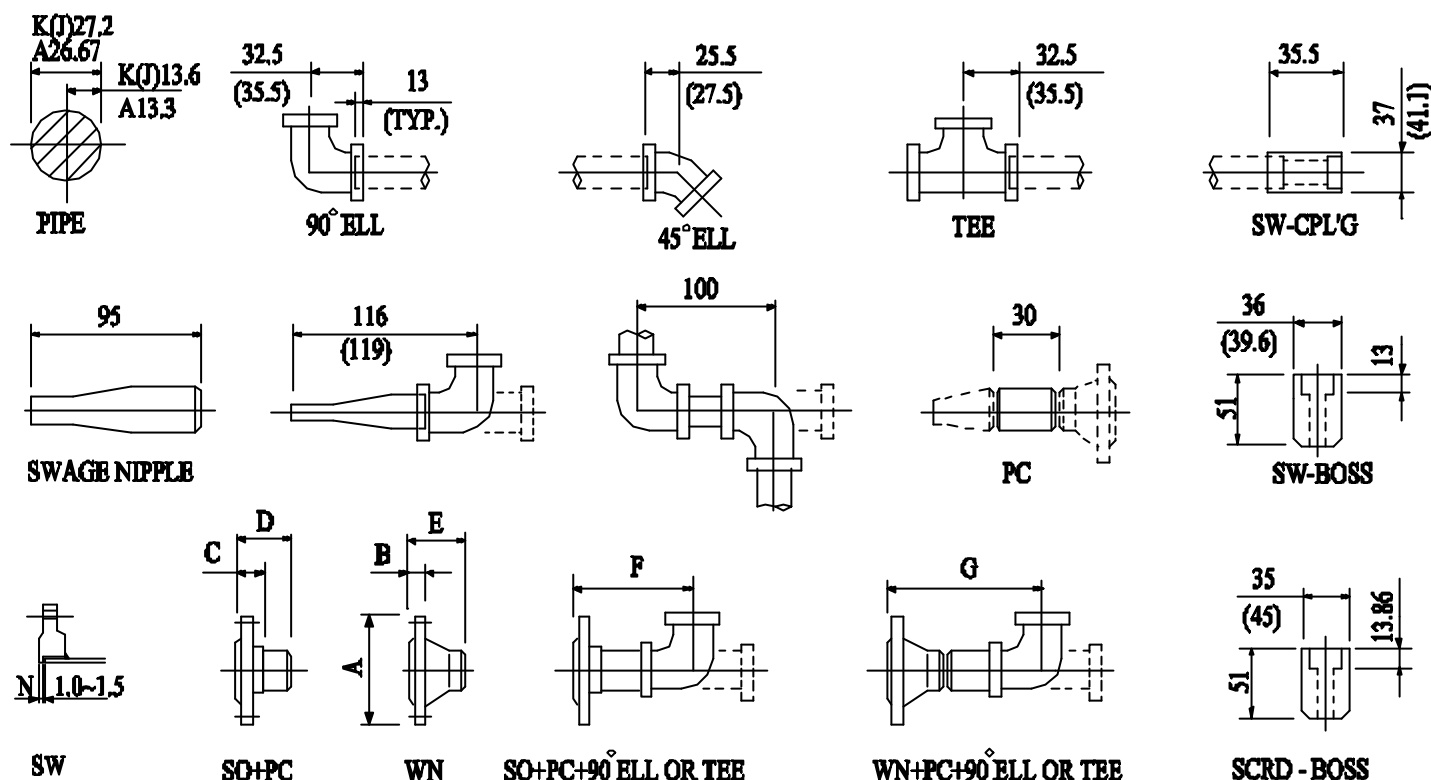
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
3/4"(20mm)-SW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 3 OF 74

DATE : DEC. 1995



* UPPER DIMENSION = SCH40,80/3000LB * () DIMENSION = SCH160/6000LB

(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	100	100	120	99	117	117	117	117	130	130	140
B	14	16	18	12.7	15.7	22.1	22.1	22.1	31.8	31.8	38.1
C	14	22	28	15.7	25.4	31.8					
D	44	52	58	46	55	62					
E			45	52.3	57.2	63.5	63.5	63.5	76.2	76.2	85.6
F	100	110	110	100	110	120					
G			130	140	140	150	150	150	160	160	170
N				4.6	14.2	20.6					
RING NO.							R13	R13	R14	R14	R16
FL'G SPACE							4.1	4.1	4.1	4.1	4.1

VALVE

API 602 (800 LB)			JPI - 7S - 36 - 75 (600 LB)					
MANUFACTURER'S STD			BOLTED BONNET			SCREWED BONNET		
GATE	GLOBE	CHECK	GATE	GLOBE	CHECK	GATE	GLOBE	CHECK

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
3/4"(20mm)-SW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 4 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D= 26.67 mm OUTSIDE SURFACE = 0.08 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) :							
5S	1.65	23.37	1.30	1.020	0.89	0.765	1.04	0.43
10S	2.11	22.45	1.63	1.236	0.87	0.927	1.31	0.39
STD 40 40S	2.87	20.93	2.15	1.542	0.85	1.156	1.71	0.34
XS 80 80S	3.91	18.85	2.80	1.864	0.82	1.398	2.24	0.27
160	5.56	15.60	3.68	2.193	0.77	1.645	2.90	0.19
XXS	7.82	11.02	4.63	2.411	0.72	1.808	3.64	0.09

2. FITTING WEIGHT (Kg)-SW

LB.	90 ° ELL.	45 ° ELL.	TEE					SWG. NIPPLE	COUPL.	BOSS	CAP	
			FULL									
3000	0.31	0.40	0.40						0.18	0.28	0.18	
6000	0.65	0.60	0.91						0.25	0.52	0.22	
9000	0.78	1.37	1.33						0.33	-	0.32	

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	0.6	1.2	1.4	2.4	2.3	4.1
W.N	0.7	1.3	1.6	2.7	2.7	4.1
BLIND	0.6	1.2	1.4	2.7	2.7	4.5

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#FLGD	300#FLGD	600#		800#SW	1500#		2500#SW
			FLGD	SW		FLGD	SW	
GATE	3.5	4.9	5.4	3.8	2.2	9.1	3.8	9.5
GLOBE	3.6	5.2	4.9	3.9	2.3	8.6	4.3	10.3
BALL	2.7	4.0		0.2	0.8	-	2.3	
CHECK	2.9	4.5	4.4	2.9	1.6	9.5	3.1	4.1

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE(192Kg/m³)COVER MATERIAL : AL SHEET (0.3t)(2699Kg/m³)

UNIT : kg/m

* WEIGHT IN () - COVER MAT'L WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	0.8 (0.3)	1.0 (0.3)	1.6 (0.4)	2.3 (0.5)	3.6 (0.6)	4.6 (0.6)	7.6	11.4	16	21.3	27.3

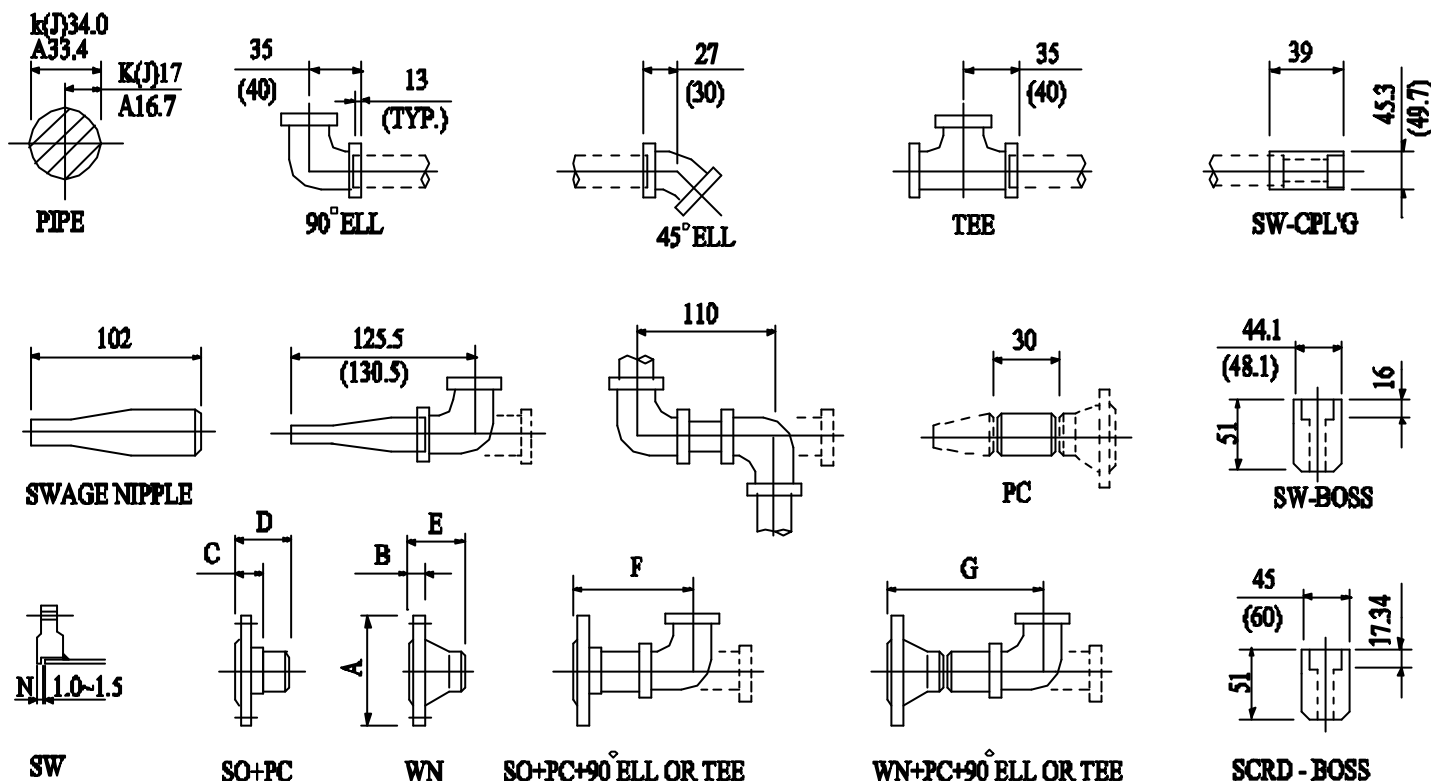
$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
1"(25mm)-SW****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 5 OF 74****DATE : DEC. 1995**

* UPPER DIMENSION = SCH40, 80/3000LB * () DIMENSION = SCH160/6000LB

(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	125	125	130	108	124	124	124	124	149	149	159
B	14	16	20	14.2	17.5	23.9	23.9	23.9	35.8	35.8	41.4
C	14	24	30	17.5	26.9	33.3					
D	44	54	60	48	57	63					
E			48	55.6	62	68.3	68.3	68.3	79.5	79.5	95.3
F	110	120	120	110	120	130					
G			140	150	160	160	160	160	170	170	190
N				4.8	14.2	20.6					
RING NO.							R16	R16	R16	R16	R18
FL'G SPACE							4.1	4.1	4.1	4.1	4.1

VALVE

API 602 (800 LB)			JPI - 7S - 36 - 75 (600 LB)					
MANUFACTURER'S STD			BOLTED BONNET			SCREWED BONNET		
GATE	GLOBE	CHECK	GATE	GLOBE	CHECK	GATE	GLOBE	CHECK

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
1"(25mm)-SW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 6 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 33.4 mm		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
OUTSIDE SURFACE	m ² /M							
SCH.	THK (mm) t							
5S	1.65	30.10	1.65	2.08	1.12	1.25	1.33	0.71
10S	2.77	27.86	2.66	3.15	1.09	1.89	2.13	0.61
STD 40 40S	3.38	26.64	3.19	3.64	1.07	2.18	2.55	0.56
XS 80 80S	4.55	24.31	4.12	4.40	1.03	2.63	3.29	0.46
160	6.35	20.70	5.40	5.21	0.98	3.12	4.24	0.34
XXS	9.09	15.21	6.94	5.85	0.92	3.50	5.45	0.18

2. FITTING WEIGHT (Kg)-SW

LB.	90 ° ELL.	45 ° ELL.	TEE					SWG. NIPPLE	COUPL.	BOSS	CAP	
			FULL									
3000	0.60	0.62	0.62						0.26	0.41	0.24	
6000	1.02	0.94	1.50						0.42	0.73	0.38	
9000	1.22	1.73	1.88						0.52	-	0.52	

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	0.9	1.4	1.7	3.4	3.4	5.4
W.N	1.1	1.6	1.9	3.9	3.9	5.4
BLIND	0.9	1.4	1.8	4.1	4.1	5.4

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#FLGD	300#FLGD	600#		800#SW	1500#		2500#SW
			FLGD	SW		FLGD	SW	
GATE	5.5	7	7.8	5.5	3.8	15.7	8.2	9.1
GLOBE	5.4	7.1	7.7	3.9	3.9	16.9	9.3	10.1
BALL	3.7	5.2		0.4	1.5		4.1	
CHECK	4.6	6.2	6.9	7.9	2.8	16.3	8.4	4.1

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATL : AL SHEET (0.3t) (2699Kg/m³)

* WEIGHT IN () = COVER MATL WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	0.9 (0.3)	1.1 (0.3)	1.8 (0.4)	2.5 (0.5)	3.9 (0.6)	4.9 (0.6)	8.0	11.9	16.6	22.0	28.2

 $W_p = 0.02466(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$

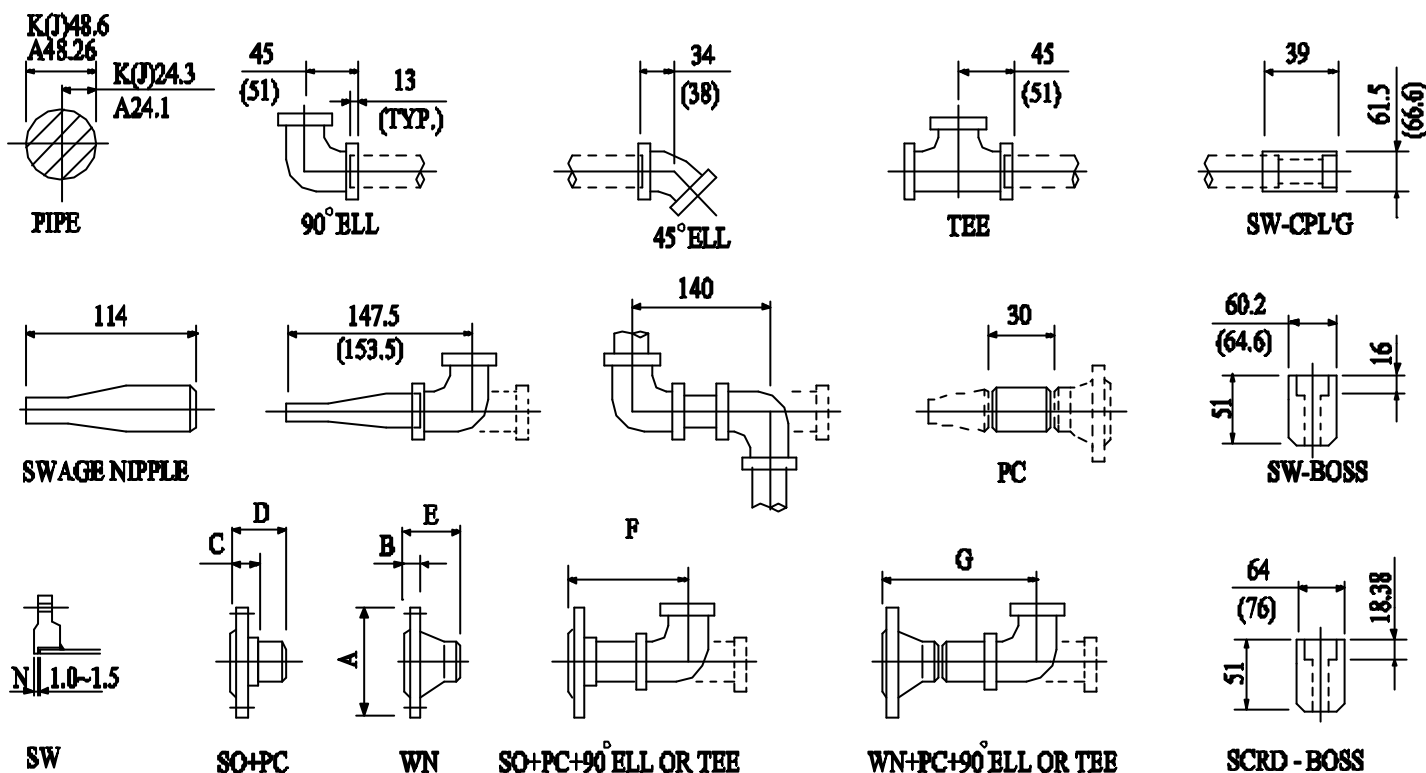
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
1-1/2"(40mm)-SW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 7 OF 74

DATE : DEC. 1995



* UPPER DIMENSION = SCH40,80/3000LB * () DIMENSION = SCH160/6000LB

(UNIT : mm)

RATING NO.	KS . JIS			ASME , JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	140	140	160	127	155	155	155	155	178	178	203
B	16	18	22	17.5	20.6	28.7	26.9	28.7	38.1	38.1	52.4
C	16	26	34	22.4	30.2	38.1					
D	46	56	64	52	60	68					
E			54	62	68.3	76.2	74.7	76.2	88.9	88.9	119.2
F	120	130	140	130	130	140					
G			160	170	170	180	180	180	190	190	220
N				6.6	14.5	22.4					
RING NO.							R20	R20	R20	R20	R23
FL'G SPACE							4.1	4.1	4.1	4.1	3.0

VALVE

API 602 (800 LB)

JPI - 7S - 36 - 75 (600 LB)

MANUFACTURER'S STD**BOLTED BONNET****SCREWED BONNET**

GATE	GLOBE	CHECK	GATE	GLOBE	CHECK	GATE	GLOBE	CHECK

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****1-1/2"(40mm)-SW****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 8 OF 74****DATE : DEC. 1995****1. PIPE DATA****(ASME B36.10M, ASME B36.19M)**

D= 48.26 mm		INSIDE DIA d (mm)	METAL SECTION AREA :A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
OUTSIDE SURFACE	=0.13 m ² /M							
SCH.	THK (mm)							
5S	1.65	44.96	2.42	6.57	1.65	2.72	1.95	1.54
10S	2.77	42.72	3.96	10.27	1.61	4.26	3.17	1.43
STD 40 40S	3.68	40.89	5.16	12.9	1.58	5.35	4.13	1.31
XS 80 80S	5.08	38.10	6.89	16.28	1.54	6.75	5.51	1.14
160	7.14	33.99	9.22	20.08	1.48	8.32	7.25	0.51
XXS	10.15	27.94	12.16	23.64	1.39	9.80	9.56	0.51

2. FITTING WEIGHT (Kg)-SW

LB.	90 ° ELL.	45 ° ELL.	TEE				SWG. NIPPLE	COUPL.	BOSS	CAP	
			FULL								
3000	0.85	0.72	1.13					0.47	0.63	0.61	
6000	2.38	1.98	2.95					0.67	1.12	0.74	
9000	2.98	5.06	3.69					0.94	-	1.44	

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	1.4	2.5	3.1	5.5	5.5	11.0
W.N	1.8	3.1	3.6	5.9	5.9	11.4
BLIND	1.6	2.7	3.4	5.9	5.9	10.4

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#FLGD	300#FLGD	600#		800#SW	1500#		2500#SW
			F	S		F	S	
GATE	10.4	13.2	13.6	8.0	7.3	22.0	12.2	29.8
GLOBE	11.3	13.6	15.2	13.8	9.2	24.9	15.6	31.2
BALL				0.5	3.0		8.2	
CHECK	9.4	12.7	14.2	11.7	7.7	17.0	13.4	16.3

5. INS. WEIGHT**MATERIAL : PERLITE MOLDED PIPE (192kg/m³)****COVER MATERIAL : AL SHEET (0.30)(2699Kg/m³)***** WEIGHT IN () = COVER MAT'L WEIGHT****Wp = 0.02466(D-t)****Ww = 0.0007854d²****A = 0.007854(D² - d²)****I = 0.000004909 x (D⁴ - d⁴)****Z = 0.00009817 x $\frac{D^4 - d^4}{D}$**

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	1.1 (0.3)	1.4 (0.4)	2.1 (0.5)	3.0 (0.5)	4.4 (0.6)	5.6 (0.7)	8.9	13.1	17.9	23.6	30.0

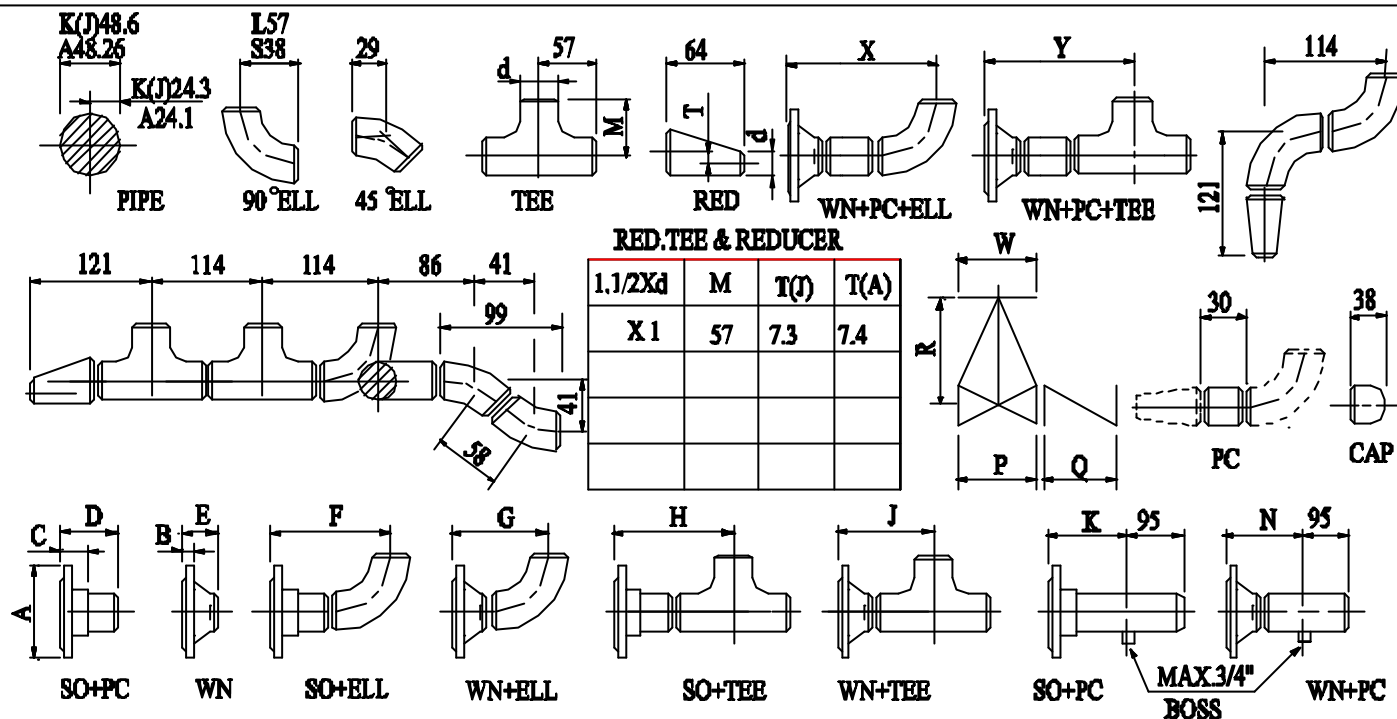
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
1-1/2"(40mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 9 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	140	140	160	127	155	155	155	155	178	178	203
B	16	18	22	17.5	20.6	28.7	26.9	28.7	38.1	38.1	52.4
C	16	26	34	22.4	30.2	38.1					
D	46	56	64	52	60	68					
E			54	62	68.3	76.2	74.7	76.2	88.9	88.9	119.2
F	103	113	121	109	117	125					
G			111	119	125	133	132	133	146	146	176
H	123	133	141	129	137	145					
J			111	119	125	133	132	133	146	146	176
K	110	120	130	120	125	140					
N			150	160	165	170	170	170	185	185	215
X											
Y											
RING NO.							R20	R20	R20	R20	R23
FL/G SPACE							4.1	4.1	4.1	4.1	3.0
GATE	P	163 (165)	190		165	191	241	203	241	305	387
	R				442	442	432	442	432	541	541
	W				254	254	203	254	203	254	254
GLOBE	P	163 (190)	229		165	229	241	241	241	305	387
	R					397	448	397	448		
	W					203	203	203	203		
CHECK	Q	163 (190)	241		165	241	241	254	241	305	387

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
1-1/2"(40mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 10 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 48.26 mm OUTSIDE SURFACE = 0.15 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	1.65	44.96	2.42	6.5	1.65	2.7	1.95	1.59
10S	2.77	42.72	3.96	10	1.61	4.3	3.17	1.43
STD 40 40S	3.68	40.89	5.16	13	1.58	5.3	4.13	1.31
XS 80 80S	5.08	38.10	6.89	16	1.54	6.7	5.51	1.14
160	7.14	33.99	9.22	20	1.48	8.3	7.25	0.91
XXS	10.15	27.94	12.16	24	1.39	9.8	9.56	0.61

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 1	x 3/4		x 1	x 3/4			
5S	0.17	0.09	0.28	0.26	0.24		0.11	0.10			0.08
10S	0.28	0.14	0.46	0.42	0.40		0.17	0.15			0.13
STD 40 40S	0.37	0.19	0.61	0.56	0.53		0.22	0.21			0.17
XS 80 80S	0.50	0.25	0.81	0.74	0.70		0.30	0.27			0.24
160	0.65	0.33					0.38	0.35			0.35
XXS	0.93	0.47					0.50	0.45			0.50

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	1.4	2.5	3.1	5.5	5.5	11.0
W.N	1.8	3.1	3.6	5.9	5.9	11.4
BLIND	1.6	2.7	3.4	5.9	5.9	10.4

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	10.4	13.2	13.6		22.0	
GLOBE	11.3	13.6	15.2		24.9	
BALL						
CHECK	9.4	12.7	14.2		17.0	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)
COVER MATERIAL : AL SHEET (0.3)(2699Kg/m³)

* WEIGHT IN () = COVER MATL WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	1.1 (0.3)	1.4 (0.4)	2.1 (0.5)	3.0 (0.5)	4.4 (0.6)	5.6 (0.7)	8.9	13.1	17.9	23.6	30.0

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007834d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

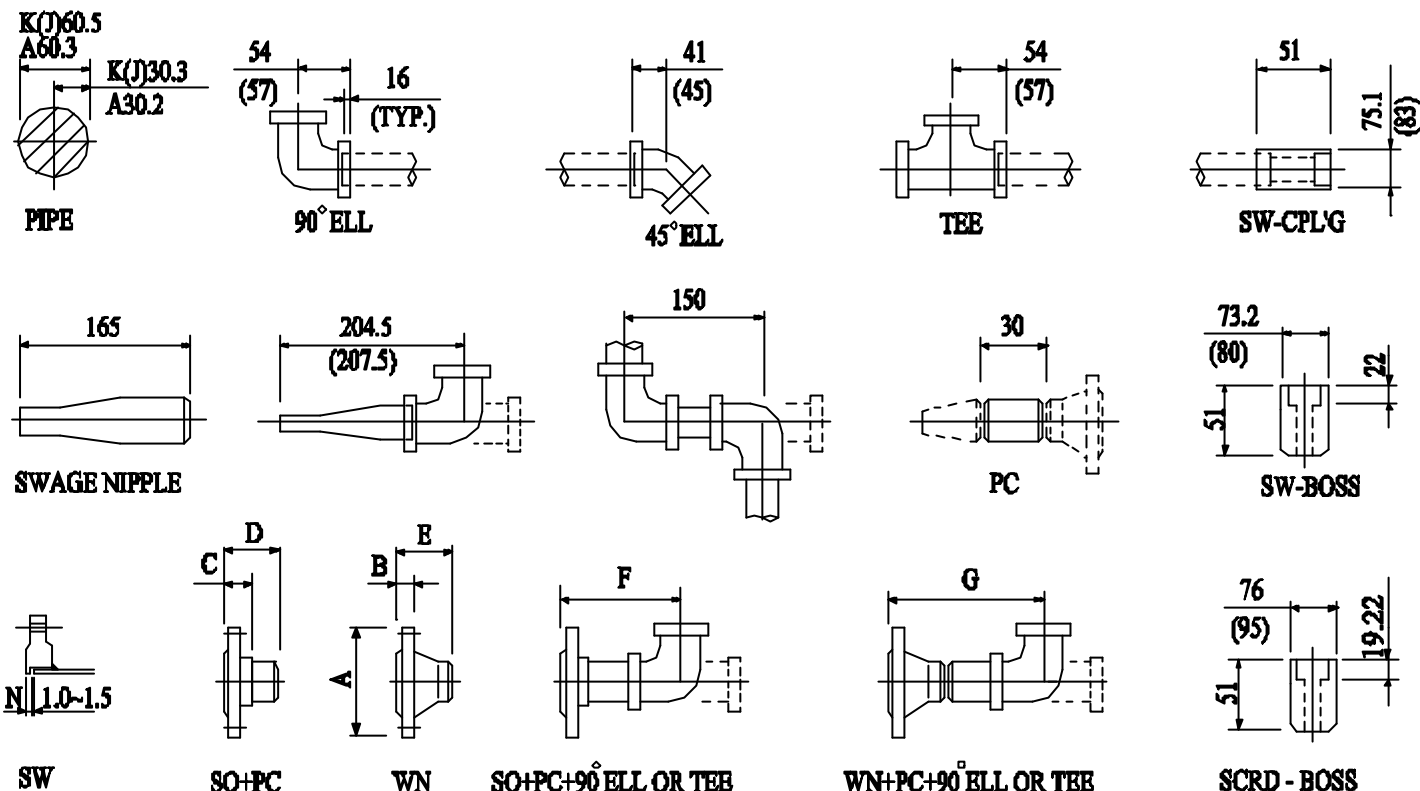
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
2"(50mm)-SW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 11 OF 74

DATE : DEC. 1995



* UPPER DIMENSION = SCH40,80/3000LB * () DIMENSION = SCH160/6000LB

(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	155	155	165	152	165	165	165	165	216	216	235
B	16	18	22	19.1	22.4	31.8	30.3	33.3	46	46	58.7
C	16	26	36	25.4	33.3	42.9					
D	46	56	66	55	63	73					
E			57	63.5	69.9	79.5	77.8	81.1	109.5	109.5	134.9
F	130	140	150	140	140	160					
G			170	180	180	190	190	190	220	220	250
N				7.9	15.7	25.4					
RING NO.							R23	R23	R24	R24	R26
FL'G SPACE							5.6	4.8	3.0	3.0	3.0

VALVE

API 602 (800 LB)			JPI - 7S - 36 - 75 (600 LB)					
MANUFACTURER'S STD			BOLTED BONNET			SCREWED BONNET		
GATE	GLOBE	CHECK	GATE	GLOBE	CHECK	GATE	GLOBE	CHECK

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
2"(50mm)-SW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 12 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 60.33 mm		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
OUTSIDE SURFACE	= 0.19 m ² /M							
SCHL	THK (mm) :							
5S	1.65	57.02	3.04	13	2.08	4.3	2.44	2.55
10S	2.77	54.79	5.01	21	2.04	6.9	4.01	2.36
STD 40 40S	3.91	52.50	6.93	28	2.00	9.2	5.54	2.17
XS 80 80S	5.54	49.25	9.53	36	1.95	11.9	7.63	1.91
160	8.74	42.90	14.13	48	1.85	16.0	11.11	1.45
XXS	11.07	38.18	17.14	55	1.78	18.1	13.45	1.15

2. FITTING WEIGHT (Kg) -SW

LB.	90° ELL.	45° ELL.	TEE				SWG. NIPPLE	COUPL.	BOSS	CAP	
			FULL								
3000	1.47	1.27	1.70					0.81	1.09	0.88	
6000	3.76	4.00	3.70					1.24	1.82	1.29	
9000	4.70	6.40	4.63					1.55	-	1.69	

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	2.3	2.8	3.6	10.0	10.5	17.3
W.N	2.6	3.4	4.5	10.9	10.9	19.1
BLIND	2.6	3.1	4.4	11.3	11.3	17.7

4. VALVE WEIGHT (Kg) (CAST : CRANE BALL : KPC (FULL BORE))

	150#FLGD	300#FLGD	600#		800#SW	1500#		2500#SW
			FLGD	SW		FLGD	SW	
GATE	14.4	18.0	18.5	10.4	9.9	42.7	21.9	29.7
GLOBE	17.2	20.0	20.1	13.8	13.6	50.7	28.0	31.2
BALL	10.8	15.5		1.0	5.0		12.5	
CHECK	15.0	17.2	19	21.5	11.8	36.9	24.7	15.1

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)
COVER MATERIAL : AL SHEET (0.3) (2699Kg/m³)

* WEIGHT IN () - COVER MAT'L WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	1.3 (0.4)	1.6 (0.4)	2.4 (0.5)	3.3 (0.6)	4.9 (0.7)	6.1 (0.7)	9.7	14.0	19.0	24.8	31.4

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.00004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

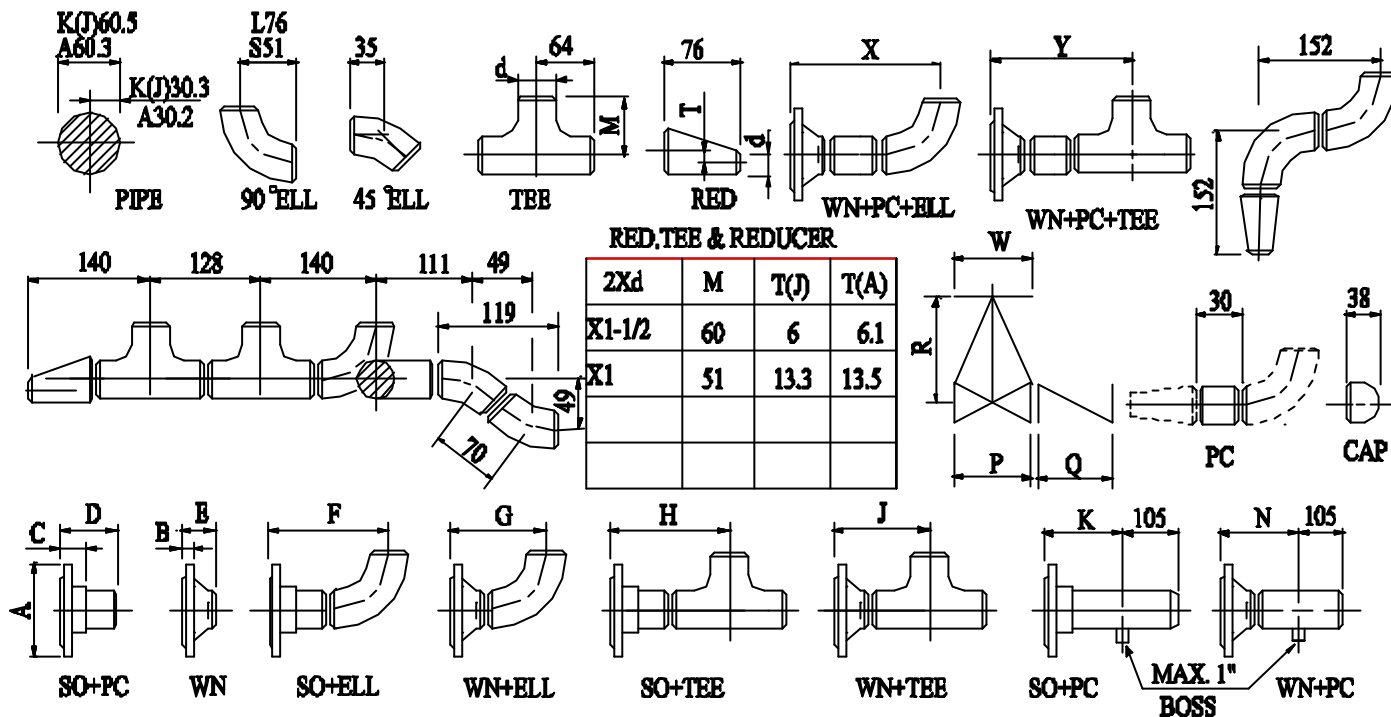
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****2"(50mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 13 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	KS, JIS			ASME, JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	155	155	165	152	165	165	165	165	216	216	235
B	16	18	22	19.1	22.4	31.8	30.3	33.3	46	46	58.7
C	16	26	36	25.4	33.3	42.9					
D	46	56	66	55	63	73					
E			57	63.5	69.9	79.5	77.8	81.1	109.5	109.5	134.9
F	122	132	142	131	139	149					
G			133	140	146	156	154	157	SEE "X"		
H	130	140	150	139	147	157					
J			121	128	134	144	SEE "Y"				
K	120	130	140	130	140	145					
N			160	170	175	185	185	185	215	215	240
X									216	216	241
Y							172	175	204	204	229
RING NO.							R23	R23	R24	R24	R26
FL'G SPACE							5.6	4.8	3.0	3.0	3.0
GATE	P	178 (180)	216	178	216	292	232	295	371	371	454
	R			451	451	451	451	451	642	642	
	W			254	254	203	254	203	254	254	
GLOBE	P	203 (200)	267	203	267	292	283	295	371	371	454
	R			400	362	495	362	495			
	W			203	203	254	203	254			
CHECK	Q	203 (200)	267	203	267	292	283	295	371	371	454

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****2"(50mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 14 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 60.33 mm OUTSIDE SURFACE = 0.19 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
SS	1.65	57.02	3.04	13	2.08	4.3	2.44	2.55
10S	2.77	54.79	5.01	21	2.04	6.9	4.01	2.36
STD 40 40S	3.91	52.50	6.93	28	2.00	9.2	5.54	2.17
XS 80 80S	5.54	49.25	9.53	36	1.95	11.9	7.63	1.91
160	8.74	42.90	14.13	48	1.85	16.0	11.11	1.45
XXS	11.07	38.18	17.14	55	1.78	18.1	13.45	1.15

2. FITTING WEIGHT

(Kg)-BW

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 1	x 3/4		x 1	x 3/4			
SS	0.29	0.14	0.38	0.36	0.33		0.16	0.14			0.10
10S	0.47	0.24	0.63	0.59	0.54		0.27	0.23			0.17
STD 40 40S	0.66	0.33	0.88	0.82	0.75		0.38	0.33			0.24
XS 80 80S	0.90	0.45	1.20	1.11	1.01		0.51	0.44			0.33
160	1.33	0.67	1.78	1.63			0.75	0.64			0.54
XXS	1.69	0.85	2.17	2.01			0.91	0.77			0.68

3. FLANGE WEIGHT

(Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	2.3	2.8	3.6	10.0	10.5	17.3
W.N	2.6	3.4	4.5	10.9	10.9	19.1
BLIND	2.6	3.1	4.4	11.3	11.3	17.7

4. VALVE WEIGHT

(Kg) (CAST : CRANE BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATB	20.9	33.6	38.1	95.3	95.3	
GLOBE	21.3	27.2	39.9	87.1	86.2	
BALL	10.0	16.2	54.0		74.0	
CHECK	15.0	20.9	28.1	68.0	68.0	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE(192Kg/m³)COVER MATERIAL : AL SHEET(0.30)(2699Kg/m³)

UNIT : kg/m

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	1.3 (0.3)	1.6 (0.4)	2.4 (0.5)	3.3 (0.5)	4.9 (0.6)	6.1 (0.7)	9.7	14.0	19.0	24.8	31.4

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.00004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^3 - d^3}{D}$$

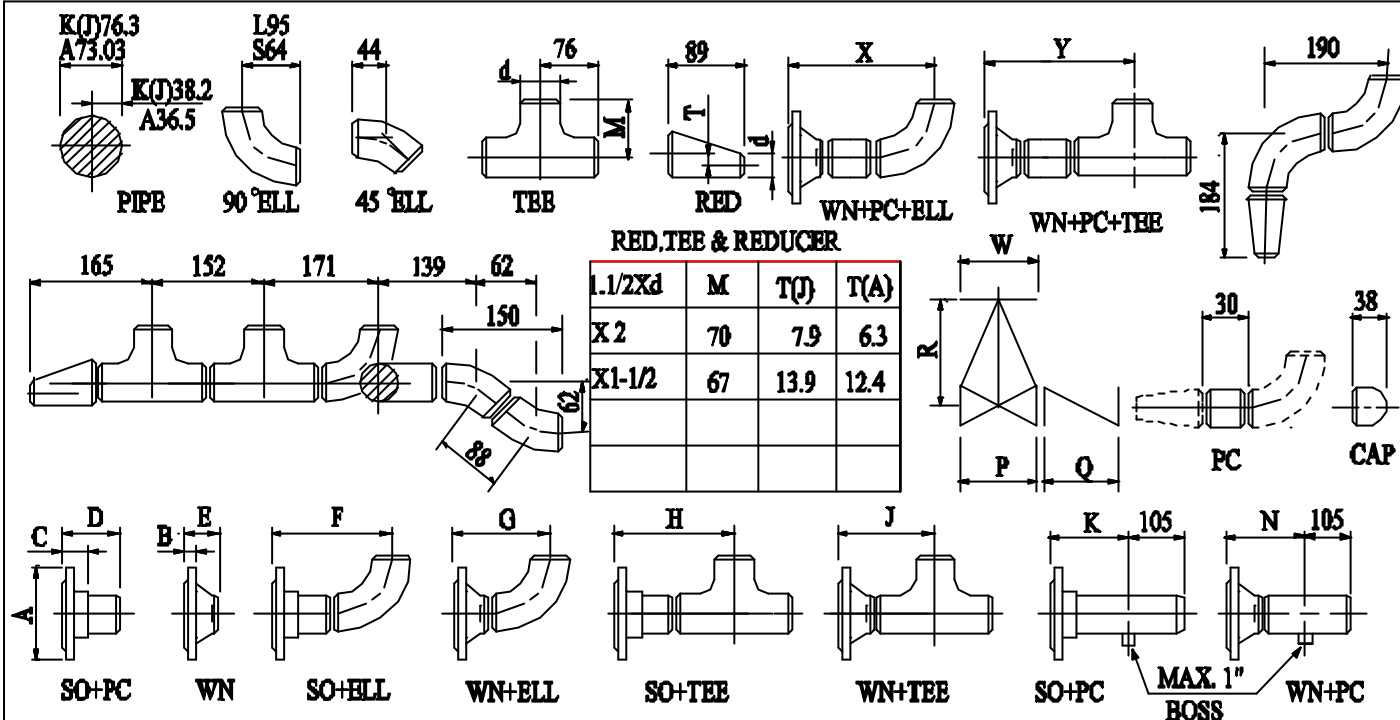
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
2-1/2"(65mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 15 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	175	175	200	178	191	191	191	191	244	244	267
B	18	20	26	22.4	25.4	34.8	33.3	36.4	49.1	49.1	66.7
C	18	30	40	28.4	38.1	47.5					
D	48	60	70	58	68	78					
E			69	69.9	76.2	85.6	84.1	87.2	112.6	112.6	152.3
F	143	155	165	153	163	173					
G			164	165	171	181	179	182	208	208	247
H	144	156	166	154	164	174					
J			SEE "Y"	146	152	162	SEE "Y"				
K	125	135	145	135	145	155					
N			175	175	180	190	190	195	220	220	260
X											
Y			175				190	193	219	219	258
RING NO.							R26	R26	R27	R27	R28
FL'G SPACE							5.6	4.8	3.0	3.0	3.0
GATE	P	190 (190)	241		191	241	330	257	333	422	514
	R				491	491	559	491	559	705	705
	W				254	254	254	254	254	356	356
GLOBE	P	216 (220)	292		216	292	330	308	333	422	514
	R				498	394	537	394	537		
	W				254	254	254	254	254		
CHECK	Q	216 (220)	292		216	292	330	308	333	422	514

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
2-1/2"(65mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 16 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D= 73.03 mm OUTSIDE SURFACE = 0.23 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm)							
5S	2.11	68.81	4.69	29	2.51	8.1	3.77	3.72
10S	3.05	66.93	6.70	41	2.48	11.3	5.36	3.52
STD 40 40S	5.16	62.71	10.99	64	2.41	17.4	8.81	3.09
XS 80 80S	7.01	59.00	14.54	80	2.35	21.9	11.64	2.73
160	9.53	53.97	19.00	98	2.27	26.8	14.92	2.29
XXS	14.02	44.98	25.99	119	2.14	32.7	20.40	1.59

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 2	x 1-1/2		x 2	x 1-1/2			
5S	0.57	0.28	0.73	0.66	0.63		0.30	0.27			0.16
10S	0.81	0.40	1.03	0.94	0.90		0.43	0.39			0.24
STD 40 40S	1.37	0.69	1.74	1.56	1.51		0.73	0.67			0.42
XS 80 80S	1.79	0.90	2.28	2.06	1.98		0.95	0.87			0.57
160	2.33	1.17	3.63	3.56	3.40		1.20	1.08			0.77
XXS	3.43	1.72	4.20	3.56	3.40		1.68	1.51			1.13

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	3.4	4.3	5.4	15.8	15.8	25
W.N	4.3	5.3	6.4	16.3	16.3	23.6
BLIND	4.1	4.8	6.8	16	16	25.4

4. VALVE WEIGHT (Kg) (CAST : CRANE, BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	31.8	36.3	59	127	129.3	
GLOBE	29.9	39.9	57.2	131.5	131.5	
BALL	15.6	23.2				
CHECK	25.9	29.9	38.1	93	93	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

* WEIGHT IN () = COVER MATL WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466t(D-t)$ $W_w = 0.0007834d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)	1.5 (0.4)	1.9 (0.4)	2.7 (0.4)	3.7 (0.5)	5.4 (0.6)	6.7 (0.6)	10.4 (0.7)	14.9	20.2	26.2	32.9	

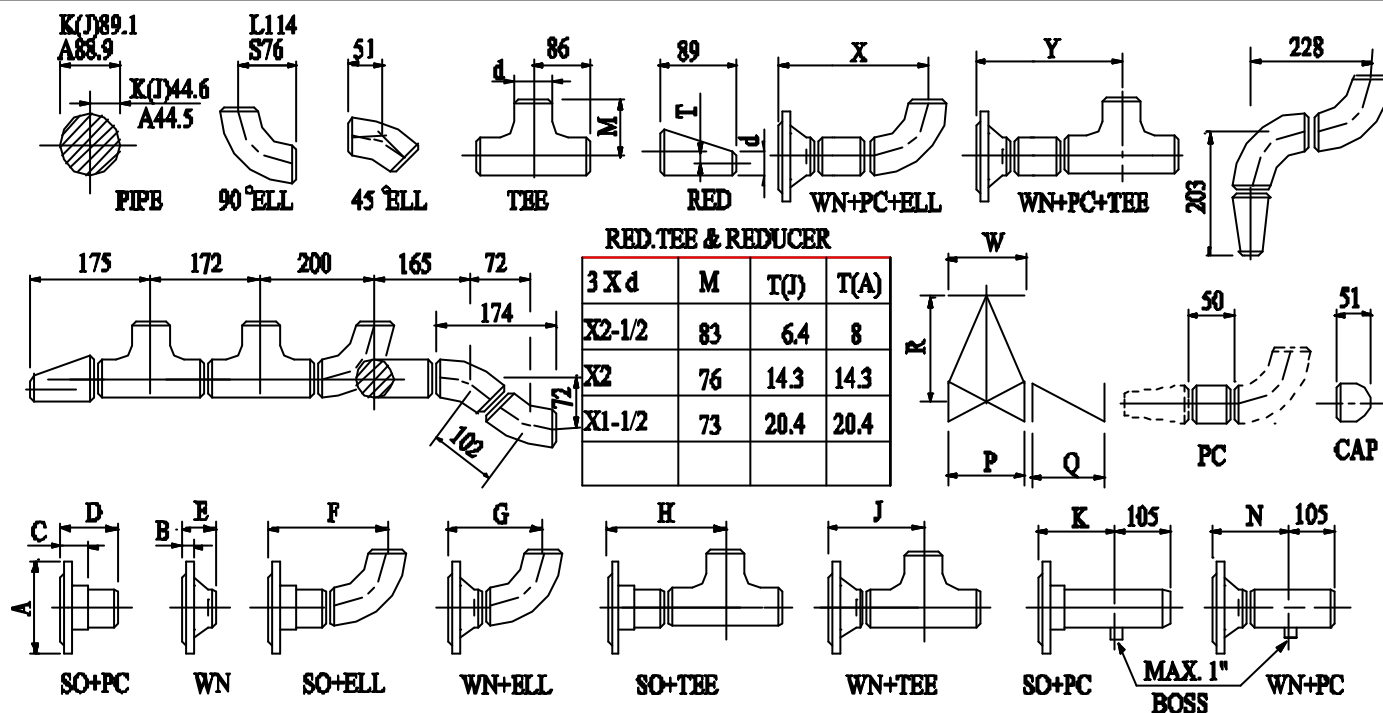
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****3"(80mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 17 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	185	200	210	191	210	210	210	210	241	267	305
B	18	22	28	23.9	28.4	38.1	36.4	39.7	46	55.7	76.1
C	18	34	44	30.2	42.9	52.3					
D	68	84	94	80	93	102					
E			73	69.9	79.2	88.9	87.2	90.5	109.5	125.3	177.7
F	182	198	208	194	207	216					
G			187	184	193	203	201	205	224	239	292
H	154	170	180	166	179	188					
J			SEE "Y"	156	165	175	SEE "Y"				
K	125	140	150	135	150	160					
N			180	175	185	195	195	195	215	230	285
X											
Y			209				223	227	246	262	314
RING NO.							R31	R31	R31	R35	R32
FL/G SPACE							5.6	4.8	4.1	3.0	3.0
GATE	P	203 (200)	283	203	283	356	298	359	384	473	584
	R			491	491	637	491	637	727	826	
	W			254	254	254	254	254	356	356	
GLOBE	P	241 (240)	318	241	318	356	333	359	384	473	584
	R			498	429	591	429	591	818		
	W			254	254	356	254	356	457		
CHECK	Q	241 (240)	318	241	318	356	333	359	384	473	584

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
3"(80mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 18 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 88.9 mm OUTSIDE SURFACE = 0.28 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	2.11	84.68	5.75	54	3.07	12.2	4.60	5.63
10S	3.05	82.80	8.22	76	3.04	17.1	6.59	5.38
STD 40 40S	5.49	77.93	14.38	126	2.96	28.6	11.52	4.76
XS 80 80S	7.62	73.66	19.46	162	2.89	36.5	15.59	4.26
160	11.13	66.65	27.18	210	2.78	47.2	21.34	3.48
XXS	15.24	58.42	35.27	249	2.66	56.1	27.68	2.68

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE					REDUCER				CAP
			FULL	x2-1/2	x 2	x1-1/2		x2-1/2	x 2	x1-1/2		
5S	0.81	0.41	0.96	0.92	0.86	0.83		0.37	0.34	0.31		0.26
10S	1.16	0.58	1.37	1.31	1.23	1.19		0.52	0.48	0.45		0.37
STD 40 40S	2.04	1.02	2.41	2.29	2.12	2.06		0.94	0.85	0.79		0.67
XS 80 80S	2.74	1.37	3.25	3.07	2.85	2.77		1.25	1.13	1.04		0.92
160	3.83	1.92	5.87	5.45	5.17	-		1.71	1.57	1.44		1.40
XXS	5.25	2.63	7.00	6.49	5.17	-		2.25	2.01	1.83		1.92

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	3.9	5.8	7.3	11.8	21.8	37.7
W.N	5.2	7.3	8.2	15	21.8	42.7
BLIND	4.9	6.8	8.9	13.2	21.8	39

4. VALVE WEIGHT (Kg) (CAST : CRANE BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	34.5	49	72.6	124.7	181.4	
GLOBE	37.2	53.1	72.6	122.5	249.5	
BALL	21.3	31.4	90	102	133	
CHECK	26.8	39	52.2	86.2	120.2	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

UNIT : kg/m

* WEIGHT IN () - COVER MAT'L WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466t(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)	(0.5)	(0.5)	(0.6)	(0.7)	(0.8)	(0.8)	(1.0)	16.1	21.6	27.9	34.9	

PIPING HANDBOOK

1. DIMENSION TABLES

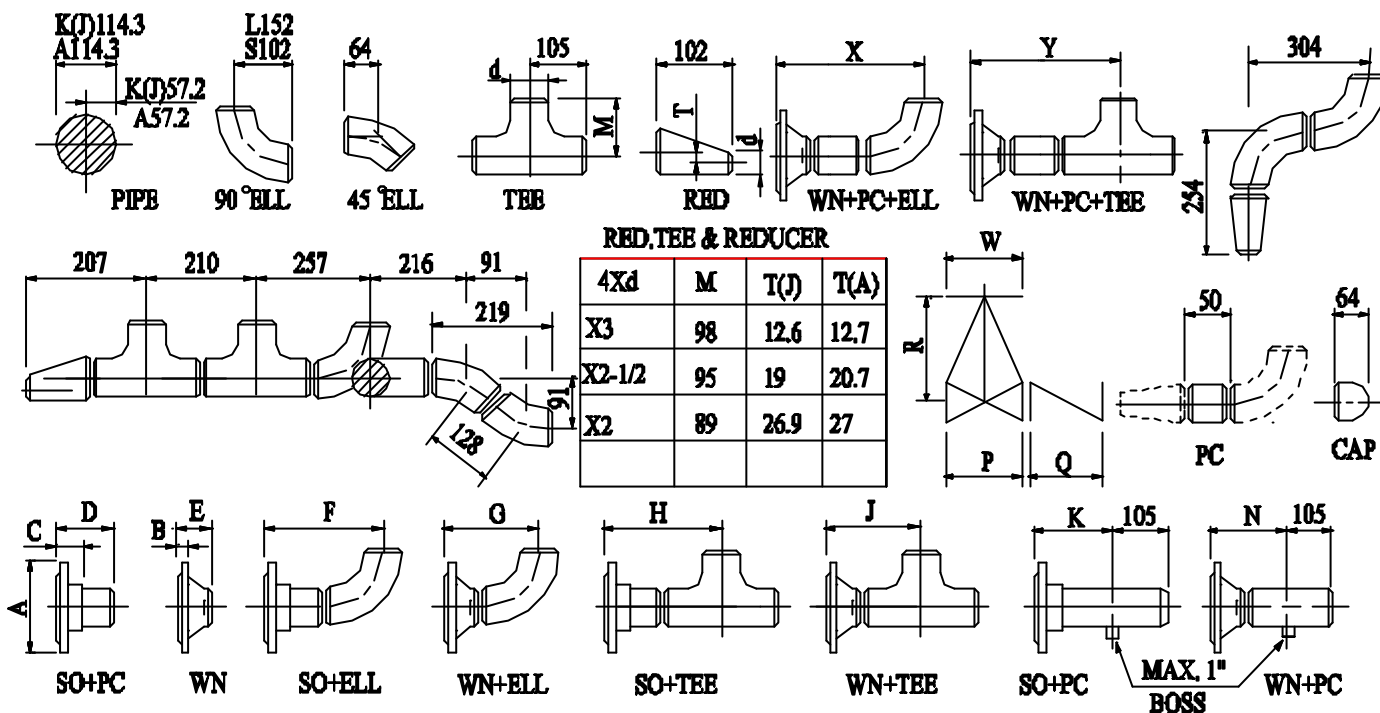
1.3 PIPE, FITTING AND VALVE DIM. CHART

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 19 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.		KS . JIS			ASME . JPI							
		10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A		210	225	240	229	254	273	254	273	292	311	356
B		18	24	32	23.9	31.8	44.5	39.7	46	52.4	61.8	87.3
C		18	36	48	33.3	47.8	60.2					
D		68	86	98	83	98	110					
E				76	76.2	85.9	108	93.8	109.5	122.2	131.9	201.6
F		220	238	250	235	250	262					
G				228	228	238	260	246	262	274	284	354
H		173	191	203	188	203	215					
J				SEE "Y"	181	191	213	SEE "Y"				
K		125	140	155	140	155	175					
N				180	180	190	215	200	215	230	240	315
X												
Y				231				249	265	277	287	357
RING NO.								R37	R37	R37	R39	R38
FLG SPACE								5.6	4.8	4.1	3.0	4.1
GATE	P	228 (210)	305	406	229	305	432	321	435	460	549	683
	R				716	715	718	715	718	806	927	
	W				254	254	356	254	356	356	457	
GLOBE	P	292 (290)	356	406	292	356	432	371	435	460	549	683
	R				540	477	714	477	714	943		
	W				356	356	457	356	457	610		
CHECK	Q	292 (290)	356	406	292	356	432	371	435	460	549	683

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
4"(100mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 20 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 114.3 mm OUTSIDE SURFACE = 0.36 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	2.11	110.08	7.43	117	3.97	20.5	5.96	9.32
10S	3.05	108.20	10.65	165	3.93	28.9	8.52	9.20
STD 40 40S	6.02	102.26	20.48	301	3.83	52.7	16.40	8.21
XS 80 80S	8.56	97.18	28.44	400	3.75	70.0	22.77	7.42
120	11.13	92.05	36.06	485	3.67	84.9	28.31	6.66
160	13.49	87.33	42.72	552	3.60	96.7	33.53	6.00
XXS	17.12	80.06	52.26	636	3.49	111.3	41.03	5.03

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	X 3	x2-1/2	x 2	X 3	x2-1/2	x 2		
5S	1.39	0.70	1.50	1.41	1.36	1.31	0.53	0.49	0.47		0.42
10S	2.00	1.00	2.15	2.02	1.95	1.88	0.76	0.71	0.67		0.59
STD 40 40S	3.84	1.92	4.12	3.83	3.71	3.53	1.45	1.37	1.27		1.17
XS 80 80S	5.36	2.68	5.77	5.33	5.15	4.94	2.02	1.90	1.76		1.68
160	8.02	4.01	8.76	8.05	7.74	7.30	3.00	2.76	2.58		2.76
XXS	10.20	5.09	12.80	11.40	11.30	11.01	3.65	3.41	3.11		3.51

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASMB B16.5)

	150#	300#	600#	900#	1500#	2500#
S.O	5.8	10.1	15	23.2	31	58
W.N	7.3	11.3	16.8	23.1	31.3	64
BLIND	7.4	12	18.6	24.5	33.1	60.4

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	49.9	74.8	136.1	192.8	272.2	
GLOBE	60.8	79.8	122.5	181.4	435.5	
BALL	34.3	52.5	153	169	197	
CHECK	42.2	69.9	87.1	145.1	235.9	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL. SHEET (0.3t) (2699Kg/m³)

* WEIGHT IN () = COVER MATL WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466t(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)	2.1 (0.5)	2.6 (0.6)	3.7 (0.7)	5 (0.7)	7 (0.8)	8.6 (0.9)	12.9 (1.1)	18	23.9	30.5	37.9	

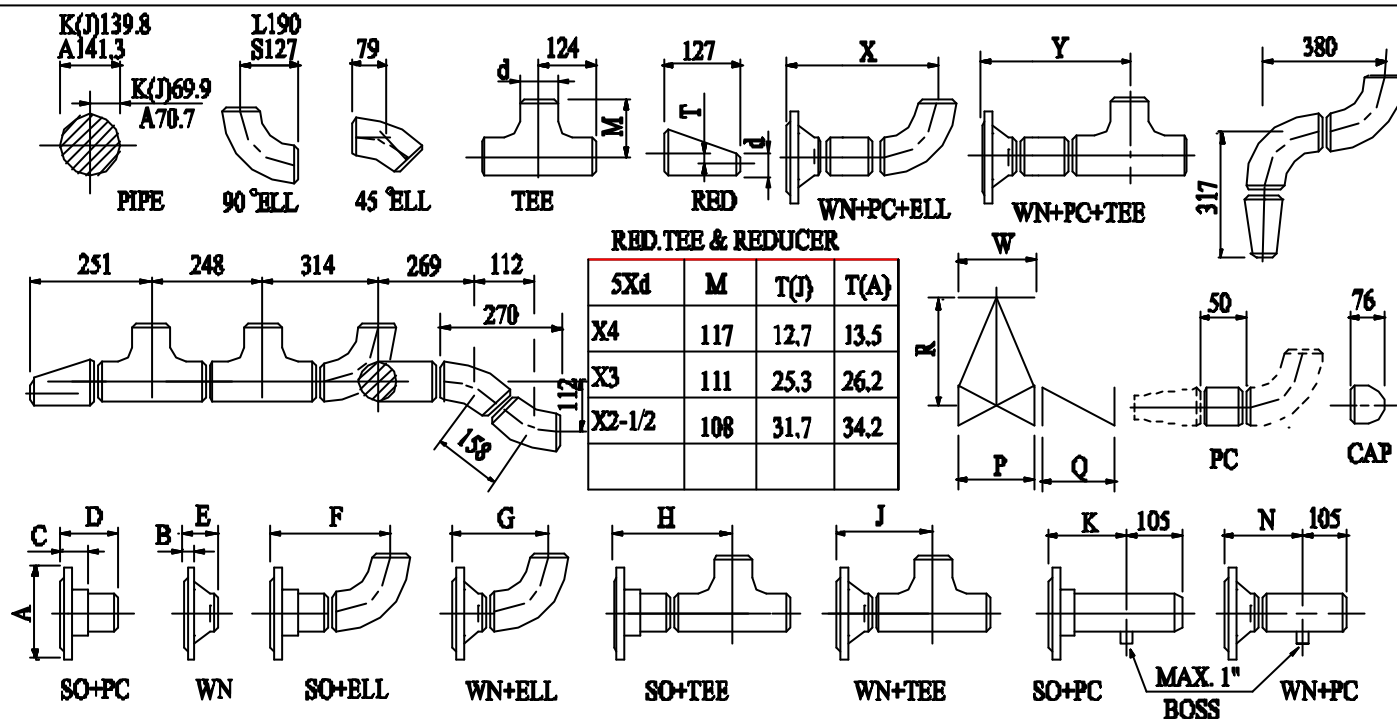
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
5"(125mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 21 OF 74

DATE : DEC. 1995



{UNIT : mm}

RATING NO.	KS, JIS			ASME, JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	250	270	275	254	279	330	279	330	349	375	419
B	20	26	36	23.9	35.1	50.8	43	52.4	58.7	81.1	104.6
C	20	40	54	36.6	50.8	66.8					
D	70	90	104	87	101	117					
E			86	88.9	98.6	120.7	106.5	122.2	134.9	163.4	241.3
F	260	280	294	277	291	307					
G			276	279	289	311	297	312	325	353	431
H	194	214	228	211	225	241					
J			210	213	223	245	231	SEE "Y"			
K	125	145	165	140	155	195					
N			190	195	205	225	210	230	240	295	365
X											
Y								296	309	337	415
RING NO.							R41	R41	R41	R44	R42
FL'G SPACE							5.6	4.8	4.1	3.0	4.1
GATE	P	254 (250)	381	457	254	381	508	397	511	562	676
	R				873	918	945	918	945	1105	1191
	W				254	356	457	356	457	610	610
GLOBE	P	356 (360)	400	457	356	400	508	416	511	562	676
	R				721	601	981	601	981		
	W				356	457	610	457	610		
CHECK	Q	330 (360)	400	457	330	400	508	416	511	562	676

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
5"(125mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 22 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 141.3 mm OUTSIDE SURFACE = 0.44 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCHL	THK (mm)							
5S	2.77	135.76	12.05	289	4.90	40.9	9.67	14.48
10S	3.40	134.49	14.75	351	4.88	49.6	11.82	14.21
STD 40 40S	6.55	128.19	27.74	631	4.77	89.3	22.20	12.91
XS 80 80S	9.52	122.25	39.43	860	4.67	121.8	31.59	11.74
120	12.70	115.90	51.31	1071	4.57	151.6	40.28	10.55
160	15.87	109.55	62.55	1250	4.47	176.9	49.10	9.43
XXS	19.05	103.20	73.16	1400	4.37	198.2	57.43	8.37

2. FITTING WEIGHT

(Kg)-BW

SCHL	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 4	X 3	x2-1/2	x 4	X 3	x2-1/2		
5S	2.83	1.41	2.85	2.67	2.56	2.50	1.09	1.00	0.93		0.805
10S	3.46	1.73	3.48	3.26	3.13	3.06	1.33	1.22	1.14		0.978
STD 40 40S	6.48	3.24	6.54	6.13	5.83	5.71	2.50	2.27	2.16		1.90
XS 80 80S	9.13	4.57	9.20	8.63	8.19	8.01	3.52	3.18	3.02		2.73
160	14.70	7.35	17.3	15.3	14.7	14.3	5.59	5.30	4.70		4.85
XXS	17.60	8.80	20.2	19.0	17.9	-	6.47	5.78	5.46		5.82

3. FLANGE WEIGHT

(Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	6.2	12.6	28.5	37.7	58.8	95.3
W.N	8.9	15.1	30.9	38.5	59	110.7
BLIND	8.8	16	30.8	39.5	60	101.2

4. VALVE WEIGHT

(Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	70.3	106.6				
GLOBE	90.3	131.5				
BALL						
CHECK	68.9	115.7				

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.30) (2699Kg/m³)

* WEIGHT IN () = COVER MATL WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	2.6 (0.5)	3.3 (0.6)	4.6 (0.6)	6.7 (0.7)	8.5 (0.7)	10.2 (0.8)	15.6 (0.9)				

$$\begin{aligned}
 W_p &= 0.02466(D-t) \\
 W_w &= 0.0007854d^2 \\
 A &= 0.007854(D^2 - d^2) \\
 I &= 0.000004909 \times (D^4 - d^4) \\
 Z &= 0.00009817 \times \frac{D^4 - d^4}{D}
 \end{aligned}$$



PIPING HANDBOOK

1. DIMENSION TABLES

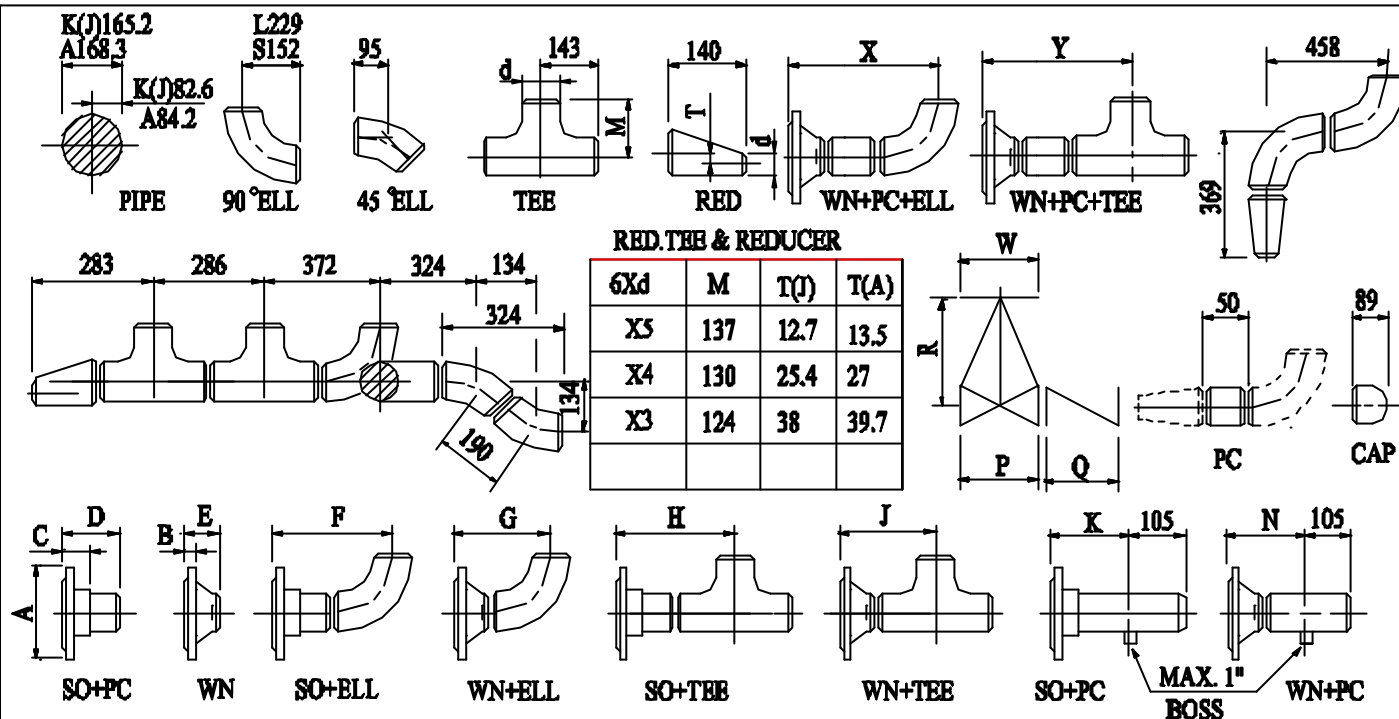
1.3 PIPE, FITTING AND VALVE DIM. CHART 6" (150mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 23 OF 74

DATE : DEC, 1995



(UNIT : mm)

RATING NO.		KS . JIS			ASME . JPI							
		10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A		280	305	325	279	318	356	318	356	381	394	483
B		22	28	38	25.4	36.6	54.1	44.5	55.7	63.6	92.1	120.7
C		22	42	58	39.6	52.3	72.9					
D		72	92	108	90	102	123					
E				95	88.9	98.6	123.7	106.5	125.3	147.6	181	285.8
F		301	321	337	319	331	352					
G				324	318	328	353	336	354	377	410	515
H		215	235	251	233	245	267					
J				238	232	242	267	250	SEE "Y"			
K		130	150	175	145	160	200					
N				200	195	205	230	210	230	255	315	410
X												
Y									318	341	374	479
RING NO.								R45	R45	R45	R46	R47
FL'G SPACE								5.6	4.8	4.1	3.0	4.1
GATE	P	267 (270)	403	495	267	403	559	419	562	613	711	927
	R				873	918	945	918	945	1105	1191	
	W				254	356	457	356	457	610	610	
GLOBE	P	406 (410)	444	495	406	445	559	460	562	613	711	927
	R				721	601	981	601	981			
	W				356	457	610	457	610			
CHECK	Q	368 (410)	444	495	356	445	559	460	562	613	711	927

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
6"(150mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 24 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 168.3 mm OUTSIDE SURFACE = 0.53 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) :							
SS	2.77	162.74	14.39	493	5.85	58.6	11.55	20.80
10S	3.40	161.47	17.63	599	5.83	71.2	14.13	20.48
STD 40 40S	7.11	154.05	36.01	1171	5.70	139.2	28.83	18.64
XS 80 80S	10.97	146.33	54.23	1685	5.57	200.3	43.42	16.82
120	14.27	139.73	69.06	2065	5.47	245.4	54.21	15.33
160	18.26	131.80	85.96	2455	5.34	291.7	67.56	13.54
XXS	21.95	124.38	100.89	2761	5.23	328.1	79.22	12.15

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE					REDUCER				CAP
			FULL	x 5	x 4	X 3		x 5	x 4	X 3		
SS	4.05	2.02	3.89	3.73	3.55	3.44		1.46	1.35	1.25		1.14
10S	4.96	2.48	4.76	4.56	4.34	4.21		1.78	1.65	1.53		1.39
STD 40 40S	9.94	4.97	9.58	9.08	8.67	8.38		3.57	3.30	3.04		2.83
XS 80 80S	15.0	7.50	14.5	13.6	13.0	12.6		5.38	4.96	4.56		4.38
160	24.20	12.10	27.3	24.3	23.2	22.5		8.63	7.88	7.21		7.81
XXS	29.10	14.50	28.4	27.1	25.8	23.7		9.89	8.98	8.21		9.38

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	7.4	16	36.3	48.3	74	146.5
W.N	11.3	19.7	36.8	49.9	74.9	176.5
BLIND	11.3	21.2	38	51.5	75	156.6

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	79.4	145.1	290.3	381	635	
GLOBE	108.9	154.2	249.5	435.5	544.3	
BALL	77.4	116	232	349	423	
CHECK	74.8	125.2	224.5	317.5	544.3	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE(192Kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

* WEIGHT IN () = COVER MAT'L WEIGHT

$$W_p = 0.02466d(D-t)$$

$$W_w = 0.0007854d^2$$

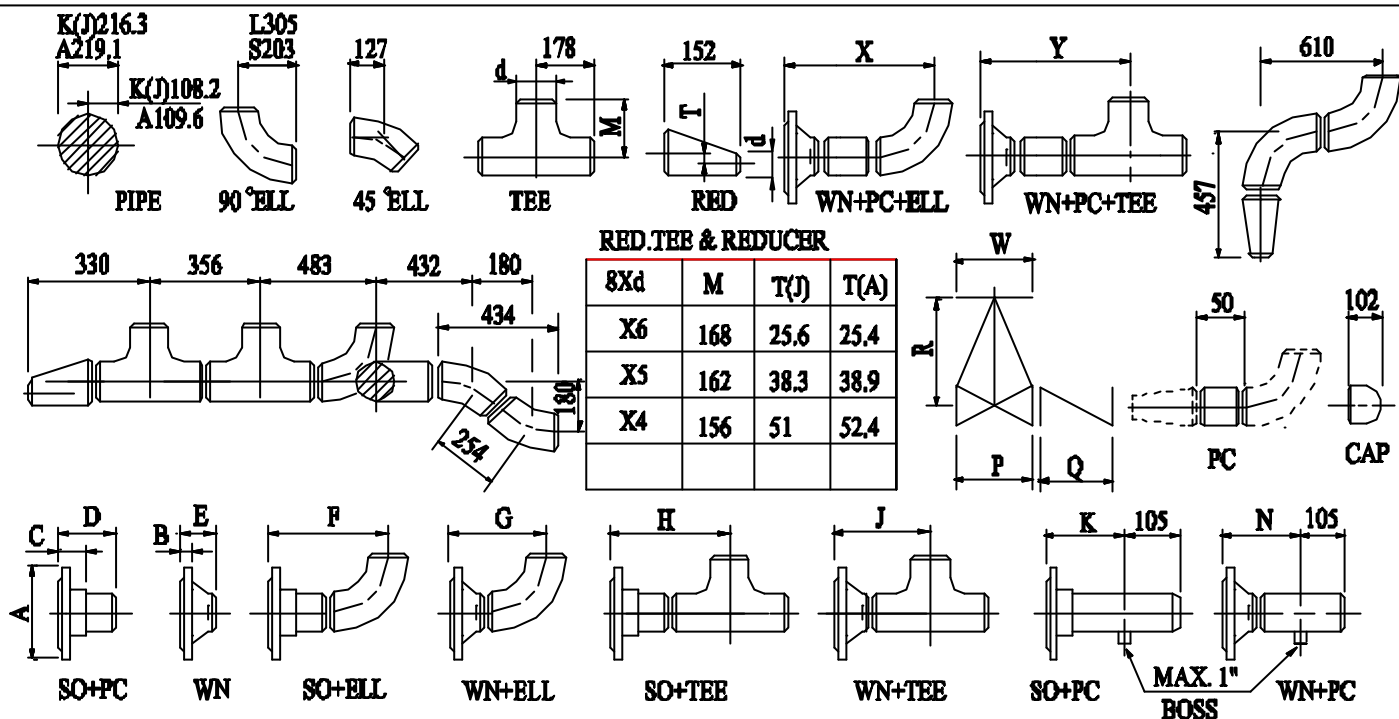
$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	2.9 (0.7)	3.6 (0.8)	5 (0.8)	6.6 (0.9)	9.1 (1.0)	11 (1.1)	16.2 (1.2)	22.1	28.8	36.2	44.4



(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	330	350	370	343	381	419	381	419	470	483	552
B	22	30	42	28.4	41.1	62	49.1	63.6	71.4	103.1	141.3
C	22	46	64	44	62	82.6					
D	72	96	114	94	112	133					
E			102	101.6	111.3	139.7	119.2	141.3	170	224	331.8
F	377	401	419	399	417	438					
G			407	407	416	445	424	446	475	529	637
H	250	274	292	272	290	311					
J			280	280	289	318	297	SEE "Y"			
K	130	150	185	150	179	225					
N			210	205	215	245	225	245	275	355	455
X											
Y								369	398	452	560
RING NO.							R49	R49	R49	R50	R51
FL'G SPACE							5.6	4.8	4.1	4.1	4.8
GATE	P	292 (290)	419	597	292	419	660	435	664	740	1038
	R				1108	1115	1103	1115	1103	1327	1524
	W				356	356	610	356	610	610	711
GLOBE	P	495 (500)	559	597	495	559	660	575	664	740	1038
	R				848	718	1137	718	1137		
	W				457	457	610	457	610		
CHECK	Q	495 (500)	533	597	495	533	660	549	664	740	1038

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
8"(200mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 26 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 219.1 mm OUTSIDE SURFACE = 0.69 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : W _p (Kg/m)	WEIGHT OF WATER : W _w (Kg/m)
SCH.	THK (mm)							
5S	2.77	213.54	18.81	1101	7.68	100.5	15.09	35.81
10S	3.76	211.56	25.43	1474	7.61	134.6	20.37	35.15
20	6.35	206.37	42.44	2403	7.52	219.3	33.31	33.45
30	7.04	205.00	46.87	2637	7.50	240.7	36.81	33.01
STD 40 40S	8.18	202.72	54.19	3017	7.46	278.8	43.39	32.28
60	10.31	198.45	67.63	3693	7.39	337.2	53.09	30.93
XS 80 80S	12.70	193.67	87.34	4400	7.31	401.7	65.95	29.46
100	15.09	188.95	96.54	5050	7.23	461.0	75.92	28.04
120	18.26	182.60	115.1	5850	7.13	534.0	90.44	26.19
140	20.62	177.83	128.6	6398	7.03	584.1	100.92	24.04
XXS	22.23	174.62	137.4	6742	7.00	615.5	107.92	23.95
160	23.01	173.05	141.7	6905	6.98	630.4	111.27	23.52

2. FITTING WEIGHT (Kg)-BW

SCH.	90° ELL.	45° ELL.	TEE					REDUCER			CAP
			FULL	X 6	x 5	x 4		X 6	x 5	x 4	
5S	7.07	3.53	6.27	5.86	5.71	5.54		2.02	1.90	1.80	1.76
10S	9.55	4.78	8.46	7.91	7.70	7.48		2.72	2.57	2.43	2.38
STD 40 40S	20.1	10.05	17.9	16.6	16.1	15.7		5.71	5.40	5.10	5.11
XS 80 80S	30.5	15.25	27.1	25.2	24.3	23.7		8.63	8.14	7.68	7.91
XXS	51.4	25.70	50.7	47.6	46.1	45.0		14.3	13.4	12.6	14.7
160	53.2	26.60	51.4	48.1	46.8	45.6		15.0	14.0	13.1	15.2

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	12.4	24.5	44	75	117.7	220
W.N	17.7	30.5	50.8	79.5	123.8	261.3
BLIND	19.9	34.6	62.2	89	137	240.6

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	140.6	226.8	489.9	635	997.9	
GLOBE	167.8	240.4	453.6	725.7	1860	
BALL	165	227	454	585	774	
CHECK	124.7	190.5	353.8	498.9	952.5	

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.3) (2699Kg/m³)

* WEIGHT IN () = COVER MAT'L WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	3.7 (0.9)	4.5 (0.9)	6.3 (1.0)	8.1 (1.1)	11.1 (1.2)	13.3 (1.3)	19.2 (1.4)	25.9 (1.5)	33.4	41.6	50.6

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.00004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

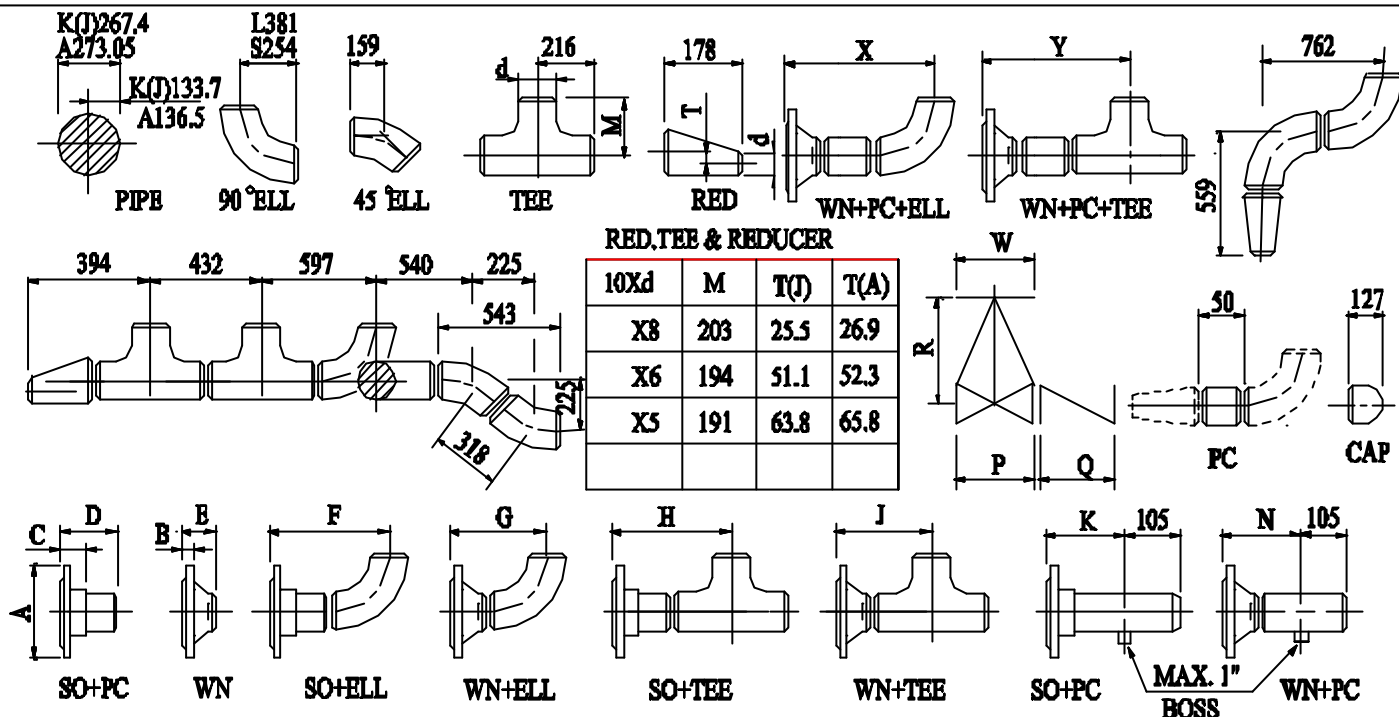
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
10" (250mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 27 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.		KS . JIS			ASME . JPI							
		10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A		400	430	450	406	445	508	445	508	546	584	673
B		24	34	48	30.2	47.8	69.9	55.7	71.4	77.8	119.1	182.6
C		36	52	72	49.3	66.5	92.2					
D		86	102	122	99	117	142					
E				118	101.6	117.3	158.8	125.3	160.3	192.1	265.1	436.6
F		467	483	503	480	498	523					
G				499	483	498	540	506	541	573	646	818
H		302	318	338	315	333	358					
J				334	318	333	375	341	376	408	SEE "Y"	
K		140	160	210	155	190	245					
N				225	205	225	265	230	265	300	400	570
X												
Y											531	703
RING NO.								R53	R53	R53	R54	R55
FL'G SPACE								5.6	4.8	4.1	4.1	6.4
GATE	P	330 (330)	457	673	330	457	787	473	791	841	1000	1292
	R				1308	1297	1345	1297	1345	1638	1854	
	W				356	356	610	356	610	711	864	
GLOBE	P	622 (620)	622	673	622	622	787	638	791	841	1000	1292
	R				815	896	1321	896	1321			
	W				457	559	864	559	864			
CHECK	Q	622 (620)	622	673	622	622	787	638	791	841	1000	1292

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
10" (250mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 28 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 273.05 mm OUTSIDE SURFACE = 0.86 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	3.40	266.24	28.83	2621	9.53	192.0	23.08	55.67
10S	4.19	264.67	35.40	3199	9.51	243.3	28.34	55.02
20	6.35	260.35	53.20	4733	9.43	346.7	41.77	53.24
30	7.80	257.45	64.98	5720	9.38	419.0	51.03	52.06
STD 40 40S	9.27	254.51	76.83	6690	9.33	490.0	61.52	50.87
XS 60 80S	12.70	247.65	103.9	8822	9.22	646.2	83.19	48.17
80	15.09	242.93	122.1	10190	9.14	746.5	96.01	46.35
100	18.26	236.58	145.9	11910	9.03	872.3	114.75	43.96
120	21.44	230.23	169.3	13500	8.93	988.5	133.06	41.63
XXS 140	25.40	222.25	197.6	15310	8.80	1121	155.15	38.80
160	28.58	215.90	219.5	16620	8.70	1217	172.33	36.61

2. FITTING WEIGHT

(Kg)-BW

SCH.	90° BLL.	45° BLL.	TEE				REDUCER				CAP
			FULL	X 8	X 6	X 5	X 8	X 6	X 5		
5S	13.52	6.76	11.60	10.80	10.40	10.30	3.66	3.37	3.24		3.37
10S	16.60	8.30	14.20	13.30	12.80	12.60	4.49	4.14	3.98		4.14
STD 40 40S	35.4	17.7	30.4	28.5	27.2	26.8	9.58	8.78	8.42		8.92
80	57.0	28.5	60.8	51.9	50.0	49.2	15.4	14.2	13.5		16.4
XXS 140	82.0	41.0	-	-	-	-	24.3	22.1	21.1		25.7
160	103.0	51.5	96.7	89.7	80.9	79.6	27.5	25.1	23.9		28.9

3. FLANGE WEIGHT

(Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	17.1	34.2	76.2	111.1	197.5	419.6
W.N	24.8	43.7	86.3	118	205.9	484.4
BLIND	29.4	55.3	102	131.5	230	465.4

4. VALVE WEIGHT

(Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	206.4	344.7	703.1	907.2	2199.9	
GLOBE	238.1	340.2				
BALL	430	547	698	880	1274	
CHECK	199.6	290.3	635	984		

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.3) (2699Kg/m³)

UNIT : kg/m

* WEIGHT IN () = COVER MATL. WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466t(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.00004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)	4.5 (1.0)	5.5 (1.1)	7.6 (1.2)	9.7 (1.3)	13.3 (1.3)	15.7 (1.4)	22.5 (1.5)	30 (1.7)	38.3	47.3	57.1	

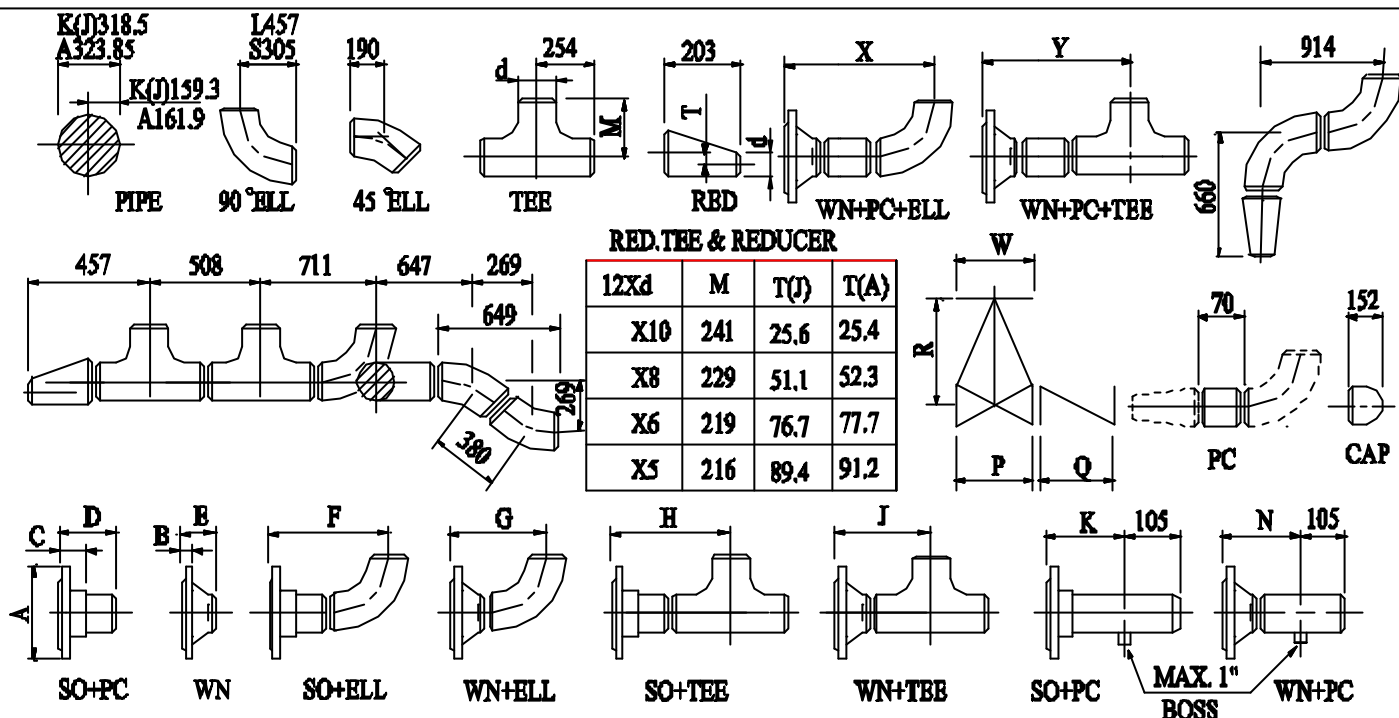
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
12"(300mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 29 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.		KS . JIS			ASME . JPI							
		10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A		445	480	515	483	521	559	521	559	610	673	762
B		24	36	52	31.8	50.8	72.9	58.7	74.5	87.2	138.2	201.6
C		38	56	78	55.6	73.2	98.3					
D		108	126	148	126	143	168					
E				127	114.3	130	161.8	138	163.4	208	296.7	481
F		565	583	605	583	600	625					
G				584	571	587	619	595	620	665	754	938
H		362	380	402	380	397	422					
J				381	368	384	416	392	417	462	SEE "Y"	
K		145	165	220	160	200	250					
N				230	220	235	265	245	270	315	450	625
X												
Y											621	805
RING NO.								R57	R57	R57	R58	R60
FL'G SPACE								5.6	4.8	4.1	4.8	7.9
GATE	P	356 (350)	502	762	356	502	838	517	841	968	1146	1445
	R				1468	1468	1519	1468	1519	1905	2184	
	W				356	457	711	457	711	711	864	
GLOBE	P	699 (700)	711	762	699	711	838	727	841	968	1146	1145
	R					1004	1321	1004	1321			
	W					559	864	559	864			
CHECK	Q	699 (700)	711	762	699	711	838	727	841	968	1146	1145

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
12" (300mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 30 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 323.85 mm OUTSIDE SURFACE = 1.02 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm)							
5S	3.96	315.93	39.80	5093	11.30	314.5	31.89	78.42
10S	4.57	314.71	45.86	5845	11.29	360.9	36.73	77.79
20	6.35	311.15	63.34	7984	11.23	493.1	49.72	76.04
30	8.38	307.09	83.07	10340	11.16	638.7	65.21	74.06
STD 40S	9.52	304.80	94.06	11630	11.12	718.0	75.32	72.97
40	10.31	303.22	101.6	12500	11.09	771.7	79.74	72.21
XS 80S	12.70	298.45	124.1	15050	11.01	929.4	99.43	69.96
60	14.27	293.30	138.8	16670	10.96	1029	108.96	68.49
80	17.48	288.95	167.9	19780	10.85	1221	132.08	65.58
100	21.44	281.03	203.4	23380	10.72	1444	159.91	62.03
XXS 120	25.40	273.05	238.2	26710	10.59	1649	186.97	58.56
140	28.57	266.70	265.1	29160	10.49	1801	208.14	55.86
160	33.32	257.20	304.2	32510	10.34	2008	238.76	51.96

2. FITTING WEIGHT (Kg)-BW

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	X 10	X 8	X 6	X 10	X 8	X 6		
5S	30.0	15.0	18.7	17.8	17.0	16.6	5.89	5.48	5.14		5.47
10S	25.8	12.90	21.6	20.5	19.6	19.1	6.78	6.31	5.92		6.15
40	57.0	28.5	58.4	55.2	53.1	51.2	14.7	13.7	12.8		13.1
80	94.0	47.0	95.8	90.5	77.1	75.2	24.8	22.7	21.4		26.4
XXS 120	130.0	65.0					34.3	31.7	29.4		36.4
160	171.0	85.5	155.0	146.0	139.0	136.0	44.6	41.0	38.0		47.7

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	27.7	51.3	97.5	146	264	590.2
W.N	39	64.4	102.5	157	306	692.4
BLIND	43.7	78.9	132	187	316	664.1

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	294.8	462.7	952.5	1542.2	3311.2	
GLOBE	408.2	499	1280			
BALL	624	786	917	1283	1744	
CHECK	308.4	453.6	793.8	1434		

5. INS. WEIGHT

UNIT : kg/m

MATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.30) (2699Kg/m³)

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	5.3 (1.2)	6.4 (1.3)	8.8 (1.3)	11.3 (1.4)	15.2 (1.5)	18 (1.5)	25.6 (1.7)	33.8 (1.9)	42.9	52.7	63.2

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$



PIPING HANDBOOK

1. DIMENSION TABLES

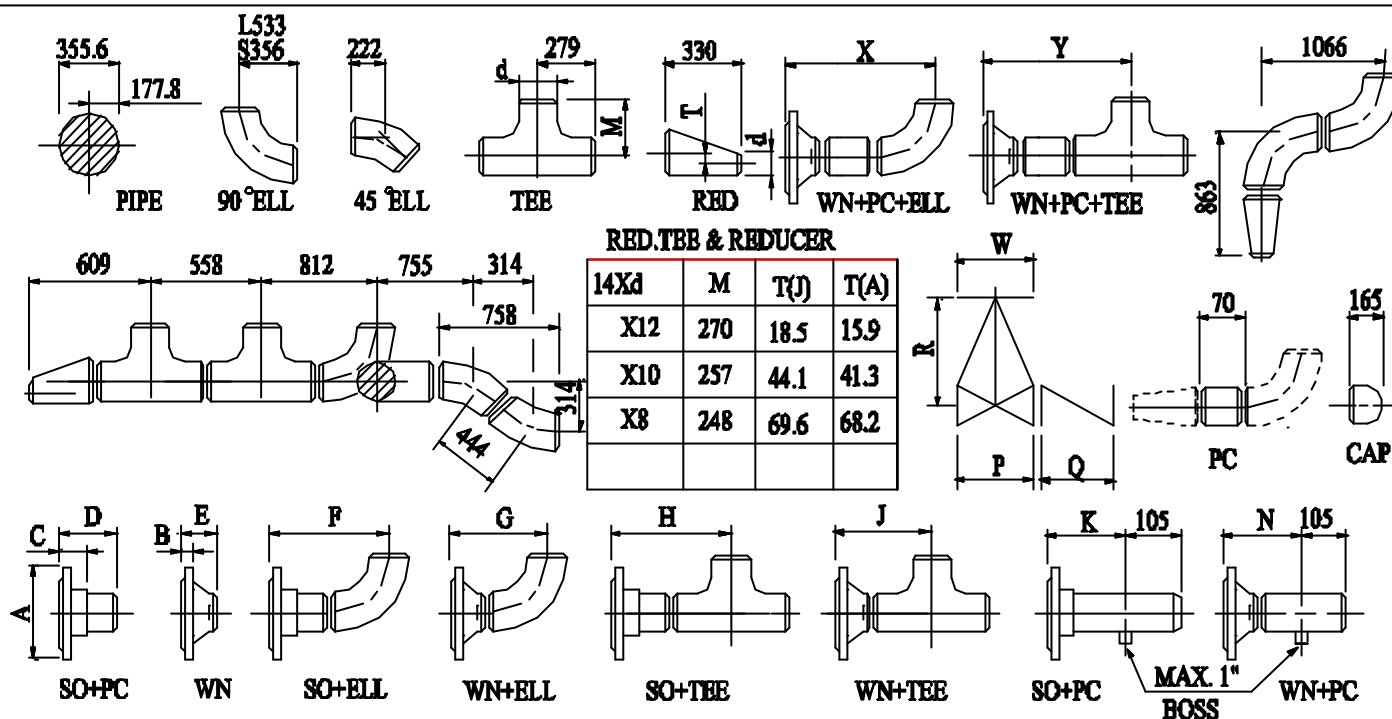
1.3 PIPE, FITTING AND VALVE DIM. CHART 14"(350mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 31 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.		KS . JIS			ASME . JPI							
		10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A		490	540	560	533	584	603	584	603	641	749	
B		26	40	54	35.1	53.8	76.2	61.8	77.8	97	149.2	
C		42	62	84	57.2	76.2	100.1					
D		112	132	154	127	146	170					
E				134	127	142.7	171.5	150.7	173	224	314.3	
F		645	665	687	660	679	703					
G				667	660	676	705	684	706	757	847	
H		391	411	433	406	425	449					
J				413	406	422	451	430	452	503	SEE "Y"	
K		150	180	225	170	210	265					
N				240	235	250	275	255	285	335	490	
X												
Y											663	
RING NO.								R61	R61	R62	R63	
FL'G SPACE								5.6	4.8	4.1	5.6	
GATE	P	381 (381)	762	826	381	762	889	778	892	1038	1276	
	R				1598	1684	1681	1684	1681	2216	2216	
	W				457	610	711	610	711	864	864	
GLOBE	P	787 (787)	838		787					1038	1276	
	R											
	W											
CHECK	Q	787 (787)	838		787	838	889	854	892	1038	1276	

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
14"(350mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 32 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 355.6 mm OUTSIDE SURFACE = 1.12 m ³ /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	3.96	347.68	43.77	6766	12.43	380.6	35.06	94.94
10S	4.78	346.05	52.63	8098	12.40	455.5	42.14	94.05
10	6.35	342.90	69.67	10630	12.35	597.7	54.69	92.35
20	7.92	339.75	86.56	13090	12.30	736.0	67.90	90.66
STD 30	9.52	336.55	103.6	15520	12.24	872.6	81.33	88.96
40	11.13	333.35	120.4	17880	12.19	1005	94.55	87.28
XS	12.70	330.20	136.8	20140	12.13	1132	107.4	85.63
60	15.09	325.48	161.1	23400	12.05	1316	126.71	83.20
80	19.05	317.50	201.4	28610	11.92	1609	158.10	79.17
100	23.83	308.00	248.1	34320	11.76	1930	194.7	74.51
120	27.79	300.08	285.9	38690	11.63	2178	224.65	70.72
140	31.75	292.10	323.0	42760	11.50	2405	253.6	67.01
160	35.71	284.18	358.9	46480	11.38	2614	281.7	63.43

2. FITTING WEIGHT (Kg)-BW

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 12	x 10	x 8	x 12	x 10	x 8		
5S	28.8	14.4	22.7	22.0	21.3	20.4	10.80	10.10	9.32		6.64
10S	34.6	17.3	27.3	26.4	25.6	24.5	13.00	12.10	11.20		7.98
40	79.1	40.1	83.2	79.4	76.1	63.7	29.5	27.4	25.4		18.6
80	133.0	66.5	129.0	123.0	108.0	103.0	49.8	46.1	42.2		34.9
XS	89.9	45.0	70.9	68.8	66.3	64.5	33.6	31.2	28.9		21.2
160	236.0	118	201.0	192.0	184.0	178.0	88.5	81.6	74.7		61.2
STD	67.9	34.0	53.5	51.9	49.9	48.2	25.4	23.6	21.8		15.9

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	35.2	72.1	102	172.4		
W.N	51.7	88.3	121.6	181.6	416	
BLIND	59.4	107.1	158	224.1	421	

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	390.1	626	1315.4	2177.2	-	
GLOBE	453.6	767				
BALL	915	1170	1313	1676	2491	
CHECK	430.9	703.1	1198			

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE(192Kg/m³)COVER MATERIAL : AL. SHEET (0.3)(2699Kg/m³)

UNIT : kg/m

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	5.7 (1.6)	7 (1.6)	9.5 (1.7)	12.2 (1.8)	16.5 (1.9)	19.3 (2.0)	27.5 (2.1)	36.2 (2.3)	45.7 (2.5)	56	67

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

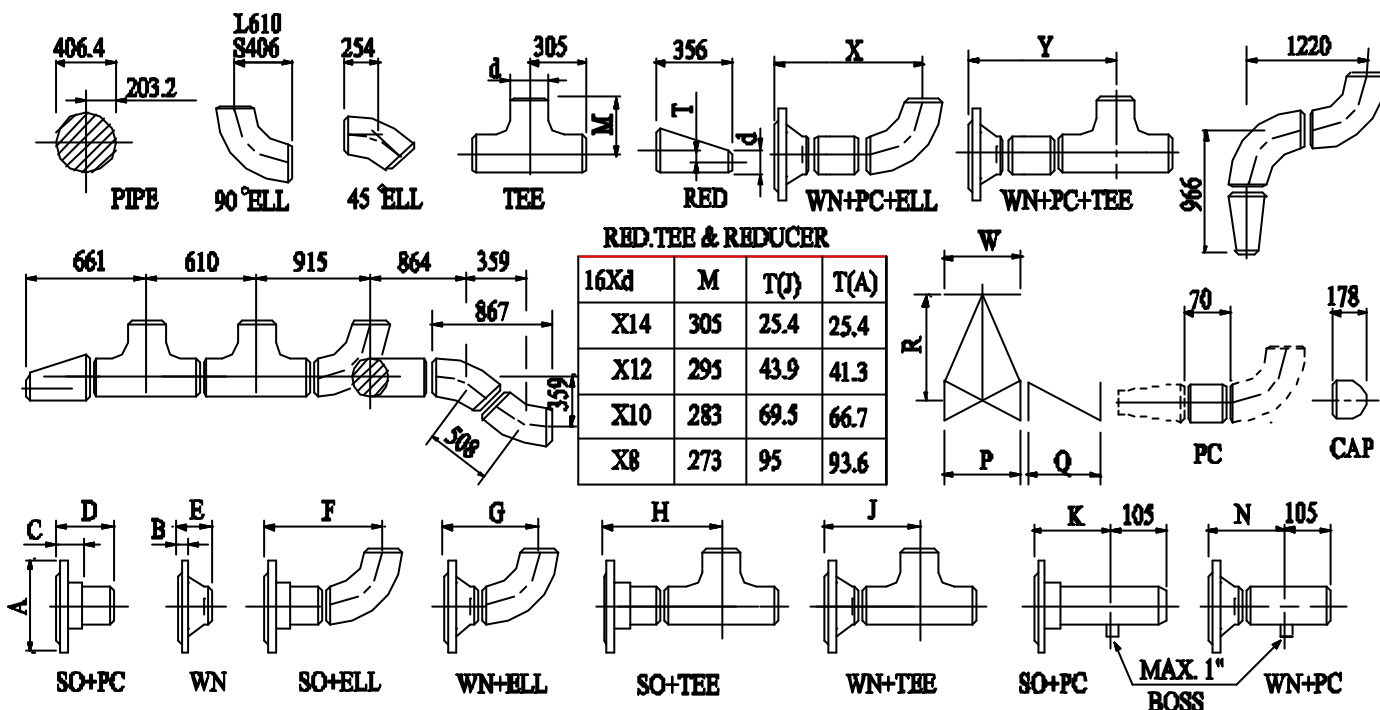
1.3 PIPE, FITTING AND VALVE DIM. CHART 16" (400mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 33 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	560	605	630	597	648	686	648	686	705	826	
B	28	46	60	36.6	57.2	82.6	65.1	84.1	100	163.5	
C	44	70	92	63.5	82.6	112.8					
D	114	140	162	134	153	183					
B			149	127	146.1	184.2	154	185.7	227	328.6	
F	724	750	772	744	763	793					
G			759	737	756	794	764	796	837	939	
H	419	445	467	439	458	488					
J			454	432	451	489	459	491	532	SEE "Y"	
K	150	190	250	170	220	285					
N			255	235	250	290	260	305	350	535	
X											
Y										724	
RING NO.							R65	R65	R66	R67	
FLG SPACE							5.6	4.8	4.1	7.9	
GATE	P	406 (408)	838	902	406	838	991	854	994	1140	1407
	R				1841	1835	1843	1835	1843		
	W				610	610	864	610	864		
GLOBE	P	914	864		914						
	R										
	W										
CHECK	Q	864	864		864	864	991	879	994	1140	1407

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****16" (400mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 34 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 406.40 mm OUTSIDE SURFACE = 1.28 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	4.19	398.02	52.96	10710	14.22	527.1	42.41	124.4
10S	4.78	396.85	60.25	12150	14.20	597.9	48.26	123.7
10	6.35	393.70	79.81	15970	14.15	785.9	62.65	121.7
20	7.92	390.55	99.21	19700	14.09	969.4	77.88	119.8
STD 30	9.52	387.35	118.8	23400	14.04	1151	93.23	117.8
XS 40	12.70	381.00	157.1	30470	13.93	1499	123.3	114.0
60	16.66	373.07	204.0	38810	13.79	1910	160.15	109.3
80	21.44	363.58	258.9	48130	13.63	2369	203.3	103.8
100	26.19	354.03	312.8	56790	13.47	2795	245.5	98.44
120	30.96	344.53	364.9	64740	13.32	3166	286.5	93.22
140	36.53	333.35	424.4	73290	13.14	3607	333.2	87.28
160	40.49	325.48	465.2	78810	13.02	3879	365.2	83.20

2. FITTING WEIGHT (Kg)-BW

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	X 14	X 12	X 10	X 14	X 12	X 10		
5S	39.7	19.8	29.5	29.0	28.2	27.2	13.9	13.4	12.7		8.79
10S	45.2	22.6	33.6	33.0	32.1	31.0	15.8	15.2	14.4		10.00
XS 40	118.0	59.0	87.7	86.1	83.6	81.2	41.1	39.2	36.8		26.7
80	195.0	97.5	173.0	158.0	152.0	147.0	67.7	65.0	60.8		49.0
STD	89.0	44.5	66.1	64.9	63.1	61.3	31.0	29.6	27.8		20.0
160	350.0	175.0	334.0	280.0	263.0	255.0	121.0	116.0	108.0		130.0

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	42.2	90.4	149.8	193		
W.N	64.4	112.9	177.1	224.7	567.5	
BLIND	77.1	139.3	224.7	272.4	559	

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	508	889	1610.2	3084.4		
GLOBE						
BALL	1319	1592	1990	2326	3235	
CHBCK	555.6	771.1	1575			

5. INS. WEIGHTMATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.3) (2699Kg/m³)

* WEIGHT IN () = COVER MATL. WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	6.5 (1.8)	7.9 (1.8)	10.8 (1.9)	13.8 (2.0)	18.5 (2.1)	21.8 (2.1)	30.5 (2.3)	40.1 (2.5)	50.3 (2.6)	61.4	73.2

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$



PIPING HANDBOOK

1. DIMENSION TABLES

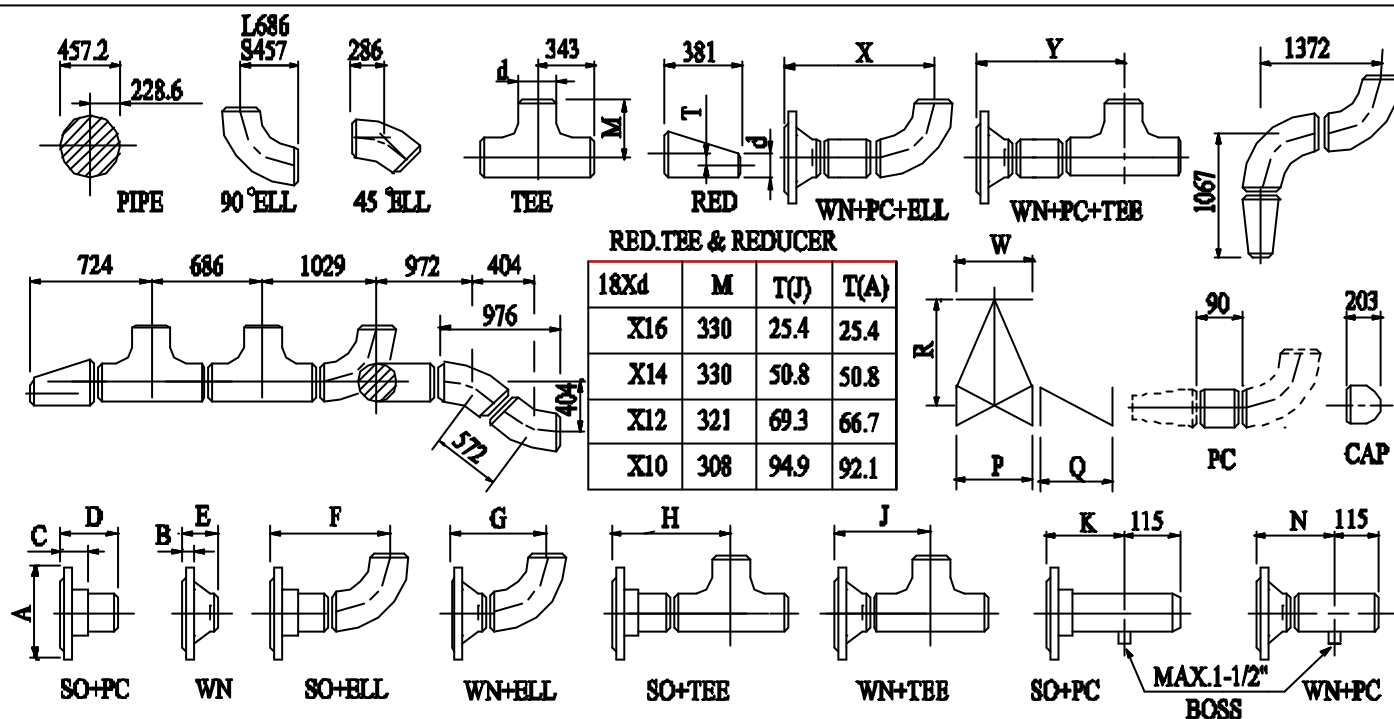
1.3 PIPE, FITTING AND VALVE DIM. CHART 18"(450mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 35 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.		KS . JIS			ASME . JPI							
		10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A		620	675		635	711	743	711	743	787	914	
B		30	48		39.6	60.5	88.9	68.4	90.5	114.3	179.5	
C		48	78		68.3	88.9	123.7					
D		138	168		158	179	214					
E					139.7	158.8	190.5	166.7	192.1	241.3	344.6	
F		824	854		844	865	900					
G					826	845	877	853	878	928	1031	
H		481	511		501	522	557					
J					483	502	534	510	535	SEE "Y"		
K		165	205		190	240	315					
N					255	275	315	285	335	400	590	
X												
Y										654	778	
RING NO.								R69	R69	R70	R71	
FL'G SPACE								5.6	4.8	4.8	7.9	
GATE	P	432 (432)	914	978	432	914	1092	930	1095	1232	1559	
	R				2008	2008	2223	2008	2223			
	W				610	610	864	610	864			
GLOBE	P	978	978									
	R											
	W											
CHECK	Q	978	978		978	978	1092	994	1095	1232	1559	

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
18" (450mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 36 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 457.2 mm OUTSIDE SURFACE = 1.44 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
SS	4.19	448.82	59.65	15300	16.02	669.4	46.82	158.2
10S	4.78	447.65	67.87	17370	16.00	759.7	53.26	157.4
10	6.35	444.50	89.94	22860	15.94	999.9	70.57	155.2
20	7.92	441.35	111.9	28230	15.89	1235	87.71	152.9
STD	9.53	438.15	133.9	33570	15.83	1469	105.2	150.8
30	11.13	434.95	155.9	36800	15.76	1697	122.4	148.6
XS	12.70	431.80	177.3	43840	15.72	1918	139.2	146.4
40	14.27	428.65	198.6	48760	15.67	2113	155.8	144.3
60	19.05	419.10	262.2	63040	15.51	2756	205.8	137.9
80	23.83	409.60	324.1	76310	15.35	3338	254.55	131.8
100	29.36	398.47	394.7	90720	15.16	3969	309.62	124.7
120	34.93	387.35	463.3	104000	14.98	4548	363.56	117.8
140	39.67	377.85	520.4	114400	14.83	5006	408.26	112.1
160	45.24	366.72	585.5	125700	14.65	5499	459.37	105.6

2. FITTING WEIGHT (Kg)-BW

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	X 16	X 14	X 12	X 16	X 14	X 12		
SS	50.3	25.1	41.6	36.8	36.2	35.7	16.9	16.0	15.5		11.3
10S	57.3	28.7	47.3	41.9	41.2	40.6	19.2	18.2	17.6		12.8
XS	150.0	75.0	111.0	108.0	106.0	104.0					34.1
40	169.0	84.5	156.0	135.0	132.0	128.0	56.2	53.0	51.0		41.5
80	275.0	138.0	253.0	228.0	223.0	217.0	91.4	86.4	83.0		69.0
STD	113.0	56.5	83.9	81.4	80.2	78.3	37.8	35.7	33.2		25.5
160	495.0	247.0	470.0	416.0	375.0	368.0	165.0	155.0	149.0		131.0

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	49.7	109	180.1	272.4		
W.N	74.8	138.3	215.7	308.7	736	
BLIND	94.8	176.9	285	385.9	761	

4. VALVE WBIGHT (Kg) (CAST : CRANE, BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	635	1111.3	2086.5			
GLOBE						
BALL	1755	2030	2482	3097	4492	
CHECK	771.1	997.9	1980			

5. INS WT. (Kg)MATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

UNIT : kg/m

* WEIGHT IN () = COVER MAT'L WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	79.3
WEIGHT (Kg)	7.3 (2.0)	8.8 (2.0)	12 (2.1)	15.3 (2.1)	20.5 (2.2)	24.1 (2.3)	33.6 (2.5)	43.9 (2.7)	54.9 (2.9)	66.7 (3.1)		

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

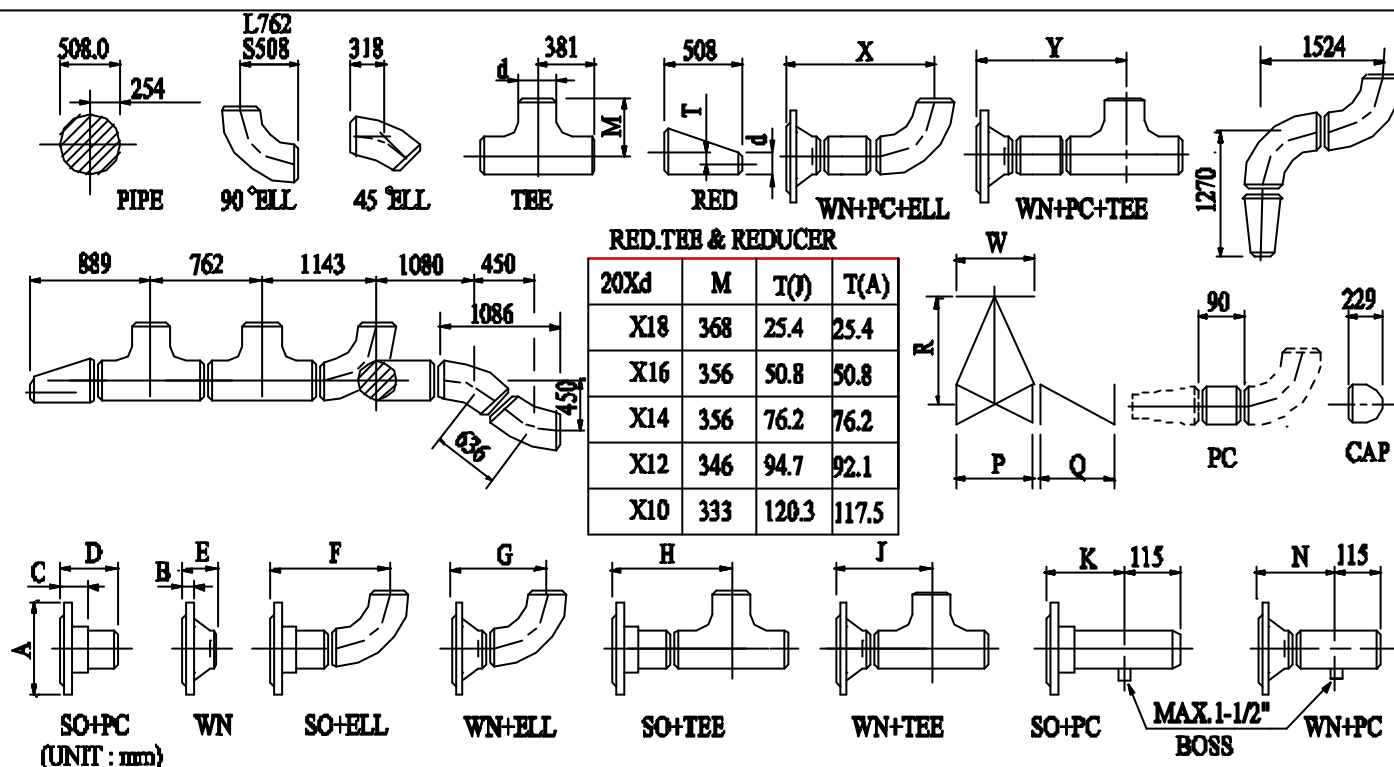
1.3 PIPE, FITTING AND VALVE DIM. CHART 20"(500mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 37 OF 74

DATE : DEC. 1995



RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	675	730		699	775	813	775	813	857	984	
B	30	50		42.9	63.5	95.3	73	98.4	120.7	195.3	
C	48	84		73.2	95.3	133.4					
D	138	174		163	185	223					
E				144.5	162.1	196.9	171.6	200	260.4	373.1	
F	900	936		925	947	985					
G				907	924	959	934	962	1022	1135	
H	519	555		544	566	604					
J				526	543	578	553	581	SEE "Y"		
K	165	210		205	250	335					
N				260	280	335	290	355	430	645	
X											
Y									731	859	
RING NO.							R73	R73	R74	R75	
FL'G SPACE							5.6	4.8	4.8	9.7	
GATE	P	457 (457)	991	1054	457	991	1194	1010	1200	1334	1686
	R				2198	2245	2356	2245	2356		
	W				610	610	864	610	864		
GLOBE	P	978	1016								
	R										
	W										
CHECK	Q	978	1016		978	1016	1194	1035	1200	1334	1686

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
20" (500mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 38 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 508.00 mm OUTSIDE SURFACE = 1.60 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH	THK (mm) t							
5S	4.78	498.45	75.49	23900	17.79	940.9	59.26	195.1
10S	5.54	496.93	87.41	27590	17.77	1086	68.61	193.9
10	6.35	495.30	100.1	31490	17.74	1240	78.56	192.7
STD 20	9.53	488.95	149.2	46350	17.63	1825	117.1	187.6
XS 30	12.70	482.60	197.6	60640	17.52	2367	155.1	182.9
40	15.09	477.88	233.3	70910	17.44	2792	183.42	179.4
60	20.62	466.75	315.8	93930	17.25	3698	247.9	171.1
80	26.19	456.63	398.4	115400	17.06	4542	311.2	163.0
100	32.54	442.92	486.0	138000	16.85	5432	381.5	154.1
120	38.10	431.80	562.4	156300	16.67	6152	441.5	148.4
140	44.45	419.10	647.3	176500	16.46	6908	508.1	137.9
160	50.01	408.03	719.3	190900	16.29	7514	564.8	130.8

2. FITTING WEIGHT (Kg)-BW

SCH	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	X 18	X 16	X 14	X 18	X 16	X 14		
5S	70.8	35.4	52.7	51.0	50.4	49.7	28.6	27.4	25.8		16.0
10S	82.0	41.0	61.0	59.0	58.3	57.5	33.1	31.7	29.9		18.5
XS 30	186.0	93.0	138.0	134.0	131.0	129.0	74.9	71.1	67.4		42.5
40	220.0	110.0	204.0	188.0	181.0	178.0	88.4	83.9	79.6		54.1
80	373.0	187.0	353.0	306.0	294.0	289.0	150.0	142.0	136.0		93.7
STD	140.0	70.0	104.0	101.0	98.4	97.2	56.4	53.5	50.8		31.8
160	676.0	338.0	631.0	528.0	508.0	491.0	-	-	-		179.0

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	65.5	136	231.5	331.4		
WN	89.4	167.4	267.9	376.8	929	
BLIND	123.4	223.2	365	488	967	

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	963.9	1764.5	2415.4			
GLOBE						
BALL	2247	2738	3129	4033	5889	
CHBCK	839.1	1270	2386			

5. INS WT. (Kg)MATERIAL : PERLITE MOLDED PIPE (192Kg/m³)COVER MATERIAL : AL SHEET (0.36) (2699Kg/m³)

* WEIGHT IN () - COVER MATL WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	85.4
WEIGHT (Kg)	8 (2.1)	9.7 (2.2)	13.2 (2.3)	16.8 (2.3)	22.5 (2.4)	26.4 (2.5)	36.7 (2.7)	47.7 (2.9)	59.5 (3.1)	72.1 (3.3)		

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

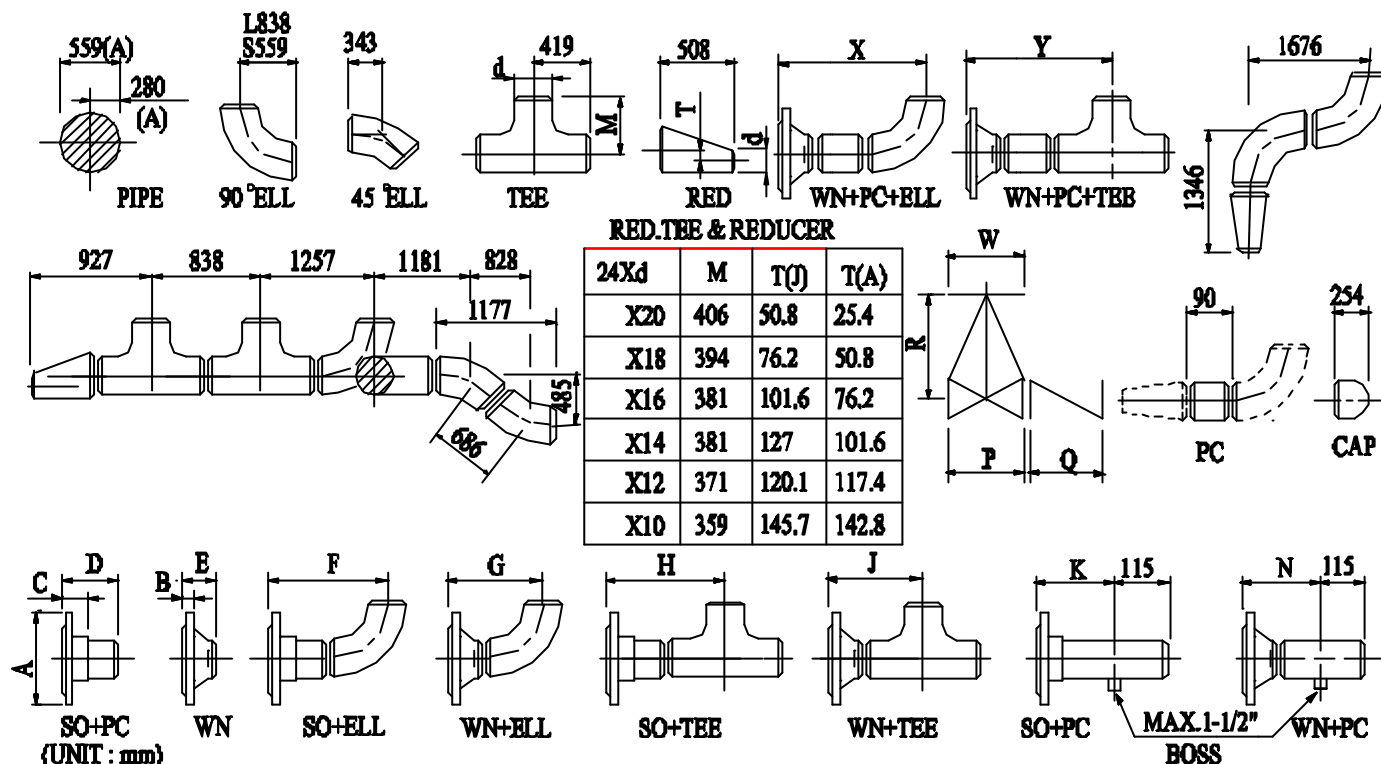
1.3 PIPE, FITTING AND VALVE DIM. CHART 22"-BW (NOT RECOMMENDED SIZE)

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 39 OF 74

DATE : DEC. 1995



RATING NO.	KS . JIS			MSS (W.N ONLY)							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A				749	838	870	838	870			
B				46	67	102	78	106			
C				-	-	-					
D				-	-	-					
E				149	165	203	176	208			
F				-	-	-					
G				987	1003	1041	1014	1046			
H				-	-	-					
J				568	584	622	595	627			
K				-	-	-					
N				240	255	295	265	300			
X											
Y								717			
RING NO.							R81	R81			
FL'G SPACE							6	6			
GATE	P										
	R										
	W										
GLOBE	P										
	R										
	W										
CHECK	Q										

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
22"-BW (NOT RECOMMENDED SIZE)**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 40 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 558.8 mm OUTSIDE SURFACE = 1.76 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
5S	4.78	549.25	83.11	31890	19.59	1141	65.24	236.9
10S	5.54	547.73	96.24	36830	19.56	1318	75.53	235.6
10	6.35	546.10	110.21	42050	19.53	1505	86.54	234.2
STD 20	9.52	539.75	164.36	62000	19.42	2219	129.13	228.8
XS 30	12.70	533.40	217.88	81270	19.31	2909	171.09	223.5
	15.88	527.05	270.77	99850	19.20	3574	212.7	218.2
60	22.23	514.35	374.65	135100	18.99	4834	294.25	207.8
80	28.58	501.65	475.99	167800	18.77	6004	373.83	197.6
100	34.93	488.95	574.79	198100	18.56	7089	451.42	187.8
120	41.28	476.25	671.07	226100	18.36	8092	527.02	178.1
140	47.63	463.55	764.8	252000	18.15	9018	600.63	168.8
160	53.98	450.85	856.02	275800	17.95	9872	672.26	159.6

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	X 20	X 18	X 16	X 20	X 18	X 16		
5S											
10S											
10	114.8	57.4	85.3	83.1	81.2	79.5	42.3	40.4	38.6		
STD 20	169.0	84.5	126	123	120	117	62.4	59.4	56.4		38.8
XS 30	225.0	113.0	167	163	159	156	82.9	78.9	74.8		51.7
80	493.0	257.0	453	386	373	354	181.0	172.0	164.0		116.0
160	886.0	443.0	835	740	696	656	-	-	-		219.0

3. FLANGE WEIGHT (Kg)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N						
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	1040					
GLOBE						
BALL	2772	3704	3979			
CHECK						

5. INS WT.(Kg)MATERIAL : PERLITE MOLDED PIPE(192Kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

* WEIGHT IN () = COVER MAT'L WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	8.8 (2.3)	10.7 (2.4)	14.5 (2.4)	18.4 (2.5)	24.5 (2.6)	28.7 (2.7)	39.7 (2.9)	51.6 (3.1)	64.1 (3.3)	77.5 (3.5)	91.6 (3.6)

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

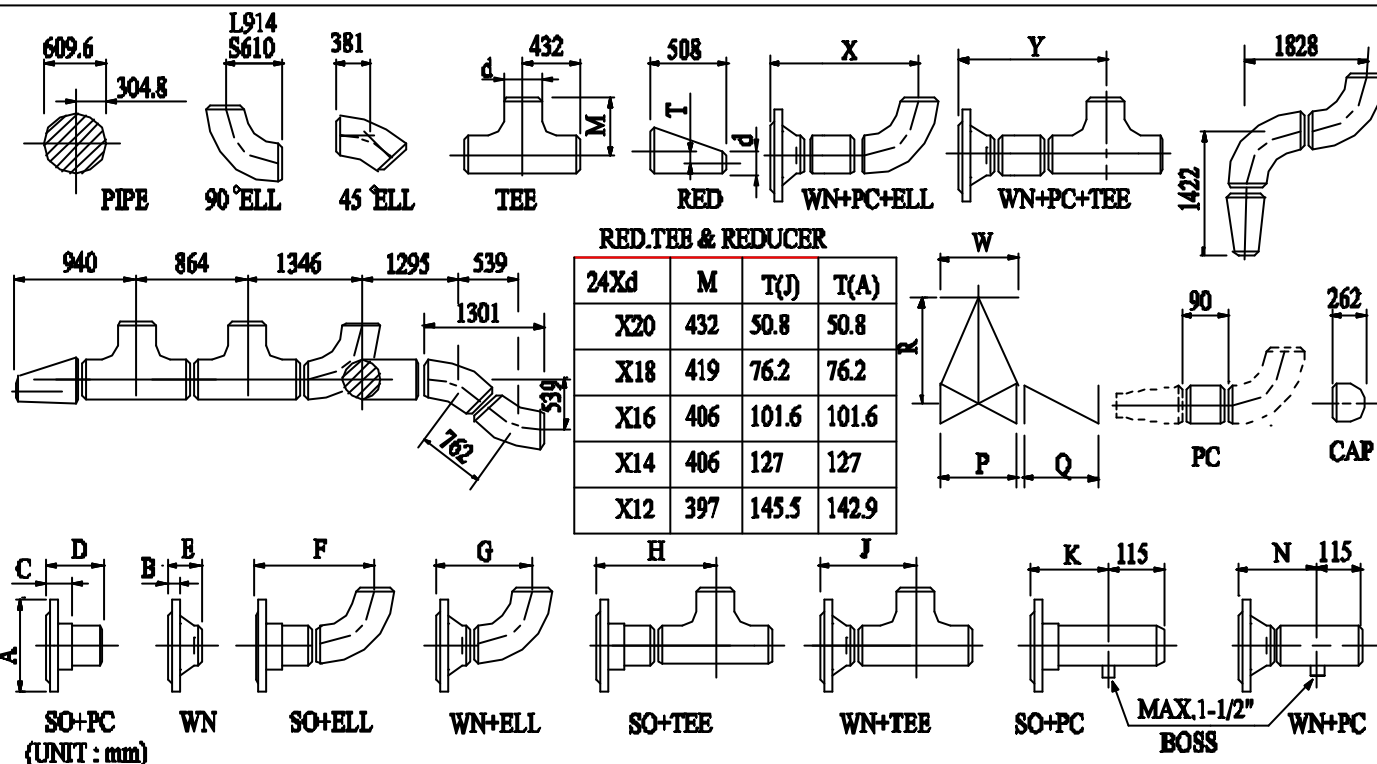
1.3 PIPE, FITTING AND VALVE DIM. CHART 24" (600mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 41 OF 74

DATE : DEC. 1995



RATING NO.	KS . JIS			ASME . JPI							
	10K RF	20K RF	30K RF	150 RF	300 RF	600 RF	300 RJ	600 RJ	900 RJ	1500 RJ	2500 RJ
A	795	845		813	914	940	914	940	1041	1168	
B	32	54		47.8	69.9	108	81	112.7	155.6	223.8	
C	52	96		82.6	106.4	146.1					
D	142	186		173	196	236					
E				152.4	168.1	209.6	179.3	214.3	308	427	
F	1056	1100		1087	1110	1150					
G				1066	1082	1124	1093	1128	1222	1341	
H	574	618		605	628	668					
J				584	600	642	611	SEE "Y"			
K	175	230		220	275	375					
N				270	285	375	315	400	530	725	
X											
Y								736	830	990	
RING NO.							R77	R77	R78	R79	
FLG SPACE							6.4	5.6	5.6	11.2	
GATE	P	508 (508)	1143	1232	508	1143	1397	1165	1407	1568	1972
	R				2618	2602	2750	2602	2750		
	W				711	711	864	711	864		
GLOBE	P	1295	1346								
	R										
	W										
CHECK	Q	1295	1346		1295	1346	1397	1369	1407	1568	1972

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
24" (600mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 42 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 609.6 mm		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
OUTSIDE SURFACE	= 1.92 m ² /M							
SCH.	THK (mm)							
5S	5.54	598.53	105.1	47930	21.36	1573	82.49	281.3
10 10S	6.35	596.90	120.3	54750	21.33	1796	94.53	279.8
STD 20	9.53	590.54	179.6	80840	21.22	2652	141.12	273.9
XS	12.70	584.20	238.2	106100	21.11	3481	187.06	268.0
30	14.27	581.05	266.9	118300	21.05	3653	209.64	265.2
40	17.48	574.64	324.6	142400	20.94	4672	255.41	259.4
60	24.61	560.38	451.9	193700	20.70	6364	355.26	246.7
80	30.96	547.68	562.4	236100	20.49	7745	442.08	235.6
100	38.89	531.82	697.2	285200	20.22	9357	547.71	222.1
120	46.02	517.33	814.9	325700	19.99	10690	640.03	210.4
140	52.37	504.85	916.9	359000	19.79	11780	720.15	200.2
160	59.54	490.52	1028.5	393600	19.56	12910	808.22	189.0

2. FITTING WEIGHT (Kg)-BW

SCH.	90 ° ELL.	45 ° ELL.	TEE					REDUCER			CAP
			FULL	X 20	X 18	X 16		X 20	X 18	X 16	
5S											
10 10S			94.3	92.3	90.3			44.5	42.7		
STD 20	202.0	101.0	139	136	133			65.7	63.0		45.1
XS	268.0	134.0	185	181	177			87.3	83.8		60.1
40	366.0	183.0	252.0	243.0	237.0	232.0		119.0	114.0	108.0	90.1
80	636.0	318.0	548	467	418	-		206.0	197.0	189.0	160.0
160	1160.0	580.0	1012	843	769			-	-	-	307.0

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B16.5 FORGED)

	150#	300#	600#	900#	1500#	2500#
S.O	90.5	204	330	632		
W.N	119.5	235.4	372	685	1504	
BLIND	188.2	342	533.5	905	1568	

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	900#	1500#	2500#
GATE	1415.2	2701.1	3810.2			
GLOBE						
BALL	3033	4420	4970	6595	9355	
CHECK	1315.4	1655.6	3640			

5. INS WT.(Kg)MATERIAL : PERLITE MOLDED PIPE(192Kg/m³)COVER MATERIAL : AL SHEET (0.3) (2699Kg/m³)

* WEIGHT IN () = COVER MATL. WEIGHT

UNIT : kg/m

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	9.6 (2.5)	11.6 (2.6)	15.7 (2.6)	19.9 (2.7)	26.5 (2.8)	31 (2.9)	42.8 (3.1)	55.4 (3.3)	68.8 (3.5)	82.9 (3.6)	97.7 (3.8)

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

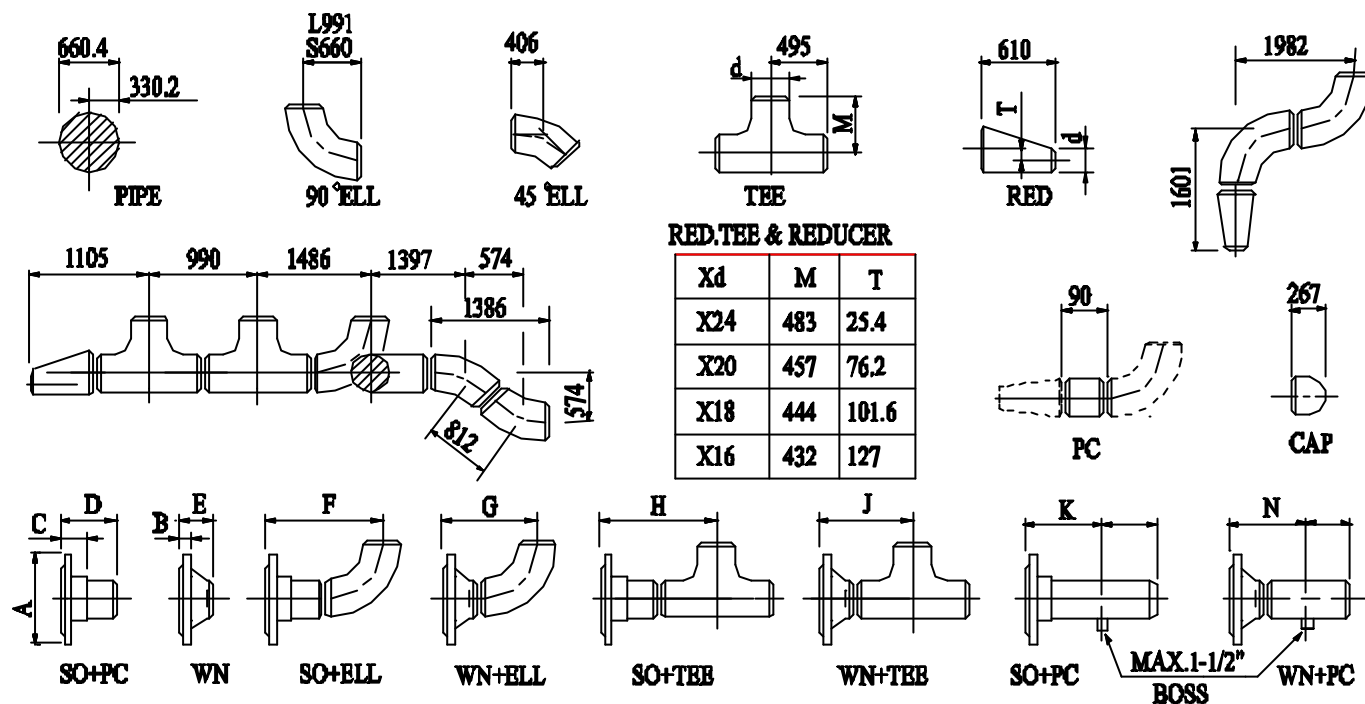
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
26"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 43 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	762	786	867	889	1022	870	971.6		1016		1085.9	
B	33.3	41.3	88.9	111.1	134.9	68.3	79.2	91.9	108	120.7	140.1	157.2
E	58.7	88.9	144.5	181	258.8	120.7	184.2	184.2	228.6	235	292.1	303.2
G	1050	1080	1136	1172	1250	1112	1175	1175	1220	1226	1283	1294
J	554	584	640	676	754	616	679	679	724	730	787	798
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	R93	—	R93	—	R100

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	870		870		870		—		800.1	971.6	831.9
B	20.6	25.4	33.3	25.4	69.9	50.8	—	—	34.9	71.5	63.5
C	20.6	44.5	33.3	44.5	69.9	85.7	—	—	69.9	120.7	114.3
D	111	115	123	115	160	141	—	—	125	162	154
E	—	—	—	—	—	—	—	—	85.7	147.7	127
F	1102	1106	1114	1106	1151	1132	—	—	1116	1153	1145
G	—	—	—	—	—	—	—	—	1077	1139	1118
H	606	610	618	610	655	636	—	—	620	657	649
J	—	—	—	—	—	—	—	—	581	643	622
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****26"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 44 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B39.19M)

D = 660mm OUTSIDE SURFACE = 2.07 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
	6.35	647.30	130.4	69640		2110	102.4	329.1
10	7.92	644.16	162.2	86240	23.07	2613	127.4	325.9
STD	9.53	640.94	194.7	103000	23.01	3121	152.9	322.7
	11.13	637.74	226.8	119400		3619	178.1	319.4
XS 20	12.70	634.60	258.2	135300	22.91	4100	202.7	316.3
	15.88	628.24	321.3	166700	22.81	5053	252.3	310.0
	19.05	621.90	383.5	197100		5974	301.1	303.8
	22.23	615.24	445.4	226700		6870	349.6	297.6
	25.40	609.20	506.3	255300		7737	397.5	291.5

2. FITTING WEIGHT (Kg)

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 24	x 22	x 20	x 24	x 22	x 20		
STD	237.0	119.0	176.0	172.0	169.0	166.0	89.4	85.8	82.1		50.5
XS	315.0	158.0	234.0	229.0	225.0	211.0	119.0	114.0	109.0		67.3

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	52	200.2				
BLIND						

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#	300#		800#		2500#
GATE						
GLOBE						
BALL	4198	5392	5994			
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE(192kg/m³)COVER MATERIAL : AL. SHEET(0.3t)(2699Kg/m³)

UNIT : kg/m FOR PLANE

* WEIGHT IN () - COVER MAT'L WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)	48	57.6	76.8	96	124.8	144	192	240	288	336	384

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

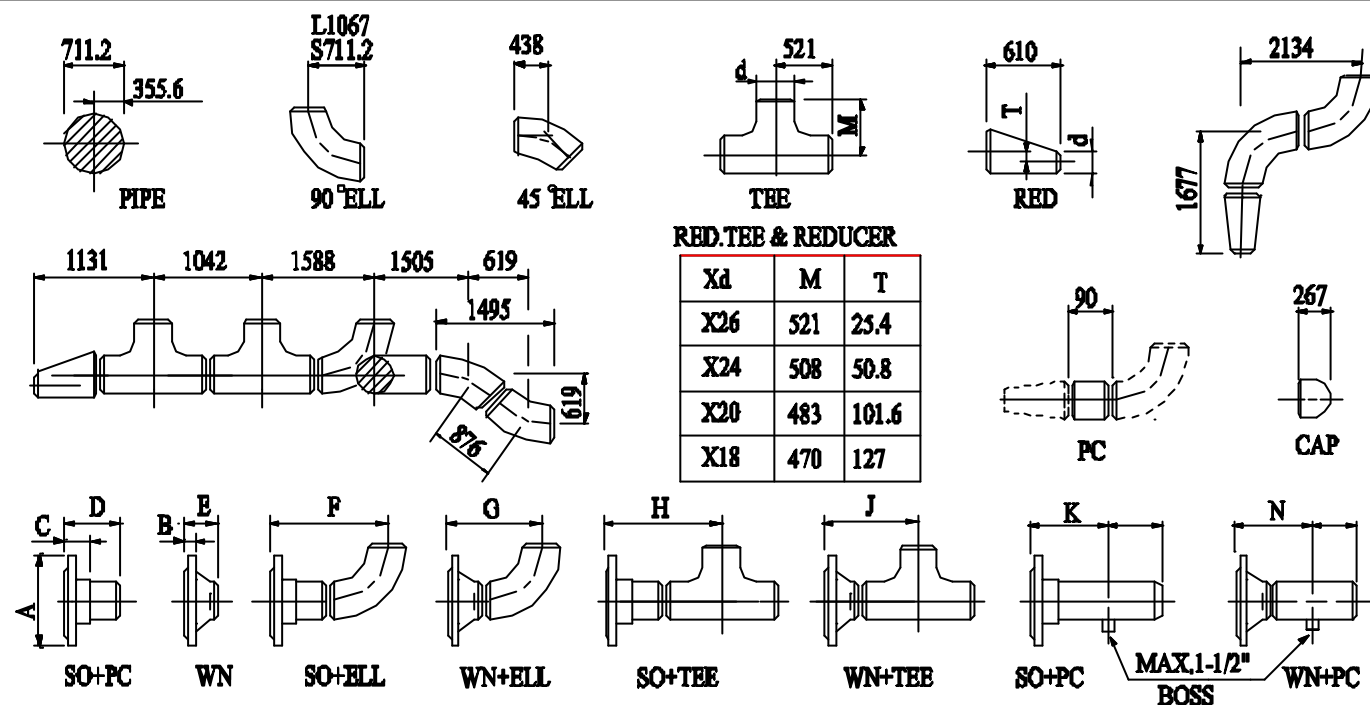
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
28"(700mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 45 OF 74

DATE : DEC. 1995



RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	813	837	921	952	1105	927.1	1035.1		1073.2		1168.4	
B	33.3	44.4	88.9	122.3	154	71.4	85.9	98.6	117.1	124	149.1	160.2
B	61.9	95.2	149.2	196.9	282.6	125.5	196.9	209.6	241.3	247.7	304.8	315.9
G	1129	1162	1216	1264	1350	1193	1264	1277	1308	1315	1372	1383
J	583	616	670	718	804	647	718	731	762	769	826	837
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	R94	—	R94	—	R101

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CLB (80PSI)		CLD (175PSI)		CLE (275PSI)		CLF (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	927.1		927.1		927.1		—		850.9	1035.1	882.7
B	22.2	25.4	33.3	25.4	69.9	52.4	—	—	34.9	74.6	63.5
C	22.2	44.5	33.3	44.5	69.9	87.3	—	—	69.9	127	114.3
D	112	135	123	135	160	177	—	—	160	217	204
E	—	—	—	—	—	—	—	—	85.7	150.8	127
F	1179	1202	1190	1202	1227	1244	—	—	1227	1284	1271
G	—	—	—	—	—	—	—	—	1153	1218	1194
H	633	656	644	656	681	698	—	—	681	738	725
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART**
28" (700mm)-BW

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 46 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 711.0mm OUTSIDE SURFACE = 2.23 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
	6.35	698.30	140.5	87250		2454	110.3	383.0
10	7.92	695.16	174.9	108100	24.87	3041	137.3	379.5
STD	9.53	691.94	210.0	129200	24.81	3634	164.9	376.0
	11.13	688.74	244.7	149800		4215	192.1	376.6
XS 20	12.70	685.60	278.6	169800	24.70	4778	218.7	369.2
30	15.88	679.24	346.7	209500	24.59	5894	271.2	362.4
	19.05	672.90	414.1	248000		6977	325.1	355.6
	22.23	666.54	481.0	285500		8032	377.6	348.9
	25.40	660.20	547.0	321800		9054	429.4	342.3

2. FITTING WEIGHT

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 26	x 24	x 22	x 26	x 24	x 22		
STD	276.0	138.0	192.0	189.0	184.0	182.0	96.6	93.0	89.4		56.2
XS	367.0	184.0	256.0	251.0	244.0	242.0	129.0	124.0	119.0		74.9

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
WN	58.1	210.2				
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE, BALL : KPC (FULL BORE))

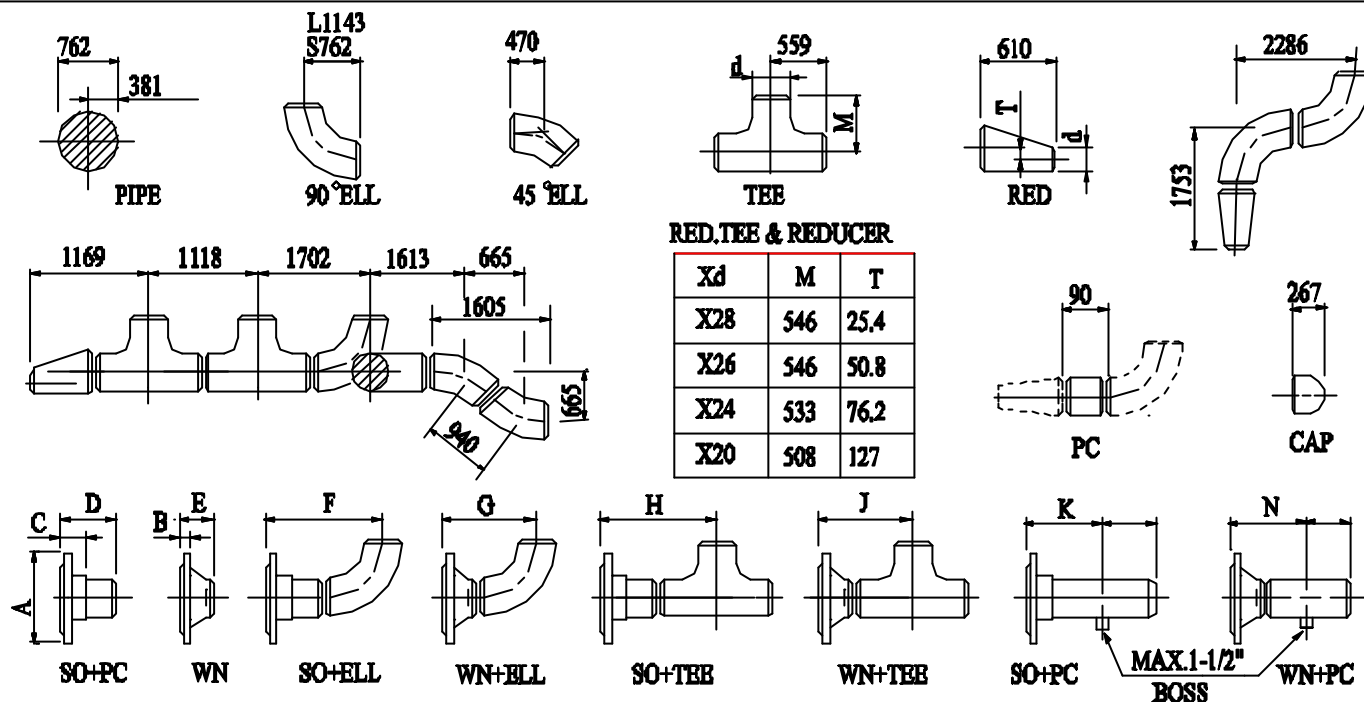
	150#	300#	600#	800#		2500#
GATE						
GLOBB						
BALL	4763	6148	7125			
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

* WEIGHT IN () - COVER MAT'L WEIGHT

UNIT : kg/m FOR PLANE

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466t(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)												



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	864	887	991	1022	1181	984.3	1092.2		1130.3		1231.9	
B	33.3	44.4	93.7	131.8	162	74.7	91.9	104.6	120.7	127	155.7	166.8
B	65.1	100	158	211.2	295.3	136.7	209.6	222.3	254	260.4	317.5	328.6
G	1208	1243	1301	1354	1438	1280	1353	1365	1397	1403	1461	1472
J	624	659	717	770	854	696	769	781	813	819	877	888
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	R95	—	R95	—	R102

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	984.3		984.3		984.3		1092.2		908.1	1092.2	939.8
B	22.2	25.4	34.9	25.4	73	54	74.6	76.2	34.9	76.2	66.7
C	22.2	44.5	34.9	44.5	73	88.9	74.6	127	69.9	127	120.7
D	122	135	125	135	163	179	165	217	160	217	211
B	—	—	—	—	—	—	—	—	92.1	152.4	133.4
F	1265	1278	1268	1278	1306	1322	1308	1360	1303	1360	1354
G	—	—	—	—	—	—	—	—	1235	1295	1276
H	681	694	684	694	722	738	724	776	719	776	770
J	—	—	—	—	—	—	—	—	651	711	692
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
30"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 48 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 762.0mm OUTSIDE SURFACE = 2.39 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm)							
5S	6.35	749.30	150.7	107600	26.72	2824	118.3	441.0
10S 10	7.92	746.16	187.6	133300	26.66	3500	147.4	437.3
STD	9.53	742.94	225.2	159400	26.61	4185	176.8	433.5
	11.13	739.74	262.5	185000		4857	206.1	429.8
XS 20	12.70	736.60	298.9	209800	26.50	5508	234.7	426.1
30	15.88	730.24	372.2	259100		6801	292.2	418.8
	19.05	723.90	444.6	306900		8057	349.0	411.6
	22.23	717.54	516.6	353700		9284	405.5	404.4
	25.40	711.20	587.7	399100		10470	461.4	397.3

2. FITTING WEIGHT (Kg)

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 28	x 26	x 24	x 28	x 26	x 24		
STD	316.0	158.0	228.0	226.0	222.0	218.0	104.0	100.0	96.6		62.1
XS	421.0	211.0	304.0	301.0	296.0	291.0	138.0	133.0	129.0		82.8

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	65.1	270.2				
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE, BALL : KPC (FULL BORE))

	150#	300#	600#	800#		2500#
GATE	2050.2	3946.0				
GLOBE						
BALL	5348	7214	8499			
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m²)

UNIT : kg/m FOR PLANE

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

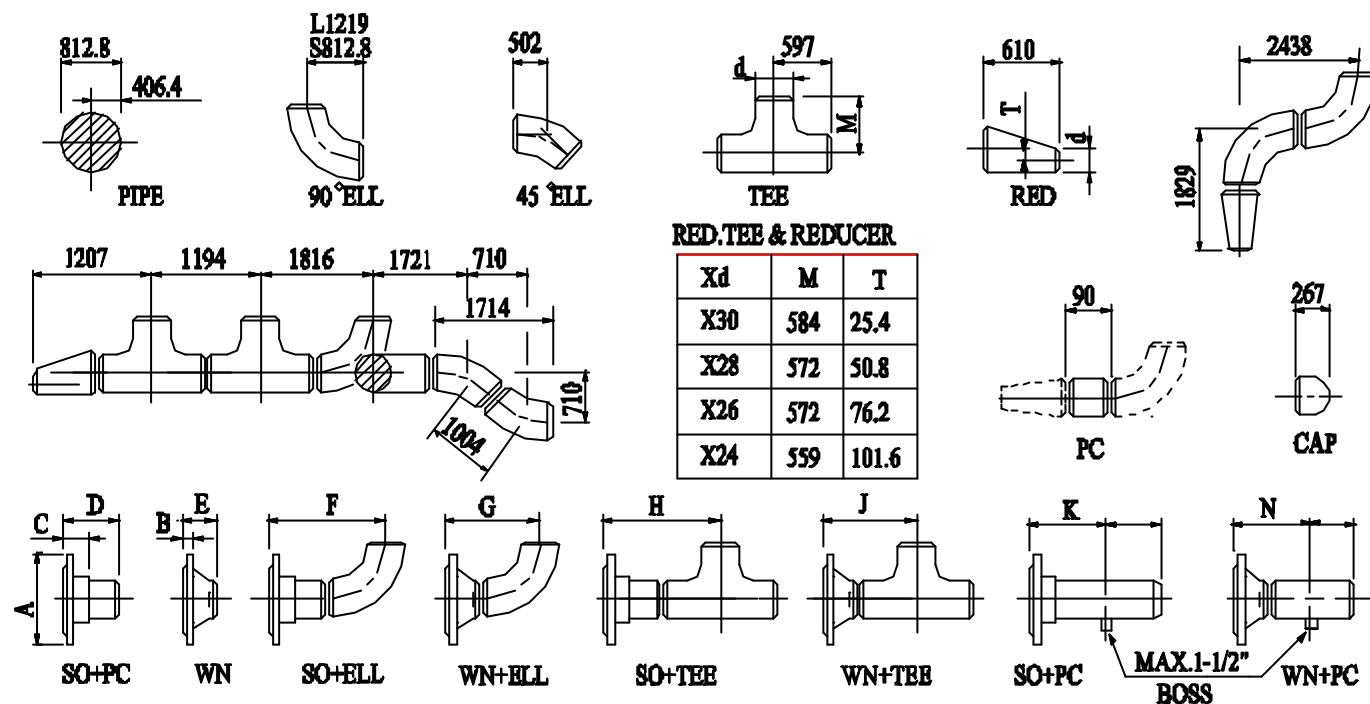
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****32"(800mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 49 OF 74

DATE : DEC. 1995



RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	914	941	1054	1086	1238	1060.5	1149.4		1193.8		1314.5	
B	34.9	46	103.2	136.6	166.7	80.8	98.6	112.8	123.7	131.6	165.1	176.2
E	69.8	108	168.3	222.3	309.6	144.5	222.3	236.5	266.7	274.6	336.6	347.7
G	1289	1327	1387	1441	1529	1364	1441	1456	1486	1494	1556	1567
J	667	705	765	819	907	742	819	834	864	872	934	945
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	R96	—	R96	—	R103

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1060.5		1060.5		1060.5		—		958.9	1149.4	990.6
B	23.8	28.6	38.1	28.6	76.2	57.2	—	—	34.9	79.4	69.9
C	23.8	44.5	38.1	44.5	76.2	92.1	—	—	69.9	130.2	127
D	114	135	128	135	166	182	—	—	160	220	217
E	—	—	—	—	—	—	—	—	92.1	155.6	139.7
F	1333	1354	1347	1354	1385	1401	—	—	1379	1439	1436
G	—	—	—	—	—	—	—	—	1311	1375	1359
H	711	732	725	732	763	779	—	—	757	817	814
J	—	—	—	—	—	—	—	—	689	753	737
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****32"(800mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 50 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 813mm OUTSIDE SURFACE = 2.55 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
10	7.92	797.16	200.3	162300	28.45	3992	157.2	499.1
STD	9.53	793.94	240.5	194100	28.40	4776	188.8	495.1
XS 20	12.70	787.60	319.3	255700	28.30	6290	250.6	487.2
30	15.88	781.24	397.6	315900	28.17	7773	312.2	479.4
40	17.48	778.04	436.8	345700	28.12	8505	342.9	475.5
	25.40	762.20	628.4	487800		12000	493.3	456.3
	28.58	755.84	704.3	542400		13340	552.9	448.7
	31.75	749.50	779.2	595500		14650	611.7	441.2

2. FITTING WEIGHT (Kg)

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 30	x 28	x 26	x 30	x 28	x 26		
STD	361.0	180.0	259.0	254.0	250.0	248.0	111.0	108.0	104.0		68.4
XS	480.0	240.0	331.0	325.0	319.0	317.0	148.0	143.0	138.0		91.2
40	654.0	327.0									126.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	85.1	330.3				
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE BALL : KPC (FULL BORE))

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (2699Kg/m²)

UNIT : kg/m FOR PLANE

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

$$W_p = 0.02466(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.00004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

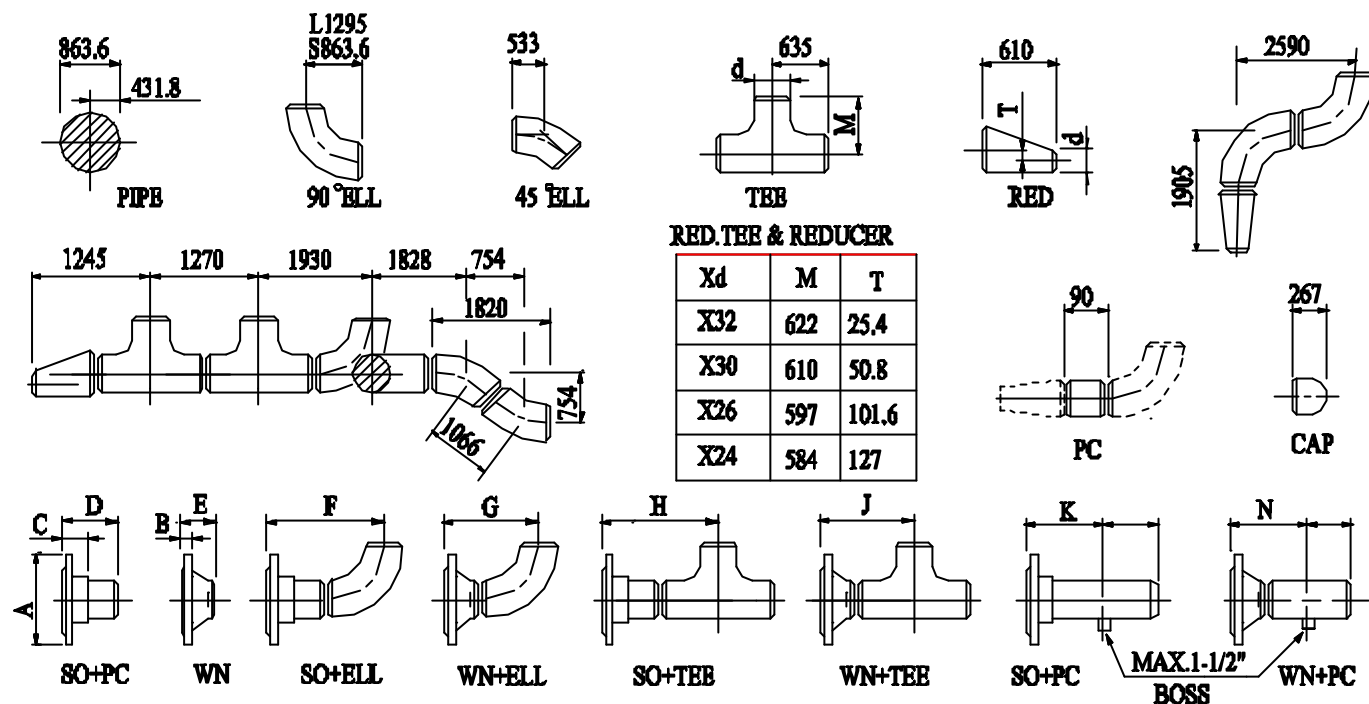
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
34"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 51 OF 74

DATE : DEC. 1995



(UNIT : mm)

ASME B16.47 SERIES B (WN ONLY)														ASME B16.47 SERIES A (WN ONLY)							
RATING NO.	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900										
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ									
A	965	1005	1108	1162	1314	1111.3	1206.5		1244.6		1397										
B	34.9	49.2	103.2	147.7	177.8	82.6	101.6	115.9	127	134.9	171.5	185.7									
E	73	110.3	173	239.8	325.5	149.4	231.6	245.9	276.1	284	355.6	369.9									
G	1368	1405	1468	1535	1621	1445	1527	1541	1571	1579	1651	1665									
J	708	745	808	875	961	784	867	881	911	919	991	1005									
N	—	—	—	—	—	—	—	—	—	—	—	—									
RING NO.	—	—	—	—	—	—	—	R97	—	R97	—	R104									

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1111.3		1111.3		1111.3		—		1022.4	1206.5	1041.4
B	23.8	28.6	38.1	28.6	76.2	58.7	—	—	44.5	82.6	73
C	23.8	44.5	38.1	44.5	76.2	93.7	—	—	85.7	133.4	130.2
D	114	135	128	135	166	184	—	—	135	173	163
E	—	—	—	—	—	—	—	—	95.3	158.8	146.1
F	1409	1430	1423	1430	1461	1479	—	—	1430	1468	1458
G	—	—	—	—	—	—	—	—	1390	1454	1441
H	749	770	763	770	801	819	—	—	770	808	798
J	—	—	—	—	—	—	—	—	730	794	781
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
34"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 52 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 864mm OUTSIDE SURFACE = 2.71 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
10	7.92	848.16	213.0	195100	30.25	4517	167.2	563.0
STD	9.53	844.94	255.8	233500	30.20	5405	200.3	560.7
	11.13	841.74	298.2	271100		6277	234.1	556.5
XS 20	12.70	838.60	339.6	307700	30.10	7124	266.6	552.3
30	15.88	832.24	423.1	380500	29.97	8809	332.1	544.0
40	17.48	829.04	464.8	416500	29.92	9643	364.9	539.8
	20.62	822.76	546.3	486000		11250	428.9	531.7
	25.40	813.20	669.1	588700		13620	525.3	519.4
	31.75	800.50	830.1	719700		16660	651.6	503.3

2. FITTING WEIGHT (Kg)

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 32	x 30	x 28	x 32	x 30	x 28		
STD	408.0	204.0	295.0	292.0	290.0	288.0	118.0	115.0	111.0		75.0
XS	543.0	272.0	393.0	389.0	380.0	377.0	158.0	153.0	148.0		100.0
40	739.0	369.0									138.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	100.1	360.3				
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE(192kg/m³)COVER MATERIAL : AL SHEET(0.3t)(2699Kg/m²)

UNIT : kg/m FOR PLANE

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.00004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)												

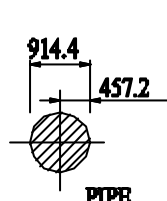
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****36" (900mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 53 OF 74

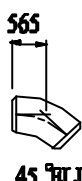
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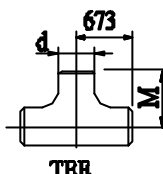
PIPE



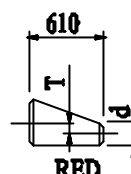
90° ELL



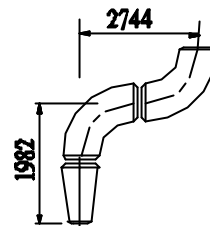
45° ELL



TBE



RED



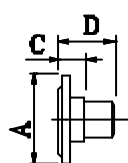
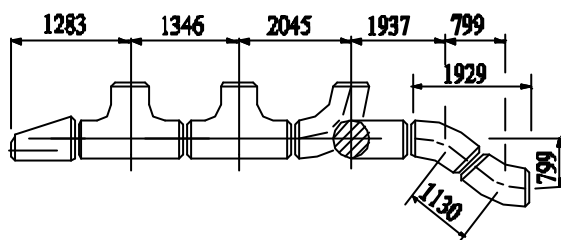
PC



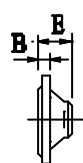
CAP

RED. TEE & REDUCER

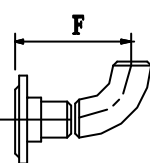
Xd	M	T
X34	660	25.4
X32	648	50.8
X30	635	76.2
X26	622	127



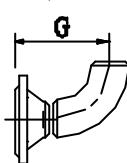
SO+PC



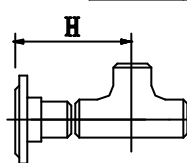
WN



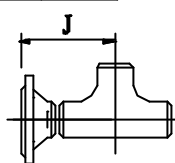
SO+ELL



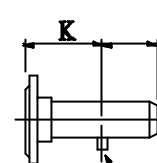
WN+ELL



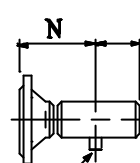
SO+TEE



WN+TEE



SO+PC



WN+PC

MAX. 1-1/2"
BOSS

(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1033	1057	1172	1213	1346	1168.4	1270		1314.5		1460.5	
B	36.5	52.4	103.2	152.4	179.4	90.4	104.6	118.9	130.3	138.2	177.8	192.1
E	85.7	117.5	181	249.3	331.8	149.4	241.3	255.6	288.8	296.7	368.3	382.6
G	1458	1490	1553	1621	1704	1521	1613	1628	1661	1669	1740	1755
J	759	791	854	922	1005	822	914	929	962	970	1041	1056
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	R98	—	R98	—	R105

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1168.4		1168.4		1168.4		1270		1073.2	1270	1111.3
B	25.4	28.6	41.3	28.6	79.4	60.3	81	85.9	44.5	85.7	79.4
C	25.4	44.5	41.3	44.5	79.4	95.3	81	136.7	85.7	136.5	142.9
D	115	135	131	135	169	185	171	227	176	227	233
E	—	—	—	—	—	—	—	—	95.3	161.9	155.6
F	1487	1507	1503	1507	1541	1557	1543	1599	1548	1599	1605
G	—	—	—	—	—	—	—	—	1467	1534	1528
H	788	808	804	808	842	858	844	900	849	900	906
J	—	—	—	—	—	—	—	—	768	835	829
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****36" (900mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 54 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 914.0mm OUTSIDE SURFACE = 2.87 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
10	7.92	898.16	225.4	231300	32.05	5062	177.0	633.6
STD	9.53	894.94	270.7	276900	31.98	6059	212.6	629.0
	11.13	891.74	315.7	321700		7040	247.8	624.6
XS 20	12.70	888.60	359.6	363200	31.88	3596	282.3	620.2
30	15.88	882.24	448.0	451900	31.78	9888	351.7	611.3
40	19.05	875.90	535.6	536400	31.65	11730	420.4	602.6
	25.40	863.20	709.0	700400		15320	556.6	585.2
	28.58	856.84	794.9	779800		17060	624.0	576.6
	31.75	850.50	880.0	857300		18760	690.8	568.1

2. FITTING WEIGHT (Kg)

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 34	x 32	x 30	x 34	x 32	x 30		
STD	457.0	228.0	331.0	329.0	326.0	323.0	126.0	122.0	118.0		81.9
XS	608.0	304.0	441.0	434.0	431.0	422.0	167.0	163.0	158.0		109.0
40	904.0	452.0									164.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	115.1	410.4				
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	800#		2500#
GATE	3111.6					
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

UNIT : kg/m FOR PLANE

* WEIGHT IN () = COVER MATL. WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

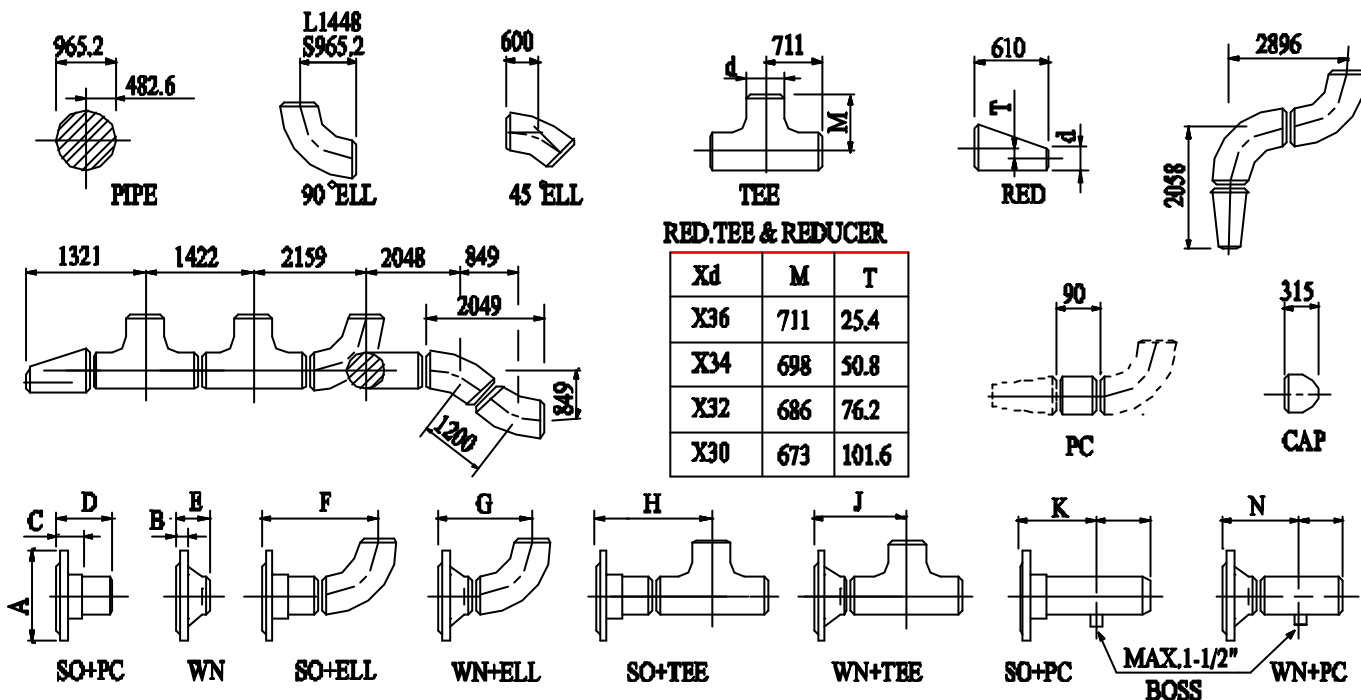
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
38"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 55 OF 74

DATE : DEC. 1995



RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1084	1124	1222	1270	1460	1238.3	1168.4		1270		1460.5	
B	38.1	54	111.1	158.8	196.9	87.4	108	—	158.8	—	196.9	—
E	88.9	123.8	192.1	260.4	358.8	157.2	180.8	—	260.4	—	358.9	—
G	—	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1238.3		1238.3		1238.3		—		1124	1327.2	1162.1
B	25.4	28.6	41.3	28.6	79.4	60.3	—	—	50.8 / 44.5	87.3	79.4
C	25.4	44.5	41.3	44.5	79.4	95.3	—	—	95.3	139.7	142.9
D	—	—	—	—	—	—	—	—	—	—	—
E	—	—	—	—	—	—	—	—	104.8	163.5	155.6
F	—	—	—	—	—	—	—	—	—	—	—
G	—	—	—	—	—	—	—	—	—	—	—
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
38"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 56 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 965.0mm OUTSIDE SURFACE = 3.02 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
STD	9.53	945.94	286.0	326400	37.36	6766	224.5	702.8
	11.13	942.74	333.5	379300		7862	261.8	698.0
XS	12.70	939.60	379.9	430700	37.26	8928	298.2	693.4
	15.88	933.24	473.5	533300	37.13	11050	371.7	684.0
	19.05	926.90	566.1	633400	37.06	13120	444.4	674.8
	22.23	920.54	658.4	731900		15160	516.8	665.5
	25.40	914.20	749.7	828000		17160	588.5	656.4
	28.58	907.84	840.7	922400		19110	660.0	647.3
	31.75	901.50	930.8	1014000		21020	730.7	638.3

2. FITTING WEIGHT (Kg)

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 36	x 34	x 32	x 36	x 34	x 32		
STD	510.0	255.0	370.0	367.0	362.0	357.0	133.0	129.0	126.0		94.7
XS	679.0	339.0	493.0	489.0	481.0	476.0	177.0	172.0	167.0		126.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	135.1	570.5				
BLIND						

4. VALVE WEIGHT (Kg) (CAST : CRANE. BALL : KPC (FULL BORE))

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHBCK						

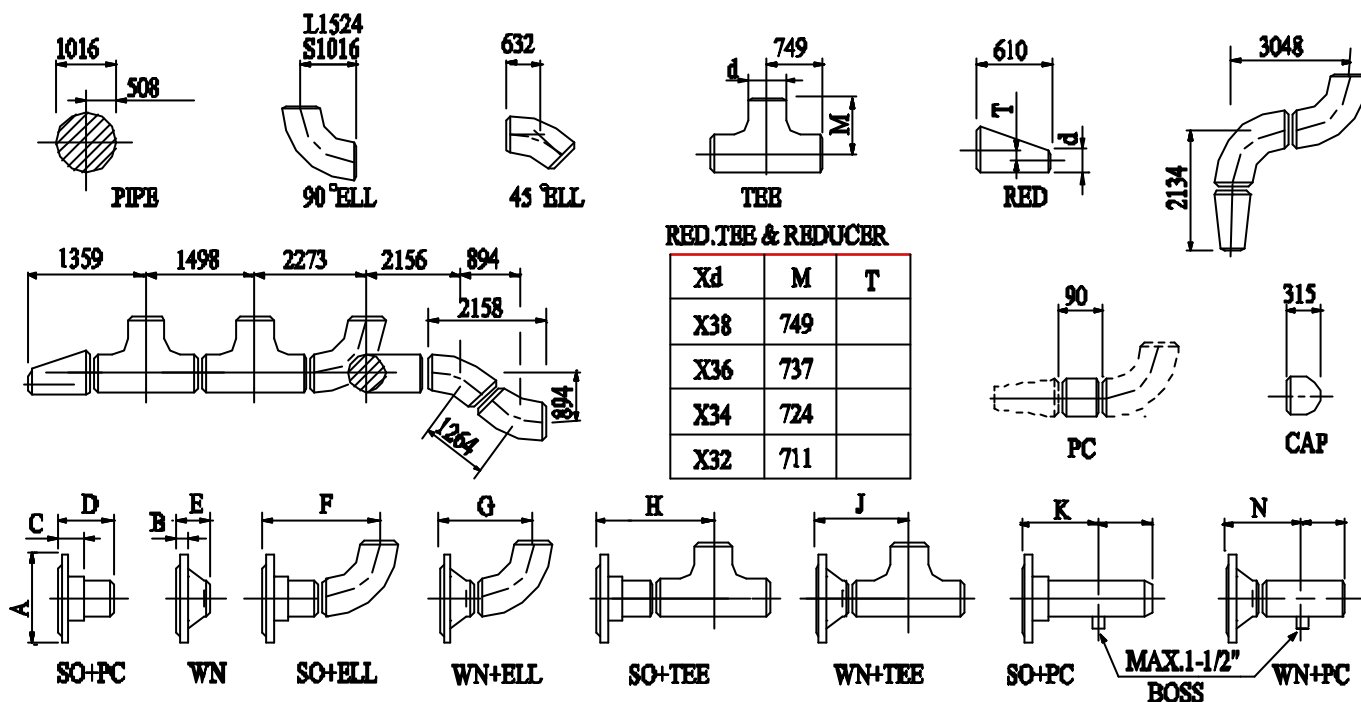
5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.31)(2699Kg/m³)

UNIT : kg/m FOR PLANE

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

$$\begin{aligned}
 W_p &= 0.02466(D-t) \\
 W_w &= 0.0007854d^2 \\
 A &= 0.007854(D^2 - d^2) \\
 I &= 0.00004909 \times (D^4 - d^4) \\
 Z &= 0.00009817 \times \frac{D^4 - d^4}{D}
 \end{aligned}$$

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
40"(1000mm)-BW****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 57 OF 74****DATE : DEC. 1995**

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1135	1175	1273	1321	1511	1289.1	1238.3		1320.8		1511.3	
B	38.1	55.6	115.9	165.2	203.2	90.4	114.3	—	165.1	—	203.2	—
E	92.1	128.6	198.4	269.9	369.9	163.6	193.5	—	270	—	369.8	—
G	1616	1653	1722	1794	1894	1688	1718	—	1794	—	1894	—
J	841	878	947	1019	1119	913	943	—	1019	—	1119	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1289.1		1289.1		1289.1		—		1174.8	1384.3	1212.9
B	25.4	28.6	41.3	28.6	82.6	63.5	—	—	50.8 44.5	90.5	82.6
C	25.4	44.5	41.3	44.5	82.6	98.4	—	—	101.6	139.7	149.2
D	115	135	131	135	173	188	—	—	192	230	239
E	—	—	—	—	—	—	—	—	104.8	166.7	158.8
F	1639	1659	1655	1659	1697	1712	—	—	1716	1754	1763
G	—	—	—	—	—	—	—	—	1629	1691	1683
H	864	884	880	884	922	937	—	—	941	979	988
J	—	—	—	—	—	—	—	—	854	916	908
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
40" (1000mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 58 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 1016mm OUTSIDE SURFACE = 3.19 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
STD	9.53	996.94	301.3	381500		7511	236.5	780.6
	11.13	993.74	351.3	443500		8731	275.8	775.6
XS	12.70	990.60	400.3	503700		9916	314.2	770.7
	15.88	984.24	498.9	623900		12280	391.7	760.8
	19.05	977.90	596.6	741500		14590	468.3	751.1
	22.23	971.54	694.0	857100		16870	544.8	741.3
	25.40	965.20	790.4	970200		19090	620.5	731.7
	28.58	958.84	886.5	1081000		21280	695.9	722.1
	31.75	952.50	981.7	1190000		23420	770.6	712.6

2. FITTING WEIGHT (Kg)

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 38	x 36	x 34	x 38	x 36	x 34		
STD	565.0	282.0	411.0	408.0	402.0	397.0	140.0	137.0	133.0		102.0
XS	753.0	376.0	547.0	543.0	536.0	529.0	187.0	182.0	177.0		137.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
WN	150.1	660.6				
BLIND						

4. VALVE WEIGHT

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL. SHEET (0.30) (2699Kg/m³)

* WEIGHT IN () = COVER MAT'L WEIGHT

UNIT : kg/m FOR PLANE

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

 $W_p = 0.02466t(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$

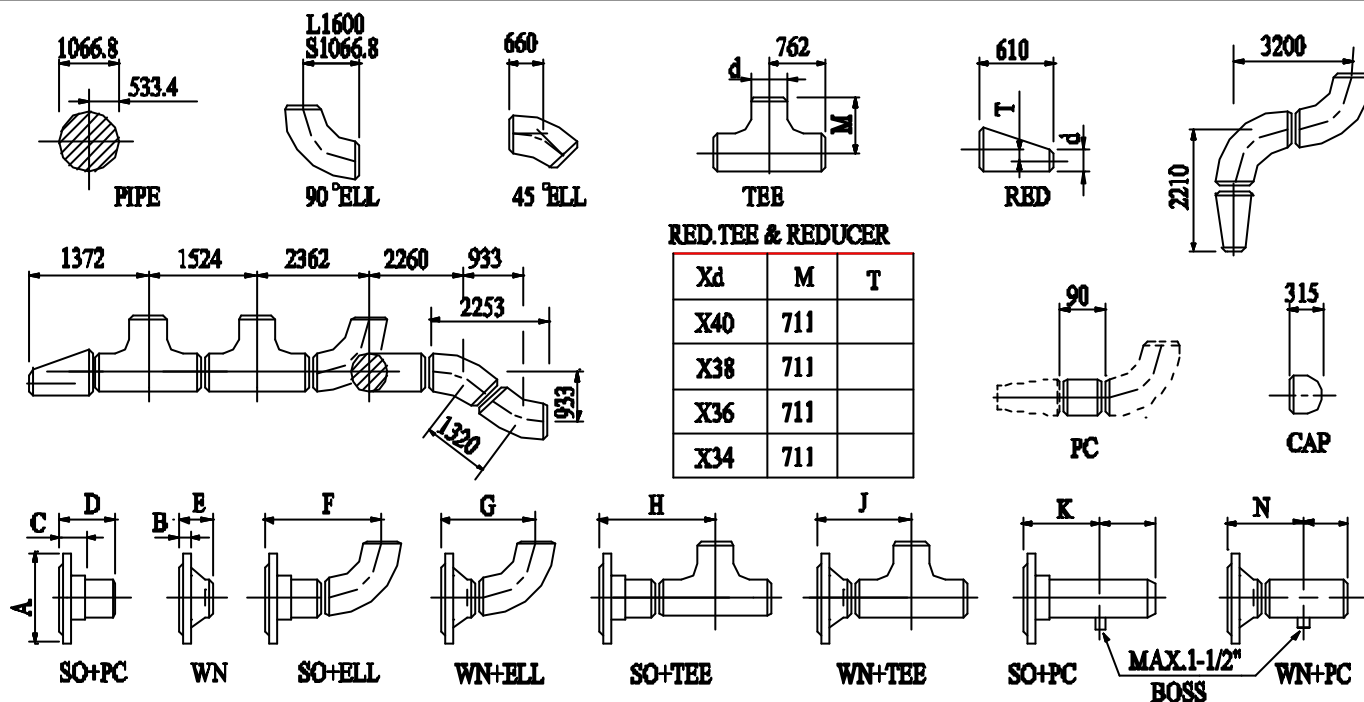
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****42"(1100mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 59 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1186	1228	1334	1403	1562	1346.2	1289.1		1403.4		1562.1	
B	39.7	58.7	119.1	174.7	212.8	96.8	119.1	—	174.5	—	212.6	—
E	95.2	133.4	204.8	285.8	377.9	171.5	200.2	—	285.8	—	377.7	—
G	1695	1733	1805	1886	1978	1772	1800	—	1886	—	1978	—
J	857	895	967	1048	1140	934	962	—	1048	—	1140	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1346.2		1346.2		1346.2		1447.8		1244.6	1447.8	1270
B	28.6	31.8	44.5	31.8	85.7	66.7	87.3	93.7	60.3	93.7	88.9
C	28.6	44.5	44.5	44.5	85.7	101.6	87.3	143	111.1	142.9	155.6
D	119	135	135	135	176	192	177	233	201	233	246
E	—	—	—	—	—	—	—	—	114.3	176.2	165.1
F	1719	1735	1735	1735	1776	1792	1777	1833	1801	1833	1765
G	—	—	—	—	—	—	—	—	1714	1776	1765
H	881	897	897	897	938	954	939	995	963	995	1008
J	—	—	—	—	—	—	—	—	876	938	927
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
42"(1100mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 60 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D = 1067mm OUTSIDE SURFACE = 3.35 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
STD	9.53	1047.94	316.6	442500		8295	248.5	862.5
	11.13	1044.74	369.1	514500		9644	289.8	857.3
XS	12.70	1041.60	420.6	584500		10950	330.2	852.1
	15.88	1035.24	524.3	724300		13570	411.6	841.7
	19.05	1028.90	627.1	861200		16140	492.3	831.5
	22.23	1022.54	729.6	995900		18660	572.7	821.2
	25.40	1016.20	831.1	1127000		21140	652.4	811.1
	28.58	1009.84	932.3	1257000		23570	731.9	800.9
	31.75	1003.50	1032.0	1384000		25950	810.6	790.9

2. FITTING WEIGHT (Kg)

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 40	x 38	x 36	x 40	x 38	x 36		
STD	622.0	311.0	422.0	420.0	418.0	416.0	147.0	144.0	140.0		110.0
XS	828.0	414.0	562.0	559.0	557.0	554.0	196.0	192.0	187.0		147.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
WN	165.2	720.6				
BLIND						

4. VALVE WEIGHT

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE(192kg/m³)COVER MATERIAL : AL. SHEET(0.3t)(2699Kg/m²)

* WEIGHT IN () = COVER MATL WEIGHT

 $W_p = 0.02466(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.000004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

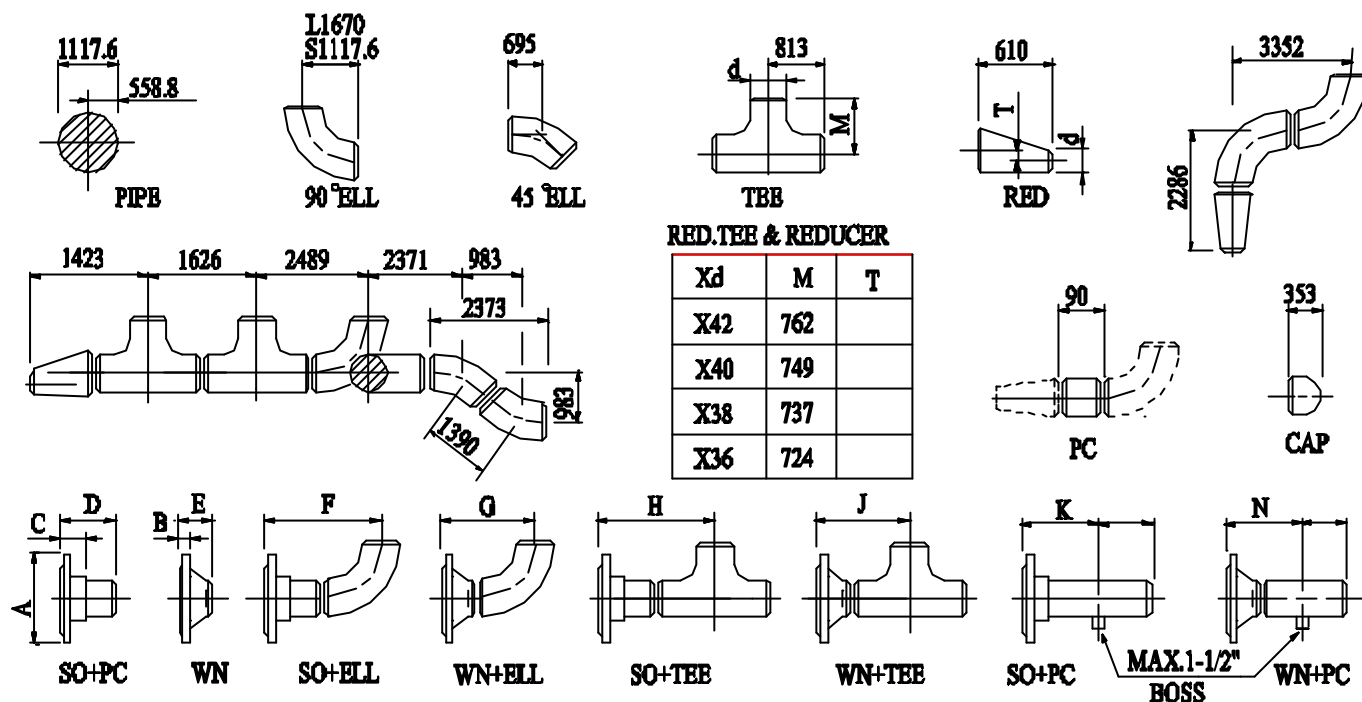
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
44"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 61 OF 74

DATE : DEC. 1995



RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1251	1276	1384	1454	1648	1403.4	1352.6		1454.2		1648	
B	42.9	60.3	127	179.4	220.7	101.6	124	—	179.3	—	220.7	—
B	104.8	136.5	214.3	295.3	396.9	177.8	206.2	—	295.4	—	397	—
G	1781	1813	1890	1971	2073	1854	1882	—	1971	—	2073	—
I	918	950	1027	1108	1210	991	1019	—	1108	—	1210	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1403.4		1403.4		1403.4		—		1295.4	1505	1339.9
B	28.6	31.8	44.5	31.8	85.7	66.7	—	—	60.3 / 50.8	95.3	95.3
C	28.6	57.2	44.5	57.2	85.7	101.6	—	—	111.1	146.1	171.5
D	119	147	135	147	176	192	—	—	201	236	262
B	—	—	—	—	—	—	—	—	114.3	177.8	171.5
F	1795	1823	1811	1823	1852	1868	—	—	1877	1912	1938
G	—	—	—	—	—	—	—	—	1790	1854	1848
H	—	—	—	—	—	—	—	—	1014	1049	1075
I	—	—	—	—	—	—	—	—	927	991	985
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
44"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 62 OF 74

DATE : DEC. 1995

1. PIPE DATA

(ASME B36.10M, ASME B36.19M)

D = 1118mm OUTSIDE SURFACE = 3.51 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH	THK (mm) t							
STD	9.53	1098.94	331.8	509700		9118	260.5	948.5
	11.13	1095.74	387.0	592700		10600	303.8	943.0
XS	12.70	1092.60	440.9	673500		12040	346.2	937.6
	15.88	1086.24	549.8	834000		14930	431.6	926.7
	19.05	1079.90	657.6	993100		17760	516.3	915.9
	22.23	1073.54	765.2	1149000		20550	600.7	905.2
	25.40	1067.20	871.8	1301000		23280	684.4	894.5
	28.58	1060.84	978.1	1452000		25970	767.8	883.9
	31.75	1054.50	1083.0	1599000		28610	850.5	873.3

2. FITTING WEIGHT (Kg)

SCH.	90° ELL.	45° ELL.	TEE				REDUCER				CAP
			FULL	x 42	x 40	x 38	x 42	x 40	x 38		
STD	684.0	342.0	475.0	473.0	467.0	462.0	155.0	151.0	147.0		126.0
XS	912.0	456.0	633.0	630.0	623.0	616.0	206.0	201.0	196.0		167.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	200.2	800.7				
BLIND						

4. VALVE WEIGHT

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.38) (2699Kg/m²)

UNIT : kg/m FOR PLANE

* WEIGHT IN () - COVER MAT'L WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											

$$W_p = 0.02466t(D-t)$$

$$W_w = 0.0007854d^2$$

$$A = 0.007854(D^2 - d^2)$$

$$I = 0.000004909 \times (D^4 - d^4)$$

$$Z = 0.00009817 \times \frac{D^4 - d^4}{D}$$

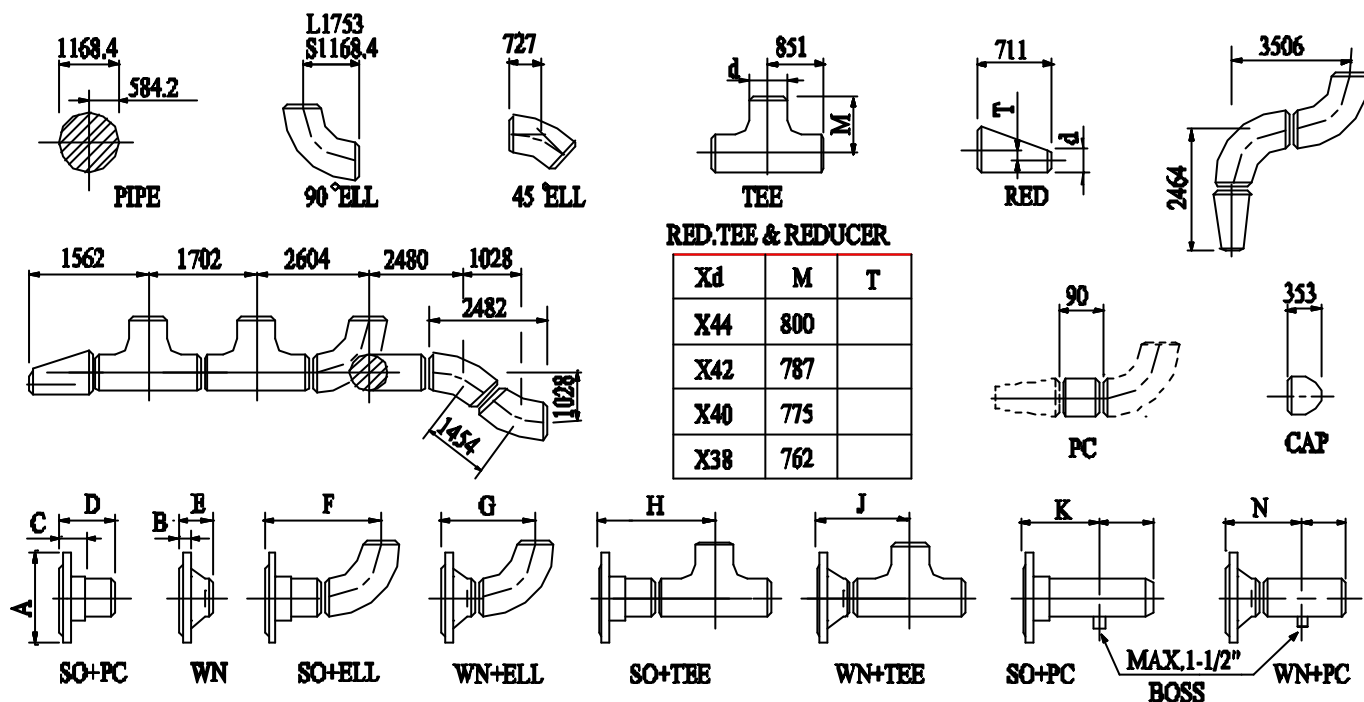
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
46"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 63 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1302	1341	1460	1511	1734	1454.2	1416.1		1511.3		1733.6	
B	44.4	61.9	128.6	185.8	231.8	103.1	128.5	—	185.7	—	231.9	—
E	108	1445	222.2	306.4	417.6	185.7	215.9	—	306.3	—	417.3	—
G	1861	1898	1975	2059	2171	1939	1969	—	2059	—	2170	—
J	959	996	1073	1157	1269	1037	1067	—	1157	—	1268	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1454.2		1454.2		1454.2		—		1346.2	1562.1	1390.7
B	28.6	31.8	44.5	31.8	87.3	68.3	—	—	62.3	98.4	108
C	28.6	57.2	44.5	57.2	87.3	103.2	—	—	117.5	149.2	184.2
D	119	147	135	147	177	193	—	—	208	239	274
E	—	—	—	—	—	—	—	—	114.3	181	184.2
F	1872	1900	1888	1900	1930	1946	—	—	1961	1992	2027
G	—	—	—	—	—	—	—	—	1867	1934	1937
H	—	—	—	—	—	—	—	—	1059	1090	1125
J	—	—	—	—	—	—	—	—	965	1032	1035
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
46"-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 64 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B36.19M)

D= 1168.0mm OUTSIDE SURFACE = 3.67 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
STD	9.53	1148.94	346.8	581800		9963	272.3	1036.9
	11.13	1145.74	404.5	676700		11580	317.5	1031.0
XS	12.70	1142.60	460.9	769100		13170	351.8	1025.4
	15.88	1136.24	574.7	953800		16330	451.2	1014.0
	19.05	1129.90	687.6	1134000		19430	539.8	1002.7
	22.23	1123.54	800.1	1313000		22490	628.1	991.4
	25.40	1117.20	911.7	1488000		25490	715.7	980.3
	28.58	1110.84	1023.0	1661000		28440	803.0	969.2
	31.75	1104.50	1133.0	1830000		31340	889.6	958.1

2. FITTING WEIGHT (Kg)

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 44	x 42	x 40	x 44	x 42	x 40		
STD	748.0	374.0	521.0	519.0	513.0	507.0	189.0	185.0	180.0		134.0
XS	997.0	498.0	562.0	691.0	683.0	676.0	252.0	246.0	241.0		179.0

3. FLANGE WEIGHT (Kg) (VENDOR : KOREA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	210.2	970.9				
BLIND						

4. VALVE WEIGHT

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

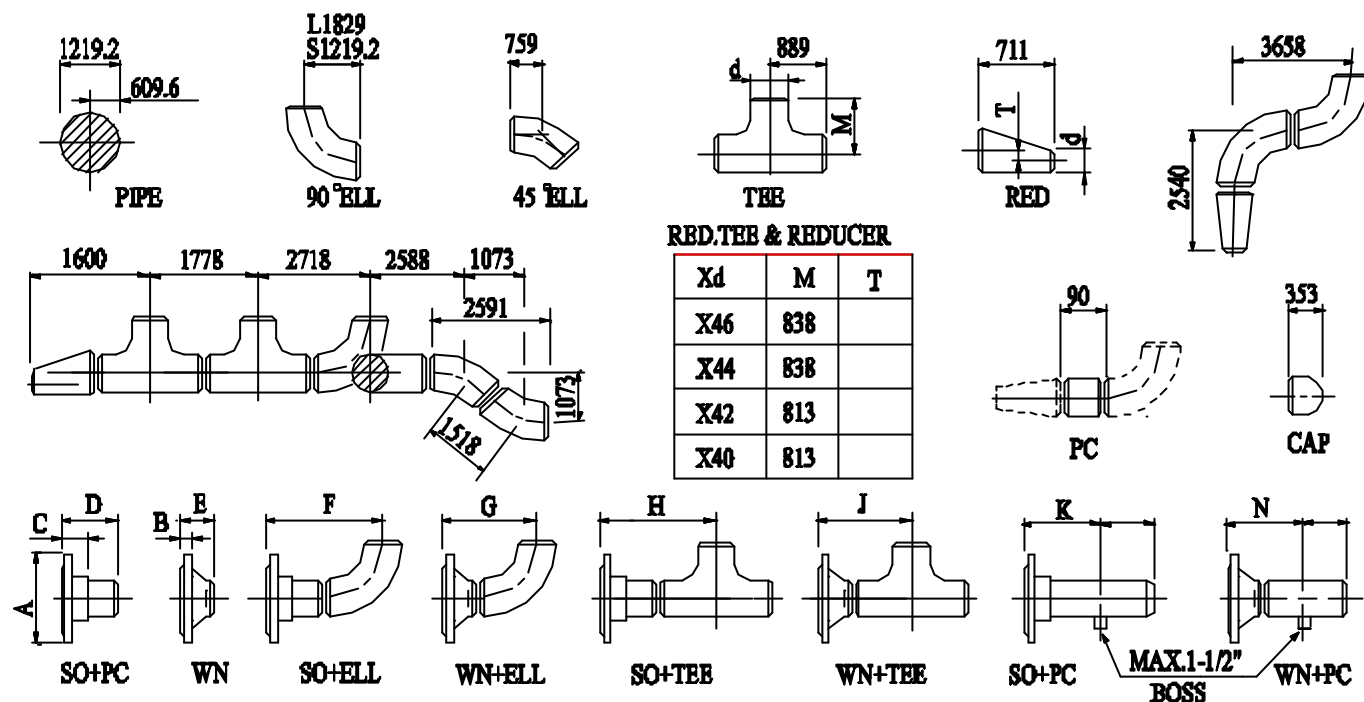
5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m²)

* WEIGHT IN () = COVER MATL WEIGHT

Wp = 0.02466(D-t)

Ww = 0.0007854d²A = 0.007854(D² - d²)I = 0.000004909 x (D⁴ - d⁴)Z = 0.00009817 x $\frac{D^4 - d^4}{D}$

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200
WEIGHT (Kg)											



RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300	CL.600	CL.900			
	RF	RF	RF	RF	RF	RF	RF RJ	RF RJ	RF RJ	RF RJ	RF RJ	RF RJ
A	1353	1392	1511	1594	1784	1511.3	1466.9	1593.9	1784.4			
B	46	65.1	128.6	195.3	239.8	108	133.4	195.3	239.8			
E	111.1	149.2	223.8	322.3	426.1	192	223.8	322.3	425.5			
G	1940	1978	2053	2151	2255	2021	2053	2151	2255			
J	—	—	—	—	—	—	—	—	—			
N	—	—	—	—	—	—	—	—	—			
RING NO.	—	—	—	—	—	—	—	—	—			

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1511.3		1511.3		1511.3		1651		1397	1651	1441.5
B	31.8	34.9	44.5	34.9	88.9	69.9	90.5	101.6	66.7 57.2	101.6	108
C	31.8	63.5	44.5	63.5	88.9	104.8	90.5	152.4	123.8	152.4	184.2
D	122	154	135	154	179	195	181	242	214	242	274
E	—	—	—	—	—	—	—	—	123.8	184.2	184.2
F	1951	1983	1964	1983	2008	2024	2010	2071	2043	2071	2103
G	—	—	—	—	—	—	—	—	1953	2013	2013
H	1011	1043	1024	1043	1068	1084	1070	1131	1103	1131	1163
J	—	—	—	—	—	—	—	—	1013	1073	1073
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
48" (1200mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 66 OF 74

DATE : DEC. 1995

1. PIPE DATA (ASME B36.10M, ASME B39.19M)

D = 1219.0mm OUTSIDE SURFACE = 3.83 m ² /M		INSIDE DIA d (mm)	METAL SECTION AREA : A (cm ²)	MOMENT OF INERTIA : I (cm ⁴)	RADIUS OF GYRATION (cm)	SECTION MODULUS : Z (cm ³)	WEIGHT OF PIPE : Wp (Kg/m)	WEIGHT OF WATER : Ww (Kg/m)
SCH.	THK (mm) t							
STD	9.53	1199.94	362.1	662100		10860	284.2	1130.9
	11.13	1196.74	422.3	770200		12630	331.5	1124.8
XS	12.70	1193.60	481.2	875500		14360	377.8	1118.9
	15.88	1187.24	600.2	1086000		17820	471.1	1107.0
	19.05	1180.90	718.1	1292000		21210	563.7	1095.3
	22.23	1174.54	835.7	1496000		24550	656.1	1083.5
	25.40	1168.20	952.4	1696000		27840	747.6	1071.8
	28.58	1161.84	1068.0	1896000		31080	839.0	1060.2
	31.75	1155.50	1184.0	2088000		34250	929.6	1048.6

2. FITTING WEIGHT (Kg)

SCH.	90 ° ELL.	45 ° ELL.	TEE				REDUCER				CAP
			FULL	x 46	x 44	x 42	x 46	x 44	x 42		
STD	814.0	407.0	569.0	566.0	564.0	555.0	197.0	193.0	189.0		143.0
XS	1085.0	542.0	759.0	755.0	751.0	739.0	263.0	257.0	252.0		191.0

3. FLANGE WEIGHT (Kg) (VENDOR : KORBA FLANGE CO., LTD. ASME B 16.47 SERIES B)

	150#	300#	600#	900#	1500#	2500#
S.O						
W.N	240.2	990.9				
BLIND						

4. VALVE WEIGHT (Kg) (FORGED : VOGT BALL : KPC (FULL BORE))

	150#	300#	600#	800#		2500#
GATE						
GLOBE						
BALL						
CHECK						

5. INS. WEIGHTMATERIAL : PERLITE PLANE (192kg/m³)COVER MATERIAL : AL SHEET (0.3t) (2699Kg/m³)

UNIT : kg/m FOR PLANE

* WEIGHT IN () = COVER MATL WEIGHT

THK : T (mm)	25	30	40	50	65	75	100	125	150	175	200	$W_p = 0.02466t(D-t)$ $W_w = 0.0007854d^2$ $A = 0.007854(D^2 - d^2)$ $I = 0.00004909 \times (D^4 - d^4)$ $Z = 0.00009817 \times \frac{D^4 - d^4}{D}$
WEIGHT (Kg)												

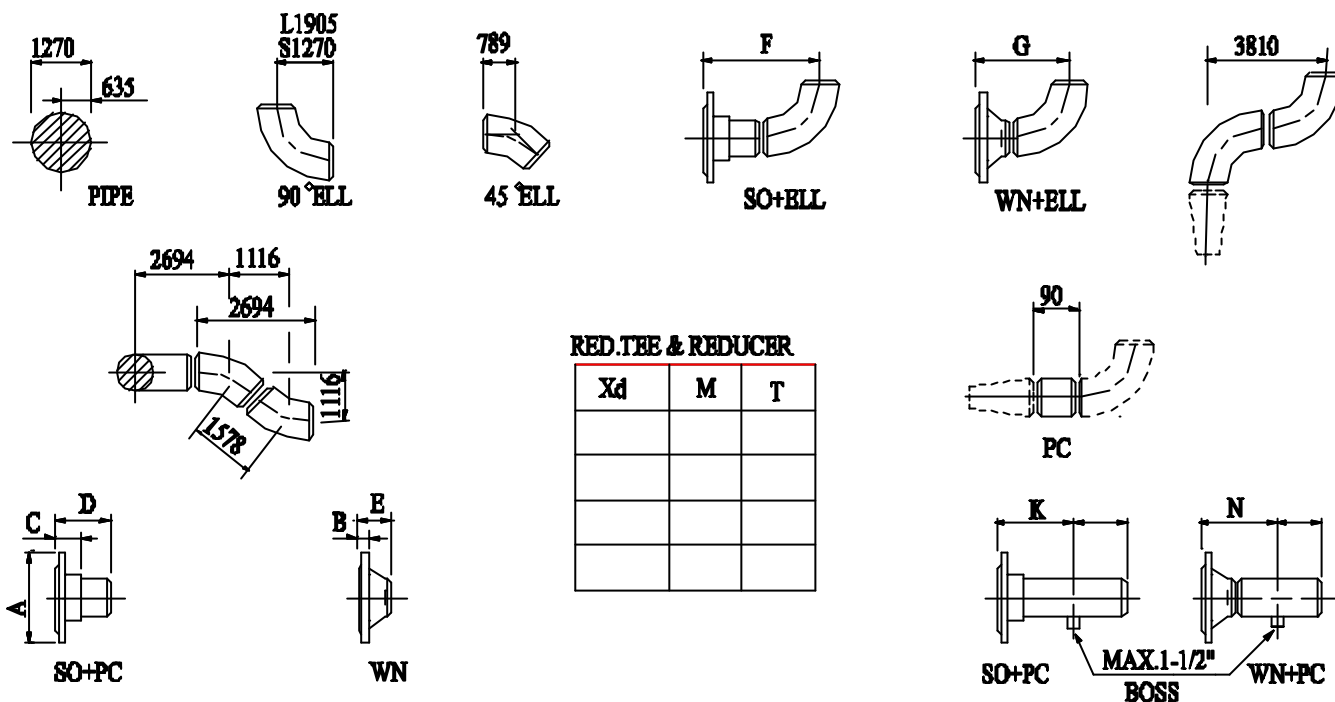
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****50"(1250mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 67 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1403	1443	1562	1670	—	1568.5	1530.4		1670.1		—	
B	47.6	68.3	138.1	203.2	—	111.3	139.7	—	203.2	—	—	—
B	115.9	154	235	335	—	203.2	231.6	—	335	—	—	—
G	2021	2059	2140	2240	—	2108	2137	—	2240	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1568.5		1568.5		1568.5		—		1447.8	—	—
B	31.8	34.9	50.8	34.9	88.9	69.9	—	—	66.7 / 37.2	—	—
C	31.8	63.5	50.8	63.5	88.9	104.8	—	—	123.8	—	—
D	122	154	141	154	179	195	—	—	214	—	—
B	—	—	—	—	—	—	—	—	123.8	—	—
F	2027	2059	2046	2059	2084	2100	—	—	2119	—	—
G	—	—	—	—	—	—	—	—	2029	—	—
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

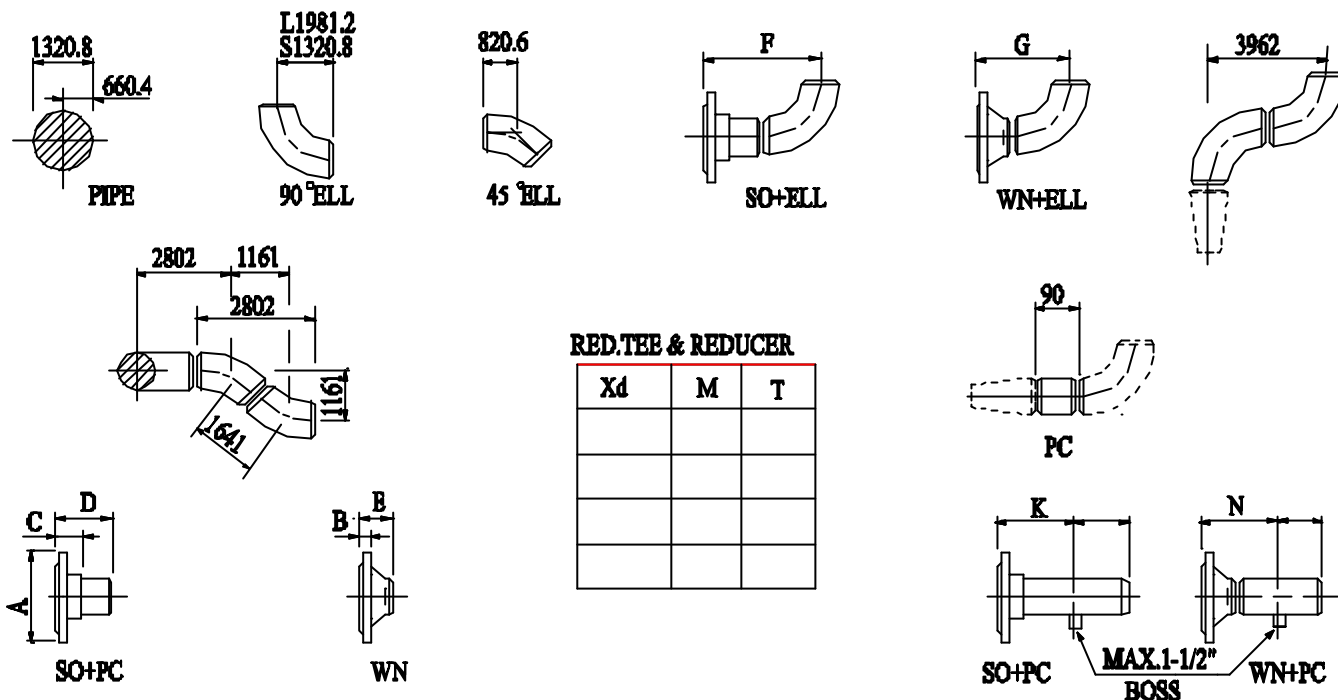
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****52"(1300mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 68 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1457	1494	1613	1721	—	1625.6	1581.2		1720.9		—	
B	47.6	69.8	142.9	209.6	—	115.8	144.5	—	209.6	—	—	—
E	120.7	157.2	242.9	343	—	209.6	238.3	—	342.9	—	—	—
G	2102	2138	2224	2324	—	2191	2220	—	2324	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1625.6		1625.6		1625.6		—		1511.3	—	1562.1
B	31.8	34.9	50.8	34.9	92.1	73	—	—	76.2	66.7	108
C	31.8	63.5	50.8	63.5	92.1	108	—	—	136.5	—	—
D	122	154	141	154	182	198	—	—	227	—	—
E	—	—	—	—	—	—	—	—	136.5	—	190.5
F	2103	2135	2122	2135	2163	2179	—	—	2208	—	—
G	—	—	—	—	—	—	—	—	2118	—	2172
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

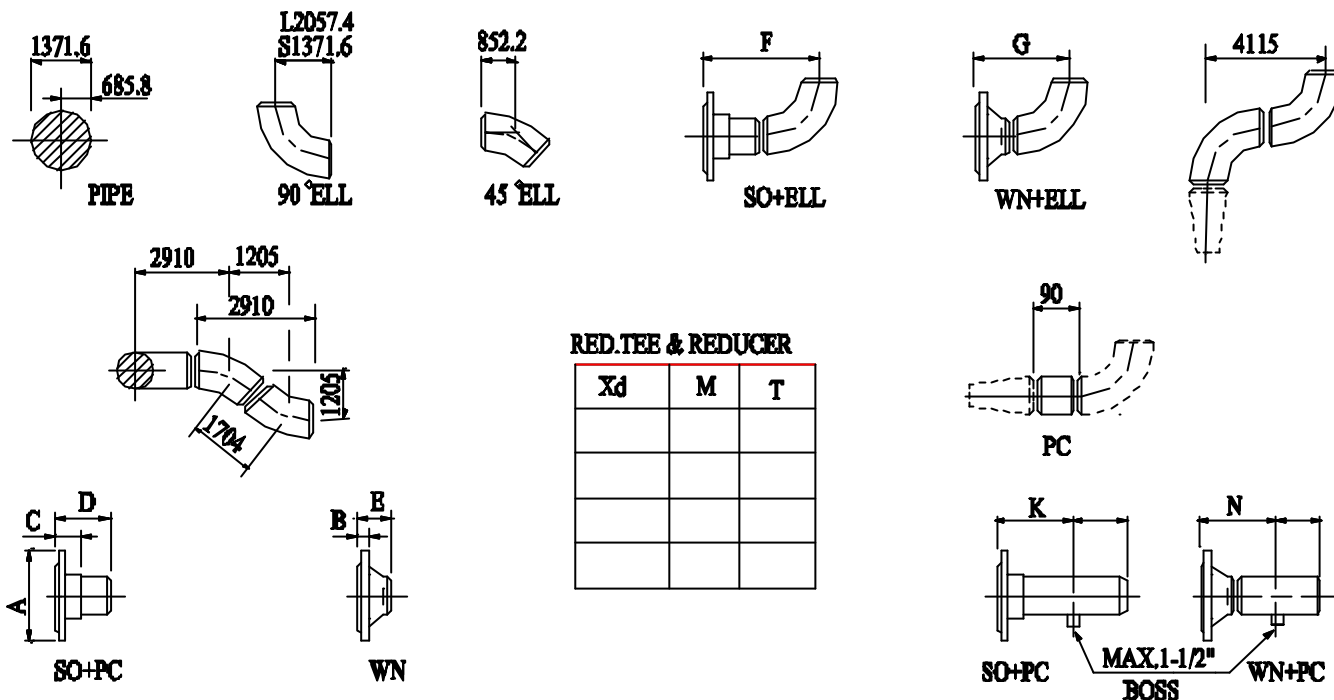
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****54"(1350mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 69 OF 74

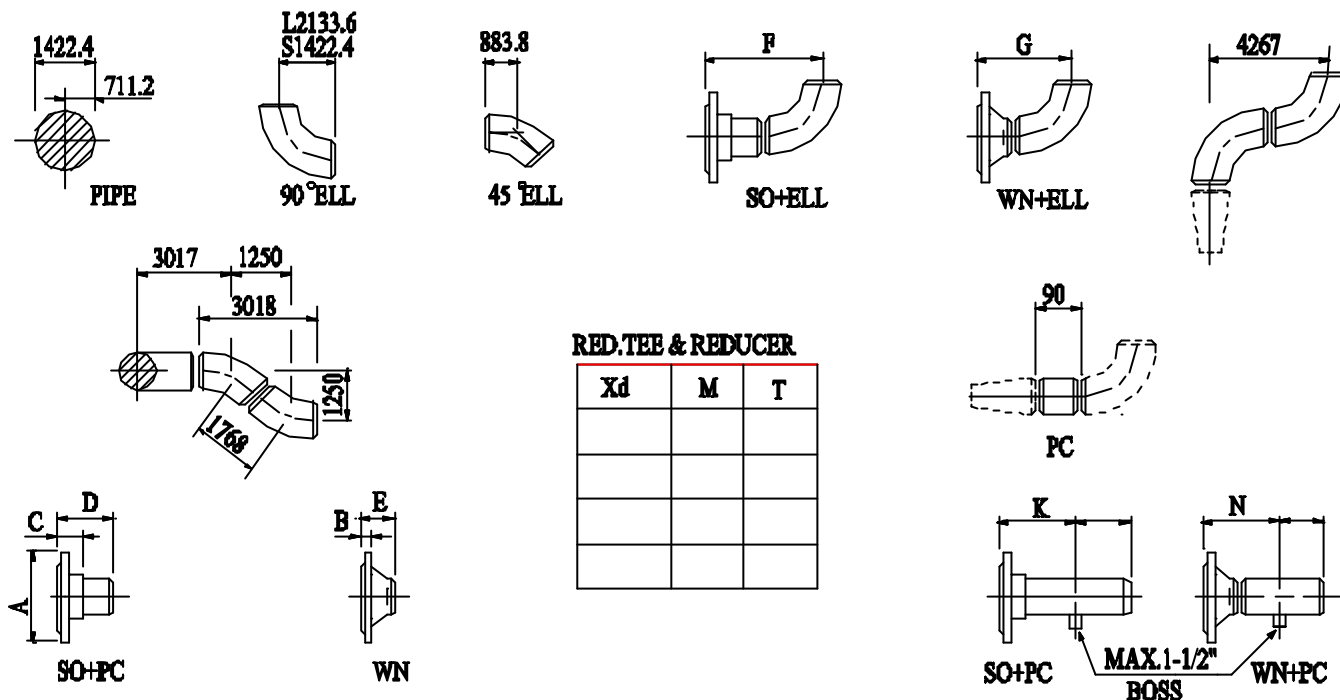
DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B(WN ONLY)					ASME B16.47 SERIES A(WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1508	1549	1673	1778	—	1682.8	1657.4		1778		—	
B	49.2	71.4	136.5	216	—	120.7	152.4	—	215.9	—	—	—
E	125.4	161.9	239.7	355.6	—	215.9	252.5	—	355.6	—	—	—
G	2183	2219	2297	2413	—	2273	2310	—	2413	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1682.8		1682.8		1682.8		—		1562.1	—	1612.9
B	34.9	34.9	54	34.9	95.3	76.2	—	—	76.2 66.7	—	120.7 114.3
C	34.9	63.5	54	63.5	95.3	111.1	—	—	136.5	—	209.6
D	125	154	144	154	185	201	—	—	227	—	300
E	—	—	—	—	—	—	—	—	136.5	—	196.9
F	2182	2211	2201	2211	2242	2258	—	—	2284	—	2357
G	—	—	—	—	—	—	—	—	2194	—	2254
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1575	1600	1765	1854	—	1746.3	1708.2		1854.2		—	
B	50.8	73	154	223.9	—	124	153.9	—	223.8	—	—	—
E	134.9	166.7	268.3	368.4	—	228.6	260.4	—	368.3	—	—	—
G	2269	2300	2402	2502	—	2362	2394	—	2502	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	—	—	—	—	—	—	—	—	—	—	—
B	—	—	—	—	—	—	—	—	—	—	—
C	—	—	—	—	—	—	—	—	—	—	—
D	—	—	—	—	—	—	—	—	—	—	—
E	—	—	—	—	—	—	—	—	—	—	—
F	—	—	—	—	—	—	—	—	—	—	—
G	—	—	—	—	—	—	—	—	—	—	—
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

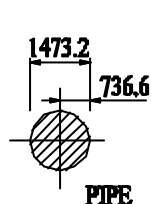
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
58"(1450mm)-BW**

LDP-L901

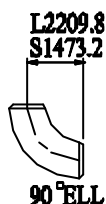
REV. 1 (OCT, 2002)

PAGE : 71 OF 74

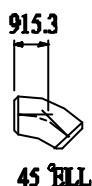
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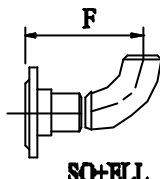
PIPE



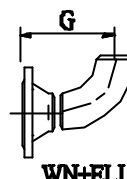
90° ELL



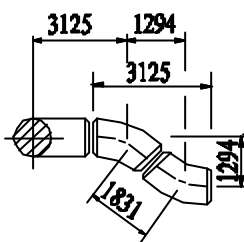
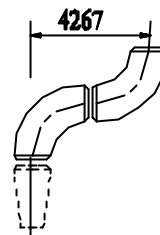
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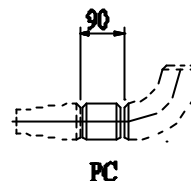
SO+EEL



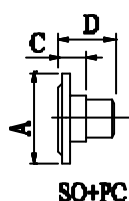
WN+EEL

**RED. TEE & REDUCER**

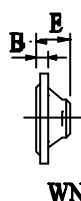
Xd	M	T



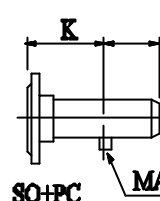
PC



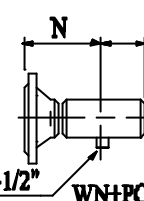
SO+PC



WN



SO+PC

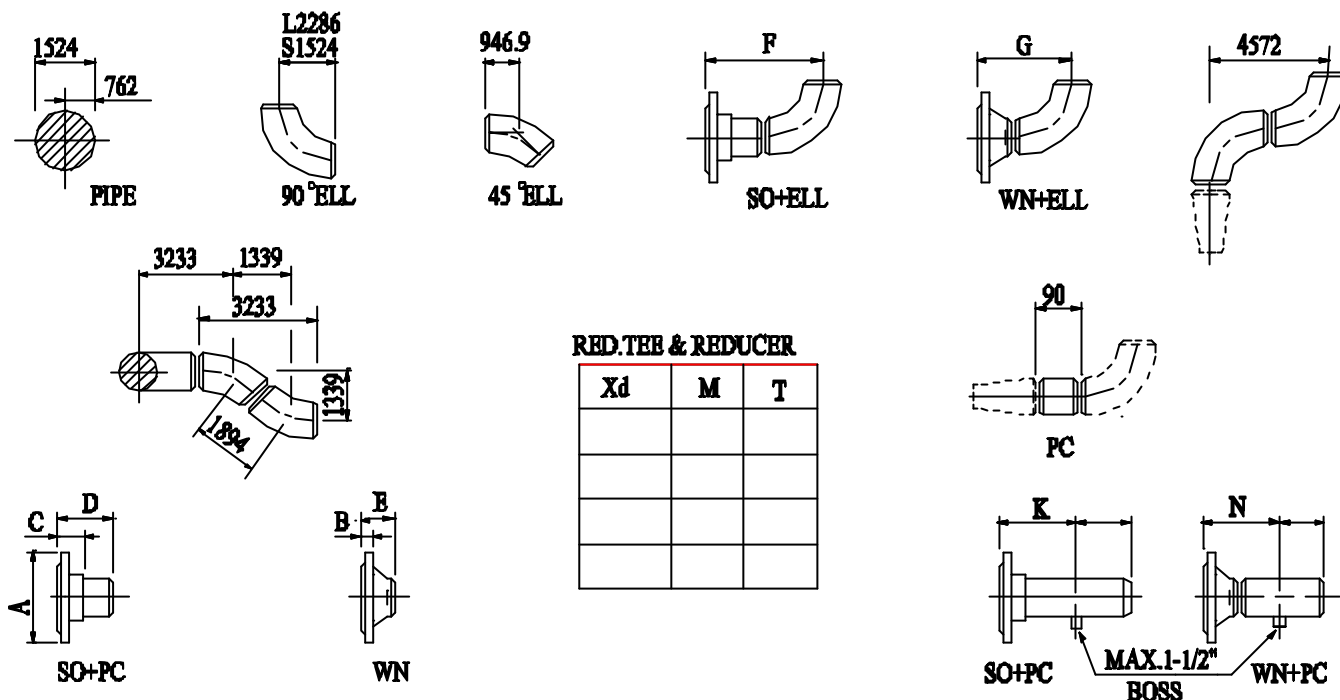


WN+PC

(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B(WN ONLY)					ASME B16.47 SERIES A(WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1626	1675	1827	1905	—	1803.4	1759		1905		—	
B	52.4	74.6	154	228.6	—	128.5	158.8	—	228.6	—	—	—
E	138.1	174.6	274.6	376.3	—	235	266.7	—	376.2	—	—	—
G	2348	2384	2484	2586.1	—	2445	2477	—	2586	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	—	—	—	—	—	—	—	—	—	—	—
B	—	—	—	—	—	—	—	—	—	—	—
C	—	—	—	—	—	—	—	—	—	—	—
D	—	—	—	—	—	—	—	—	—	—	—
E	—	—	—	—	—	—	—	—	—	—	—
F	—	—	—	—	—	—	—	—	—	—	—
G	—	—	—	—	—	—	—	—	—	—	—
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B (WN ONLY)					ASME B16.47 SERIES A (WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	1676	1726	1878	1994	—	1854.2	1809.8		1993.9		—	
B	55.6	76.2	150.8	239.8	—	131.8	163.6	—	239.8	—	—	—
E	144.5	179.4	271.5	395.3	—	239.8	273.1	—	395.2	—	—	—
G	2431	2465	2558	2681	—	2226	2559	—	2681	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	1834.2		1834.2		1834.2		—		1714.5	—	1765.3
B	38.1	38.1	57.2	38.1	98.4	79.4	—	—	79.4 / 69.9	—	120.7 / 114.3
C	38.1	69.9	57.2	69.9	98.4	114.3	—	—	149.2	—	215.9
D	128	160	147	160	188	204	—	—	239	—	306
E	—	—	—	—	—	—	—	—	146.1	—	203.2
F	2414	2446	2433	2446	2474	2490	—	—	2525	—	2592
G	—	—	—	—	—	—	—	—	2432	—	2489
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

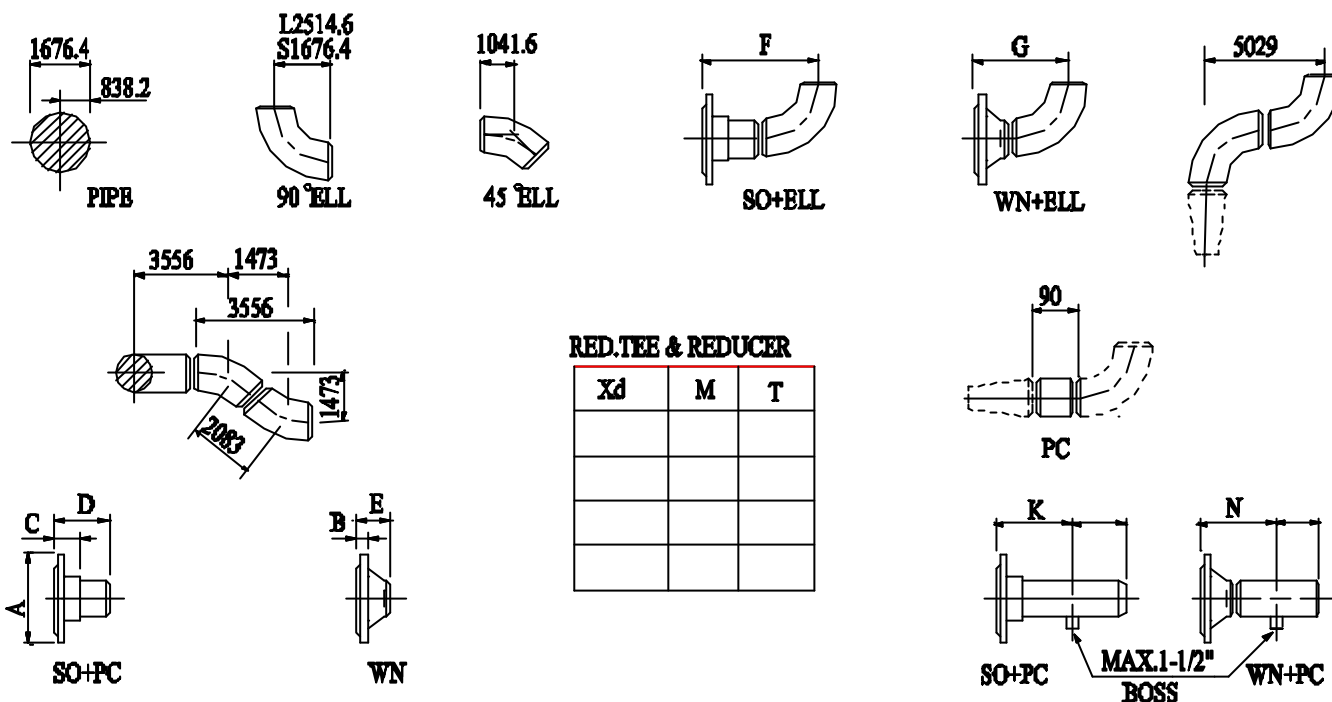
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART****66"(1650mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 73 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B(WN ONLY)					ASME B16.47 SERIES A(WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	—	—	—	—	—	—	—		—		—	
B	—	—	—	—	—	—	—	—	—	—	—	—
B	—	—	—	—	—	—	—	—	—	—	—	—
G	—	—	—	—	—	—	—	—	—	—	—	—
I	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	2032		2032		2032		—		1866.9	—	1955.8
B	41.3	38.1	63.5	38.1	108	85.7	—	—	101.6 ^{79.4}	—	101.6
C	41.3	69.9	63.5	69.9	108	123.8	—	—	174.6	—	—
D	131	160	154	160	198	214	—	—	265	—	—
B	—	—	—	—	—	—	—	—	155.6	—	215.9
F	2646	2675	2669	2675	2713	2729	—	—	2780	—	—
G	—	—	—	—	—	—	—	—	2670	—	2731
H	—	—	—	—	—	—	—	—	—	—	—
I	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—

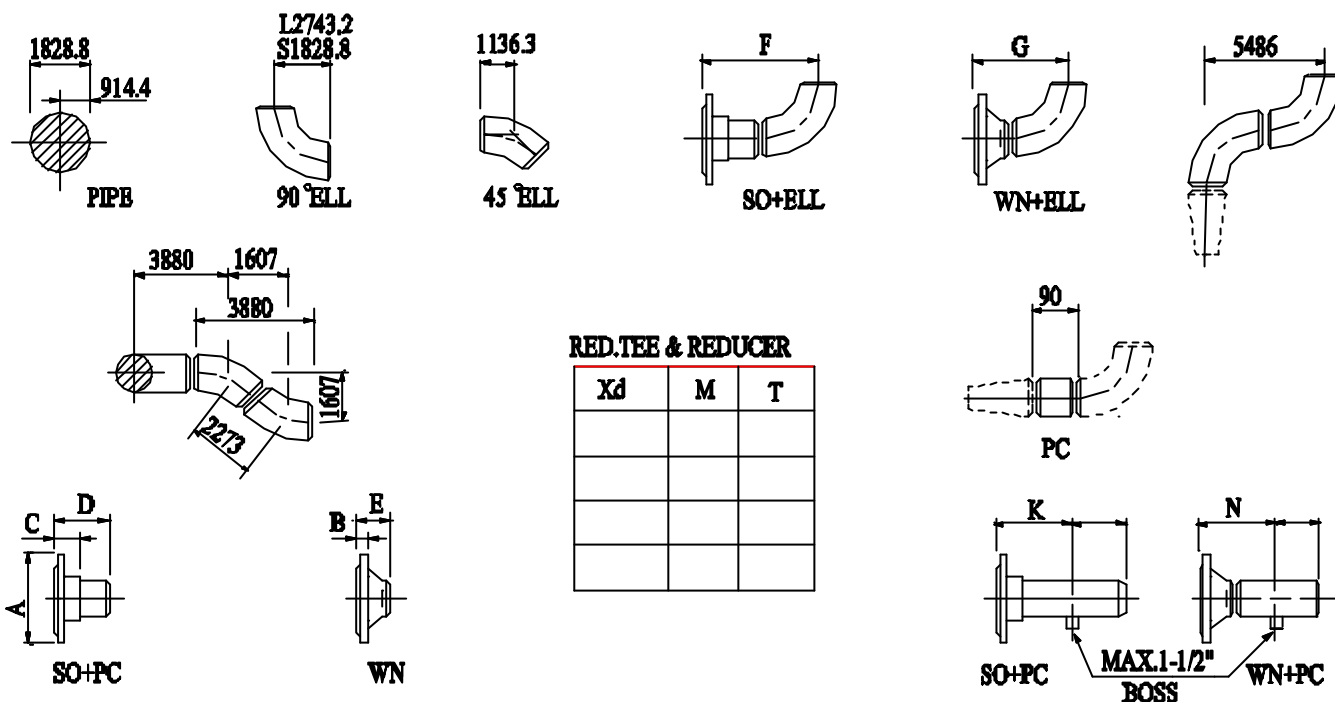
**LG E&C**PIPING DISCIPLINE
PROCEDURE**PIPING HANDBOOK****1. DIMENSION TABLES****1.3 PIPE, FITTING AND VALVE DIM. CHART
72"(1800mm)-BW**

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 74 OF 74

DATE : DEC. 1995



(UNIT : mm)

RATING NO.	ASME B16.47 SERIES B(WN ONLY)					ASME B16.47 SERIES A(WN ONLY)						
	CL.75	CL.150	CL.300	CL.600	CL.900	CL.150	CL.300		CL.600		CL.900	
	RF	RF	RF	RF	RF	RF	RF	RJ	RF	RJ	RF	RJ
A	—	—	—	—	—	—	—		—		—	
B	—	—	—	—	—	—	—	—	—	—	—	—
E	—	—	—	—	—	—	—	—	—	—	—	—
G	—	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—
RING NO.	—	—	—	—	—	—	—	—	—	—	—	—

RATING NO.	AWWA C207 (SO ONLY)								TAYLOR FORGE (SO&WN)		
	CL.B (80PSI)		CL.D (175PSI)		CL.E (275PSI)		CL.F (300PSI)		CL.175	CL.250	CL.350
	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RING TYPE	HUB TYPE	RF	RF	RF
A	2197.1		2197.1		2197.1		—		2032	—	2108.2
B	44.5	38.1	66.7	38.1	111.1	88.9	—	—	127 ¹²⁷ 92.1	—	101.6
C	44.5	69.9	66.7	69.9	111.1	127	—	—	203.2	—	—
D	135	160	157	160	201	217	—	—	293	—	—
E	—	—	—	—	—	—	—	—	168.3	—	228.6
F	2878	2903	2900	2903	2944	2960	—	—	3036	—	—
G	—	—	—	—	—	—	—	—	2912	—	2972
H	—	—	—	—	—	—	—	—	—	—	—
J	—	—	—	—	—	—	—	—	—	—	—
K	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—



PIPING HANDBOOK

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

MACHINE BOLT/NUT FOR ASME, JPI(RF, FF, LJ)

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 9
DATE : DEC. 1995

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

MACHINE BOLT/NUT FOR ASME, JPI(RF,FF,LJ)

LDP-L901

REV. 1 (OCT, 2002)

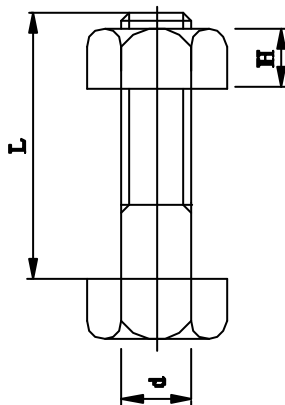
PAGE : 1 OF 9

DATE : DEC. 1995

BILION

1. ALL DIMENSIONS ARE IN mm.
2. 0.06(1.6mm) RAISED FACE IS INCLUDED IN MINIMUM FLANGE THICKNESS FOR CLASS 150 AND 300 FLANGERS.
3. GASKET THICKNESS IS BASED ON 4.5mm.
4. EACH LAP OF PIPE THICKNESS FOR LAP JOINT IS BASED ON THE FOLLOWING ;
4.1 SCH 10S AND BELOW ; SCH 10S
4.2 SCH 40S AND LARGER ; SCH 80S
5. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ASME B16.3.
6. METRIC BOLT NUT SHOULD NOT BE USED WHENEVER POSSIBLE.

NUT DIMENSION	4	H
	U1/2	12.3
	U5/8	15.5
	U3/4	18.7
	U7/8	21.8
	U1	25.0
	U1-1/8	28.2
	U1-1/4	31.0
	U1-1/2	37.3



MACHINE BOLT/NUT

[illegible]



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

STUD BOLT/NUT FOR ASME, JPI(RF, FF)

LDP-L901

REV. 1 (OCT, 2002)

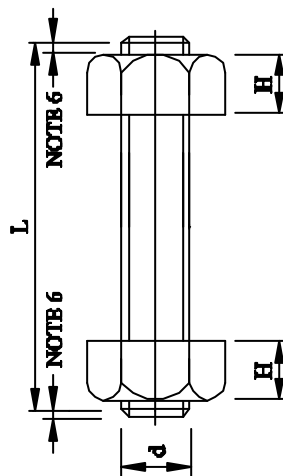
PAGE : 2 OF 9

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. THE HEIGHT OF RAISED FACE IS BASED ON THE FOLLOWING :
2.1 CLASS 150 AND 300 : 0.06m (1.6mm)
2.2 CLASS 600 AND OVER : 0.25m (6.4mm)
3. GASKET THICKNESS IS BASED ON 9mm.
4. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ASME B16.3.
5. METRIC BOLT NUT SHOULD NOT BE USED WHENEVER POSSIBLE.
6. 2 TIMES THE THREAD FITS ARE CONSIDERED.

NUT			
DIMENSION			
d	H	d	H
U1/2	12.3	U1-5/8	40.5
U3/8	15.5	U1-3/4	43.7
U3/4	18.7	U1-7/8	46.8
U7/8	21.8	U2	50.0
U1	25.0	U2-1/4	56.0
U1-1/8	28.2	U2-1/2	62.3
U1-1/4	31.0	U2-3/4	68.7
U1-3/8	34.1	U3	75.0
U1-1/2	37.3	U3-1/2	87.3



STUD BOLT/NUT

NOMINAL FLANGE SIZE		150#				300#				600#				900#				1500#				2500#				NOMINAL FLANGE SIZE	
		d		NO. OF BOLT	L	d		NO. OF BOLT	L	d		NO. OF BOLT	L	d		NO. OF BOLT	L	d		NO. OF BOLT	L						
IN	mm	T	M			U	M			U	M			U	M			U	M			U	M	U	M	U	M
1/2	15	DU/2	M12	65	4	U1/2	M12	70	4	U1/2	M12	85	4	U3/4	M20	115	4	U3/4	M20	115	4	U3/4	M20	130	4	1/2	15
3/4	20	DU/2	M12	70	4	U3/8	M16	80	4	U3/4	M16	95	4	U3/4	M20	120	4	U3/4	M20	120	4	U3/4	M20	135	4	3/4	20
1	25	DU/2	M12	70	4	U3/8	M16	85	4	U3/8	M16	100	4	U7/8	M24	135	4	U7/8	M24	135	4	U7/8	M24	150	4	1	25
1-1/4	32	DU/2	M12	75	4	U3/8	M16	90	4	U3/8	M16	105	4	U7/8	M24	135	4	U7/8	M24	135	4	U1	M27	160	4	1-1/4	32
1-1/2	40	DU/2	M12	80	4	U3/4	M20	100	4	U3/4	M20	115	4	U1	M27	150	4	U1	M27	150	4	U1-1/8	M30	180	4	1-1/2	40
2	50	U3/8	M16	90	4	U3/8	M16	95	8	U3/8	M16	115	8	U7/8	M24	155	8	U7/8	M24	155	8	U1	M27	190	8	2	50
2-1/2	65	U3/8	M16	95	4	U3/4	M20	110	8	U3/4	M20	130	8	U1	M27	170	8	U1	M27	170	8	U1-1/8	M30	205	8	2-1/2	65
3	80	U3/8	M16	100	4	U3/4	M20	115	8	U3/4	M20	135	8	U7/8	M24	155	8	U7/8	M24	155	8	U1-1/8	M30	230	8	3	80
3-1/2	90	U3/8	M16	100	8	U3/4	M20	120	8	U7/8	M24	150	8	—	—	—	—	—	—	—	—	—	—	—	3-1/2	90	
4	100	U3/8	M16	100	8	U3/4	M20	120	8	U7/8	M24	155	8	U1-1/8	M30	180	8	U1-1/4	M33	205	8	U1-1/2	M39	265	8	4	100
5	125	U3/4	M20	105	8	U3/4	M20	130	8	U1	M27	175	8	U1-1/4	M33	200	8	U1-1/2	M39	255	8	U1-3/4	M45	310	8	5	125
6	150	U3/4	M20	110	8	U3/4	M20	130	12	U1	M27	180	12	U1-1/8	M30	205	12	U1-3/8	M36	270	12	U2	M52	355	8	6	150
8	200	U3/4	M20	115	8	U7/8	M24	150	12	U1-1/8	M30	205	12	U1-3/8	M36	230	12	U1-5/8	M42	300	12	U2	M52	395	12	8	200
10	250	U7/8	M24	125	12	U1	M27	170	16	U1-1/4	M33	225	16	U1-3/8	M36	245	16	U1-7/8	M48	345	12	U2-1/2	M64	495	12	10	250
12	300	U7/8	M24	130	12	U1-1/8	M30	180	16	U1-1/4	M33	230	20	U1-3/8	M36	265	20	U2	M52	385	16	U2-3/4	M72	545	12	12	300
14	350	U1	M27	145	12	U1-1/8	M30	185	20	U1-1/4	M33	245	20	U1-1/2	M39	280	20	U2-1/4	M56	420	16	—	—	—	—	14	350
16	400	U1	M27	145	16	U1-1/4	M33	200	20	U1-1/2	M36	265	20	U1-5/8	M42	295	20	U2-1/2	M64	455	16	—	—	—	—	16	400
18	450	U1-1/8	M30	160	16	U1-1/4	M33	205	24	U1-5/8	M42	280	20	U1-7/8	M48	335	20	U2-3/4	M72	500	16	—	—	—	—	18	450
20	500	U1-1/8	M30	170	20	U1-1/4	M33	215	24	U1-5/8	M42	300	24	U2	M52	355	20	U3	M76	550	16	—	—	—	—	20	500
24	600	U1-1/4	M33	185	20	U1-1/2	M39	245	24	U1-7/8	M48	340	24	U2-1/2	M60	445	20	U3-1/2	M90	625	16	—	—	—	—	24	600



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

STUD BOLT/NUT FOR ASME, JPI(R)

LDP-L901

REV. 1 (OCT, 2002)

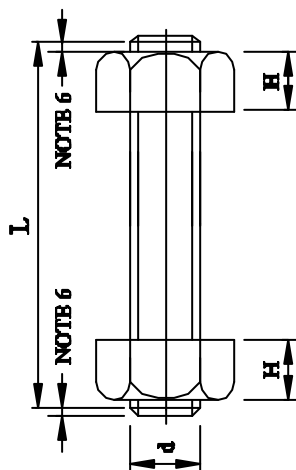
PAGE : 3 OF 9

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. GROOVE DEPTH OF RING JOINT FLANGE CONFORM TO TABLE 5 IN ASME B16.5.
3. GASKET THICKNESS FOR RING JOINT FLANGES IS BASED ON THE APPROXIMATE DISTANCE BETWEEN FLANGES LISTED IN TABLE 5 OF ASME B16.5.
4. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE REVIEWED IN ACCORDANCE WITH ANNEX F IN ASME B16.5.
5. METRIC BOLT/NUT SHOULD NOT BE USED WHENEVER POSSIBLE.
6. 2 TIMES THE THREAD PITCHES ARE CONSIDERED.

NUT DIMENSION			
d	H	d	H
1/2	12.3	1 1/8	40.5
3/8	15.5	1 1/4	43.7
1/2	18.7	1 3/8	46.8
3/4	21.8	1 1/2	50.0
1	25.0	1 3/4	54.0
1 1/8	28.3	1 7/8	62.3
1 1/4	31.0	2	68.7
1 3/8	34.1	2 1/8	75.0
1 1/2	37.3	2 1/4	81.3



STUD BOLT/NUT

NOMINAL FLANGE SIZE	150#				300#				600#				900#				1500#				2500#				NOMINAL FLANGE SIZE		
	d		L		d		L		d		L		d		L		d		L								
	U	M	RJ	NO. OF BOLT	U	M	RJ	NO. OF BOLT	U	M	RJ	NO. OF BOLT	U	M	RJ	NO. OF BOLT	U	M	RJ	NO. OF BOLT	U	M	RJ	NO. OF BOLT	IN	MM	
1/2	15	U1/2	M12	—	4	U1/2	M12	85	4	U1/2	M12	85	4	U3/4	M20	115	4	U3/4	M20	115	4	U3/4	M20	150	4	1/2	15
3/4	20	U1/2	M12	—	4	U5/8	M16	95	4	U5/8	M16	95	4	U3/4	M20	125	4	U3/4	M20	125	4	U3/4	M20	135	4	3/4	20
1	25	U1/2	M12	85	4	U5/8	M16	100	4	U5/8	M16	100	4	U7/8	M24	135	4	U7/8	M24	135	4	U7/8	M24	150	4	1	25
1-1/4	32	U1/2	M12	90	4	U5/8	M16	105	4	U5/8	M16	105	4	U7/8	M24	135	4	U7/8	M24	135	4	U1	M27	165	4	1-1/4	32
1-1/2	40	U1/2	M12	90	4	U3/4	M20	115	4	U3/4	M20	115	4	U1	M27	150	4	U1	M27	150	4	U1-1/8	M30	185	4	1-1/2	40
2	50	U3/8	M16	105	4	U5/8	M16	115	8	U5/8	M16	120	8	U7/8	M24	160	8	U7/8	M24	160	8	U1	M27	195	8	2	50
2-1/2	65	U3/8	M16	110	4	U3/4	M20	130	8	U3/4	M20	135	8	U1	M27	170	8	U1	M27	170	8	U1-1/8	M30	215	8	2-1/2	65
3	80	U3/8	M16	115	4	U3/4	M20	135	8	U3/4	M20	140	8	U7/8	M24	160	8	U1-1/8	M30	190	8	U1-1/4	M33	235	8	3	80
3-1/2	90	U3/8	M16	115	8	U3/4	M20	135	8	U7/8	M24	155	8	—	—	—	—	—	—	—	—	—	—	—	—	3-1/2	90
4	100	U3/8	M16	115	8	U3/4	M20	140	8	U7/8	M24	160	8	U1-1/8	M30	185	8	U1-1/4	M33	210	8	U1-1/2	M39	275	8	4	100
5	125	U3/4	M20	120	8	U3/4	M20	145	8	U1	M27	180	8	U1-1/4	M33	205	8	U1-1/2	M39	260	8	U1-3/4	M45	325	8	5	125
6	150	U3/4	M20	125	8	U3/4	M20	155	12	U1	M27	185	12	U1-1/8	M30	210	12	U1-3/8	M36	275	12	U2	M52	365	8	6	150
8	200	U3/4	M20	130	8	U7/8	M24	165	12	U1-1/8	M30	210	12	U1-3/8	M36	235	12	U1-5/8	M42	315	12	U2	M52	410	12	8	200
10	250	U7/8	M24	140	12	U1	M27	185	16	U1-1/4	M33	230	16	U1-3/8	M36	250	16	U1-7/8	M48	360	12	U2-1/2	M64	525	12	10	250
12	300	U7/8	M24	145	12	U1-1/8	M30	200	16	U1-1/4	M33	235	20	U1-3/8	M36	265	20	U2	M52	405	16	U2-3/4	M72	575	12	12	300
14	350	U1	M27	155	12	U1-1/8	M30	205	20	U1-3/8	M36	250	20	U1-1/2	M39	295	20	U2-1/4	M56	440	16	—	—	—	—	14	350
16	400	U1	M27	160	16	U1-1/4	M33	220	20	U1-1/2	M39	270	20	U1-5/8	M42	305	20	U2-1/2	M64	485	16	—	—	—	—	16	400
18	450	U1-1/8	M30	170	16	U1-1/4	M33	225	24	U1-5/8	M42	285	20	U1-7/8	M48	350	20	U2-3/4	M72	550	16	—	—	—	—	18	450
20	500	U1-1/8	M30	180	20	U1-1/4	M33	235	24	U1-5/8	M42	310	24	U2	M52	370	20	U3	M76	580	16	—	—	—	—	20	500
24	600	U1-1/4	M33	195	20	U1-1/2	M39	270	24	U1-7/8	M48	350	24	U2 1/2	M68	470	20	U3 1/2	M90	660	16	—	—	—	—	24	600



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

STUD BOLT/NUT FOR ASME, IPI(T/G,M/F,LJ)

LDP-L901

REV. 1 (OCT, 2002)

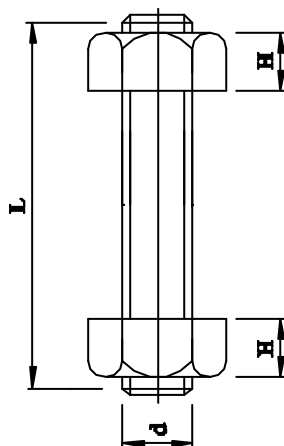
PAGE : 4 OF 9

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. GROOVE DEPTH OF RING JOINT FLANGES CONFORM TO TABLE 5 IN ANSI B16.5.
3. EACH LAP OF PIPE THICKNESS FOR LAP JOINT IS BASED ON THE FOLLOWING:
 - 3.1 SCH 10S AND BELOW ; SCH 10S
 - 3.2 SCH 40S AND LARGER ; SCH 80S
4. GASKET THICKNESS FOR RING JOINT FLANGE IS BASED ON THE APPROXIMATE DISTANCE BETWEEN FLANGES LISTED IN TABLE 5 OF ASME B16.5.
5. GASKET THICKNESS FOR LAP JOINT IS BASED ON 4.5mm.
6. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ASME B16.5.
7. METALLIC BOLT NUT SHOULD NOT BE USED WHENEVER POSSIBLE.

NUT DIMENSION			
d	H	d	H
U1/2	12.3	U1-5/8	40.5
U5/8	15.5	U1-3/4	43.7
U3/4	18.7	U1-7/8	46.8
U7/8	21.8	U2	50.0
U1	25.0	U2-1/4	56.0
U1-1/8	28.2	U2-1/2	62.3
U1-1/4	31.0	U2-3/4	68.7
U1-3/8	34.1	U3	75.0
U1-1/2	37.3	U3-1/2	87.3



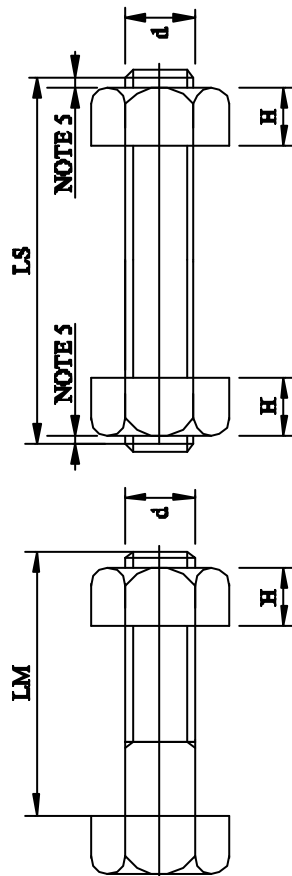
STUD BOLT/NUT

NOMINAL FLANGE SIZE			150#						300#						600#						900#						1500#						2500#						NOMINAL FLANGE SIZE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
			L			I/F			NO.			δ			L			I/F			NO.			δ			L			I/F			NO.			δ						L			I/F			NO.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
			U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U				U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M	U	U	M

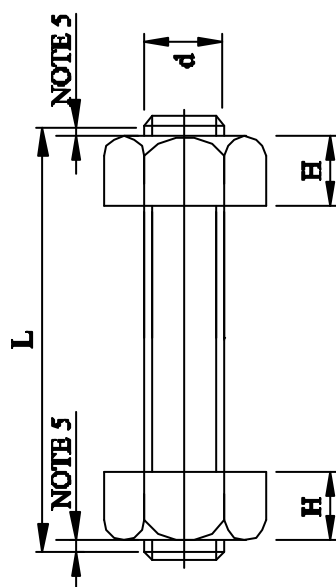
**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.4 BOLT/NUT DIMENSION CHART****MACHINE & STUD BOLT/NUT FOR ASME B16.47-B(RF)****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 5 OF 9****DATE : DEC. 1995****NOTES**

1. ALL DIMENSIONS ARE IN mm.
2. THE HEIGHT OF RAISED FACE IS BASED ON THE FOLLOWING;
2.1 CLASS 300 AND UNDER : 0.06 IN (1.6mm)
2.2 CLASS 600 AND OVER : 0.23 IN (6.4mm)
3. GASKET THICKNESS IS BASED ON 3mm.
4. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ASME B16.5.
5. 2 TIMES THE THREAD FITTERS ARE CONSIDERED.

NUT DIMENSION			
d	H	d	H
U1/2	12.3	U1-3/4	43.7
U3/8	15.5	U1-7/8	46.8
U3/4	18.7	U2	50.0
U7/8	21.8	U2-1/4	56.0
U1	25.0	U2-1/2	62.3
U1-1/8	28.2	U2-3/4	68.7
U1-1/4	31.0	U3	75.0
U1-3/8	34.1	U3-1/2	87.3
U1-1/2	37.3	U3-3/4	93.7
U1-5/8	40.5	U4	100.0

**STUD BOLT/NUT****MACHINE BOLT/NUT**

NOMINAL FLANGE SIZE		75#			150#			300#			600#			900#			NOMINAL FLANGE SIZE	
IN	mm	d	LM	LS	NO. OF BOLT	d	LM	LS	NO. OF BOLT	d	LM	LS	NO. OF BOLT	d	LM	LS	IN	mm
26	650	U5/8	105	120	36	U3/4	135	140	36	U1-1/4	235	265	32	U1-5/8	305	345	26	650
28	700	U5/8	105	120	40	U3/4	130	145	40	U1-1/4	235	265	36	U1-3/4	320	360	28	700
30	750	U5/8	105	120	44	U3/4	130	145	44	U1-5/8	250	285	36	U1-7/8	340	385	30	750
32	800	U5/8	110	125	48	U3/4	135	150	48	U1-1/2	275	310	32	U2	330	400	32	800
34	850	U5/8	110	125	52	U7/8	130	165	40	U1-1/2	275	310	36	U2-1/4	385	435	34	850
36	900	U3/4	115	135	40	U7/8	155	170	44	U1-5/8	275	315	32	U2-1/4	390	445	36	900
38	950	U3/4	120	140	40	U1	160	185	40	U1-5/8	295	330	36	U2-1/4	400	—	38	950
40	1000	U3/4	120	140	44	U1	165	185	44	U1-3/8	300	340	40	U2-1/4	415	—	40	1000
42	1050	U3/4	125	140	48	U1	170	195	48	U1-3/4	315	355	36	U2-1/2	440	—	42	1050
44	1100	U7/8	135	155	36	U1	175	195	52	U1-3/4	325	370	40	U2-1/2	455	—	44	1100
46	1150	U7/8	135	155	40	U1-1/8	180	205	40	U1-7/8	330	380	36	U2-1/2	465	—	46	1150
48	1200	U7/8	140	160	44	U1-1/8	185	210	44	U1-7/8	330	380	40	U2-3/4	490	—	48	1200
50	1250	U7/8	140	160	44	U1-1/8	190	220	48	U1-7/8	350	400	44	U3	510	—	50	1250
52	1300	U7/8	140	160	48	U1-1/8	200	220	52	U1-7/8	365	410	48	U3	525	—	52	1300
54	1350	U7/8	150	165	48	U1-1/8	200	225	36	U1-7/8	350	395	48	U3	535	—	54	1350
56	1400	U1	155	175	40	U1-1/8	205	230	60	U2-1/4	385	450	36	U3-1/4	560	—	56	1400
58	1450	U1	155	180	44	U1-1/4	210	235	48	U2-1/4	395	450	40	U3-1/4	565	—	58	1450
60	1500	U1	160	190	44	U1-1/4	210	240	52	U2-1/4	390	445	40	U3-1/2	600	—	60	1500
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.4 BOLT/NUT DIMENSION CHART****STUD BOLT/NUT FOR ASME B16.47-A(RF,RJ)****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 6 OF 9****DATE : DEC. 1995****NOTES****1. ALL DIMENSIONS ARE IN mm.****2. THE HEIGHT OF RAISED FACE IS BASED ON THE FOLLOWING :****2.1 CLASS 300 AND UNDER : 0.06 IN(1.6mm)****2.2 CLASS 600 AND OVER : 0.25 IN(6.4mm)****3. GASKET THICKNESS IS BASED ON 3mm.****4. FOR ANY DEVIATIONS THAN THE ABOVE, BOLT LENGTH SHOULD BE
DETERMINED IN ACCORDANCE WITH ANNEX F IN ASME B16.5.****5. 2 TIMES THE THREAD PITCHES ARE CONSIDERED.****STUD BOLT/NUT**

NOMINAL FLANGE SIZE IN	150#			300#			600#			900#			NOMINAL FLANGE SIZE mm		NUT DIMENSION	
	d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT	IN	mm	d	H
26	U1-1/4	225	24	U1-5/8	265	310	28	U1-7/8	350	380	28	U2-3/4	26	650	U1-1/4	31.0
28	U1-1/4	230	28	U1-5/8	280	320	28	U2	365	390	28	U3	28	700	U1-1/2	27.3
30	U1-1/4	235	28	U1-3/4	300	340	28	U2	370	400	28	U3	30	750	U1-5/8	40.5
32	U1-1/2	265	28	U1-7/8	320	365	28	U2-1/4	390	420	28	U3-1/4	32	800	U1-3/4	43.7
34	U1-1/2	265	32	U1-7/8	325	375	28	U2-1/4	395	430	28	U3-1/2	34	850	U1-7/8	46.8
36	U1-1/2	280	32	U2	340	385	32	U2-1/2	415	450	28	U3-1/2	36	900	U2	50.0
38	U1-1/2	275	32	U1-1/2	320	—	32	U2-1/4	460	—	28	U3-1/2	38	950	U2-1/4	56.0
40	U1-1/2	280	36	U1-5/8	340	—	32	U2-1/4	475	—	32	U3-1/2	40	1000	U2-1/2	62.3
42	U1-1/2	295	36	U1-5/8	350	—	32	U2-1/2	505	—	28	U3-1/2	42	1050	U2-3/4	68.7
44	U1-1/2	305	40	U1-3/4	365	—	32	U2-1/2	515	—	32	U3-3/4	44	1100	U3	75.0
46	U1-1/2	310	40	U1-7/8	380	—	28	U2-1/2	530	—	32	U4	46	1150	U3-1/4	81.0
48	U1-1/2	320	44	U1-7/8	390	—	32	U2-3/4	560	—	32	U4	48	1200	U3-1/2	87.3
50	U1-3/4	340	44	U2	410	—	32	U3	590	—	28	—	50	1250	U3-3/4	93.7
52	U1-3/4	345	44	U2	420	—	32	U3	600	—	32	—	52	1300	U4	100.0
54	U1-3/4	355	44	U2-1/4	445	—	28	U3	615	—	32	—	54	1350		
56	U1-3/4	365	48	U2-1/4	450	—	28	U3-1/4	640	—	32	—	56	1400		
58	U1-3/4	375	48	U2-1/4	460	—	32	U3-1/4	650	—	32	—	58	1450		
60	U1-3/4	380	52	U2-1/4	470	—	32	U3-1/2	685	—	28	—	60	1500		



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

STUD BOLT/NUT FOR AWWA & TAYLOR FORGE

LDP-L901

REV. 1 (OCT, 2002)

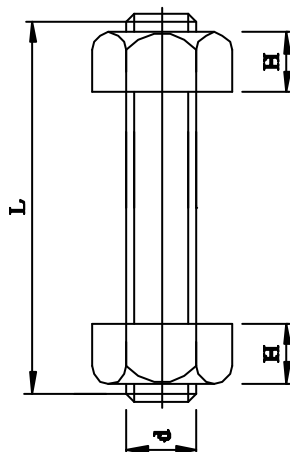
PAGE : 7 OF 9

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. THE HEIGHT OF RAISED FACE IS BASED ON 0.06 IN (1.6mm)
3. GASKET THICKNESS IS BASED ON 4.5mm.
4. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ASME B16.5.

NUT DIMENSION	
d	H
1/4	18.7
1/2	21.8
3/4	25.8
1	28.2
1 1/4	31.0
1 1/2	37.3
1 3/4	43.7



STUD BOLT/NUT

NOMINAL FLANGE SIZE		AWWA C207 (FP)										TAYLOR FORGE										NOMINAL FLANGE SIZE						
		CLB (80 PSI)		CLD (125 PSI)		CLB (125 PSI)		CLB (175 PSI)		CLB (275 PSI)		CLF (300 PSI)		CL 175		CL 250		CL 350		NO.								
		d	L	d	L	d	L	d	L	d	L	d	L	d	L	d	L	d	L	OF	BOLT							
IN	mm																								IN	mm		
26	650	1/4	100	1/4	150	1/4	24	1/1-1/4	150	1/4	225	1/4	225	1/4	225	1/4	225	1/4	225	1/4	225	1/4	225	1/4	208	28	26	650
28	700	1/4	105	1/4	150	1/4	28	1/1-1/4	150	1/4	230	1/4	235	1/4	235	1/4	235	1/4	235	1/4	235	1/4	235	1/4	208	28	28	700
30	750	1/2	110	1/2	155	1/2	28	1/1-1/4	155	1/2	230	1/2	230	1/2	230	1/2	230	1/2	230	1/2	230	1/2	230	1/2	205	32	30	750
32	800	1/2	115	1/2	175	1/2	28	1/1-1/2	175	1/2	250	1/2	250	1/2	250	1/2	250	1/2	250	1/2	250	1/2	250	1/2	210	36	32	800
34	850	1/2	115	1/2	175	1/2	32	1/1-1/2	175	1/2	250	1/2	250	1/2	250	1/2	250	1/2	250	1/2	250	1/2	250	1/2	220	40	34	850
36	900	1/2	120	1/2	180	1/2	32	1/1-1/2	180	1/2	255	1/2	255	1/2	255	1/2	255	1/2	255	1/2	255	1/2	255	1/2	240	40	36	900
38	950	1/2	120	1/2	180	1/2	32	1/1-1/2	180	1/2	255	1/2	255	1/2	255	1/2	255	1/2	255	1/2	255	1/2	255	1/2	240	40	38	950
40	1000	1/2	120	1/2	180	1/2	36	1/1-1/2	180	1/2	265	1/2	265	1/2	265	1/2	265	1/2	265	1/2	265	1/2	265	1/2	245	44	40	1000
42	1050	1/1	130	1/2	185	1/2	36	1/1-1/2	185	1/2	270	1/2	270	1/2	270	1/2	270	1/2	270	1/2	270	1/2	270	1/2	255	48	42	1050
44	1100	1/1	130	1/2	185	1/2	40	1/1-1/2	185	1/2	270	1/2	270	1/2	270	1/2	270	1/2	270	1/2	270	1/2	270	1/2	275	44	44	1100
46	1150	1/1	130	1/2	185	1/2	40	1/1-1/2	185	1/2	275	1/2	275	1/2	275	1/2	275	1/2	275	1/2	275	1/2	275	1/2	300	48	46	1150
48	1200	1/1	135	1/2	185	1/2	44	1/1-1/2	185	1/2	275	1/2	275	1/2	275	1/2	275	1/2	275	1/2	275	1/2	275	1/2	300	48	48	1200
50	1250	1/1-1/8	145	1/2	210	1/2	44	1/1-3/4	210	1/2	280	1/2	280	1/2	280	1/2	280	1/2	280	1/2	280	1/2	280	1/2	300	48	48	1200
52	1300	1/1-1/8	145	1/2	210	1/2	44	1/1-3/4	210	1/2	280	1/2	280	1/2	280	1/2	280	1/2	280	1/2	280	1/2	280	1/2	305	52	50	1250
54	1350	1/1-1/4	155	1/2	220	1/2	44	1/1-3/4	220	1/2	300	1/2	300	1/2	300	1/2	300	1/2	300	1/2	300	1/2	300	1/2	330	52	54	1350
60	1500	1/1-1/4	160	1/2	225	1/2	52	1/1-3/4	225	1/2	305	1/2	305	1/2	305	1/2	305	1/2	305	1/2	305	1/2	305	1/2	350	60	60	1500
66	1650	1/1-1/4	170	1/2	240	1/2	52	1/1-3/4	240	1/2	325	1/2	325	1/2	325	1/2	325	1/2	325	1/2	325	1/2	325	1/2	300	60	66	1650
72	1800	1/1-1/4	175	1/2	245	1/2	52	1/1-3/4	245	1/2	325	1/2	325	1/2	325	1/2	325	1/2	325	1/2	325	1/2	325	1/2	300	72	72	1800



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.4 BOLT/NUT DIMENSION CHART

MACHINE BOLT/NUT FOR JIS(RF,FF)

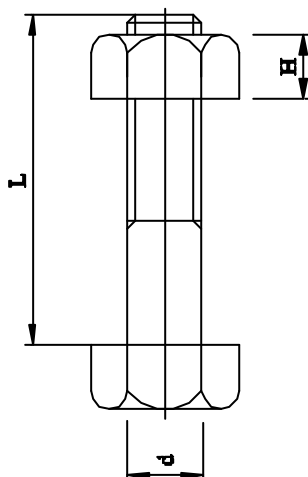
LDP-L901
REV. 1 (OCT, 2002)
PAGE : 8 OF 9
DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. GASKET THICKNESS IS BASED ON THE FOLLOWING :

2.1 20KG/Cm ² AND UNDER	: 1.5mm
2.1.1 10" & UNDER	: 3.0mm
2.1.2 12" & OVER	: 4.5mm
2.2 30KG/Cm ² AND OVER	
3. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ARMS B16.5.

NUT DIMENSION	
d	H
M10	8
M12	10
M16	13
M20	16
M22	18
M24	19
M30	24
M36	29
M42	34



MACHINE BOLT/NUT

NOMINAL FLANGE SIZE	DN	3KG/Cm ²		10KG/Cm ²		16KG/Cm ²		20KG/Cm ²		30KG/Cm ²		40KG/Cm ²		60KG/Cm ²		NOMINAL FLANGE SIZE	
		d	L	d	L	d	L	d	L	d	L	d	L	d	L	IN	mm
1/2	15	M10	35	M12	45	M12	45	M12	45	M16	60	M16	65	M16	70	1/2	15
3/4	20	M10	35	M12	45	M12	45	M12	50	M16	60	M16	65	M20	80	3/4	20
1	25	M10	35	M16	50	M16	50	M16	55	M16	65	M16	70	M20	85	1	25
1-1/4	32	M12	45	M16	55	M16	55	M16	60	M16	70	M16	75	M20	90	1-1/4	32
1-1/2	40	M12	45	M16	55	M16	55	M16	60	M20	75	M20	80	M22	95	1-1/2	40
2	50	M12	45	M16	55	M16	55	M16	60	M16	70	M16	80	M20	90	2	50
2-1/2	65	M12	45	M16	60	M16	55	M16	60	M20	80	M20	90	M22	110	2-1/2	65
3	80	M16	50	M16	60	M20	65	M20	70	M20	90	M20	95	M22	115	3	80
3-1/2	90	M16	50	M16	60	M20	65	M20	75	M22	95	M22	100	M24	120	3-1/2	90
4	100	M16	55	M16	60	M20	70	M20	75	M22	95	M22	105	M24	125	4	100
5	125	M16	55	M20	65	M22	75	M22	80	M22	105	M24	115	M30	140	5	125
6	150	M16	60	M20	70	M22	80	M22	85	M24	110	M30	130	M30	150	6	150
8	200	M20	65	M20	70	M22	80	M22	90	M24	120	M30	140	M30	165	8	200
10	250	M20	70	M22	80	M24	90	M24	100	M30	135	M30	155	M36	185	10	250
12	300	M20	70	M22	80	M24	95	M24	105	M30	145	M36	170	M36	200	12	300
14	350	M22	80	M22	85	M24	105	M30	120	M30	150	M36	175	M42	215	14	350
16	400	M22	80	M24	90	M30	115	M30	130	M36	170	M36	190	M42	230	16	400
18	450	M22	80	M24	95	M30	120	M30	135	—	—	—	—	—	—	18	450
20	500	M22	80	M24	95	M30	130	M30	140	—	—	—	—	—	—	20	500
24	600	M24	85	M30	105	M36	135	M36	155	—	—	—	—	—	—	24	600



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES 1.4 BOLT/NUT DIMENSION CHART STUD BOLT/NUT FOR JIS(RF,FF)

LDP-L901

REV. 1 (OCT, 2002)

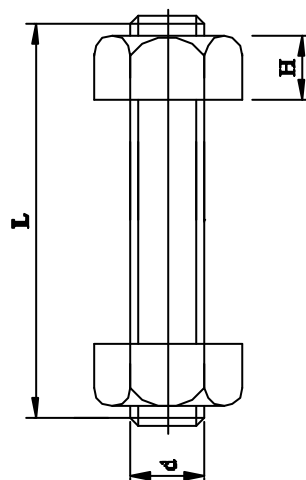
PAGE : 9 OF 9

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. GASKET THICKNESS IS BASED ON THE FOLLOWING :
2.1 20KG/Cm² AND UNDER : 1.5mm
2.1.1 10" & UNDER : 3.0mm
2.1.2 12" & OVER : 4.5mm
2.2 30KG/Cm² & OVER : 4.5mm
3. FOR ANY DEVIATIONS OTHER THAN THE ABOVE, BOLT LENGTH SHOULD BE DETERMINED IN ACCORDANCE WITH ANNEX F IN ARMS B16.5.

NUT DIMENSION	
d	H
M10	8
M12	10
M16	13
M20	16
M22	18
M24	19
M30	24
M36	28
M42	34



STUD BOLT/NUTS

NOMINAL FLANGE SIZE		50KG/Cm ²			100KG/Cm ²			150KG/Cm ²			200KG/Cm ²			300KG/Cm ²			400KG/Cm ²			600KG/Cm ²			NOMINAL FLANGE SIZE	
		d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT	d	L	NO. OF BOLT		
1/2	15	M10	45	4	M12	55	4	M12	55	4	M12	60	4	M16	85	4	M16	85	4	M16	95	4	1/2	15
3/4	20	M10	45	4	M12	60	4	M12	60	4	M12	65	4	M16	85	4	M16	85	4	M16	110	4	3/4	20
1	25	M10	45	4	M16	65	4	M16	65	4	M16	70	4	M16	85	4	M16	90	4	M20	110	4	1	25
1-1/4	32	M12	55	4	M16	70	4	M16	70	4	M16	75	4	M16	90	4	M16	95	4	M20	120	4	1-1/4	32
1-1/2	40	M12	55	4	M16	70	4	M16	70	4	M16	75	4	M20	100	4	M20	105	4	M22	130	4	1-1/2	40
2	50	M12	60	4	M16	70	4	M16	70	8	M16	75	8	M16	90	8	M16	100	8	M20	125	8	2	50
2-1/2	65	M12	60	4	M16	75	4	M16	75	8	M16	80	8	M20	110	8	M20	120	8	M22	140	8	2-1/2	65
3	80	M16	65	4	M16	75	8	M20	85	8	M20	90	8	M20	120	8	M20	120	8	M22	145	8	3	80
3-1/2	90	M16	65	4	M16	75	8	M20	85	8	M20	95	8	M22	125	8	M22	130	8	M24	155	8	3-1/2	90
4	100	M16	70	8	M20	90	8	M20	90	8	M20	95	8	M22	130	8	M22	135	8	M24	160	8	4	100
5	125	M16	70	8	M20	85	8	M22	95	8	M22	105	8	M24	135	8	M24	135	8	M30	185	8	5	125
6	150	M16	75	8	M20	90	8	M22	100	12	M22	110	12	M24	145	12	M20	170	12	M30	195	12	6	150
8	200	M20	85	8	M20	90	12	M22	105	12	M22	115	12	M24	155	12	M30	185	12	M30	205	12	8	200
10	250	M20	90	12	M22	100	12	M24	115	12	M24	125	12	M30	180	12	M30	200	12	M36	235	12	10	250
12	300	M20	90	12	M22	100	16	M24	120	16	M24	130	16	M30	190	16	M36	220	16	M36	250	16	12	300
14	350	M22	100	12	M22	105	16	M30	140	16	M30	150	16	M30	195	16	M36	230	16	M42	275	16	14	350
16	400	M22	100	16	M24	115	16	M30	145	16	M30	160	16	M36	220	16	M36	240	16	M42	290	16	16	400
18	450	M22	100	16	M24	120	20	M30	150	20	M30	165	20	—	—	—	—	—	—	—	—	—	18	450
20	500	M22	100	20	M24	120	20	M30	165	20	M30	170	20	—	—	—	—	—	—	—	—	—	20	500
24	600	M24	110	20	M30	135	24	M36	175	24	M36	190	24	—	—	—	—	—	—	—	—	—	24	600



PIPING HANDBOOK

1. DIMENSION TABLES

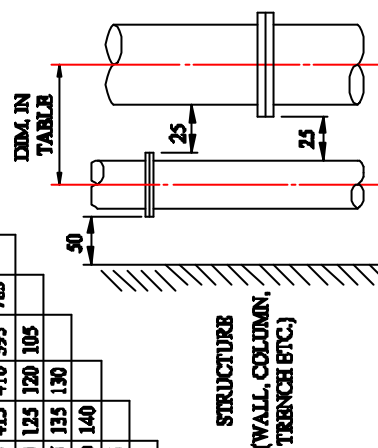
1.5 LINE SPACING(HORIZONTAL)

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995

RATING		600LB																300LB OR 400LB																150LB															
SIZE		24	25	18	16	14	12	10	8	6	4	3	2	1 1/2	1	24	25	18	16	14	12	10	8	6	4	3	2	1 1/2	1	24	25	18	16	14	12	10	8	6	4	3	2	1 1/2	1						
1	515	490	415	385	345	325	300	255	220	180	150	125	100	75	50	500	460	400	370	335	305	265	235	205	170	150	125	100	75	450	400	360	345	310	285	245	215	185	160	140	120	110	100						
1 1/2	520	460	420	385	355	330	305	260	230	190	155	135	110	85	60	505	440	405	375	345	310	275	240	210	180	155	135	110	85	455	400	365	350	320	295	255	225	190	165	145	125	115							
2	525	460	425	400	360	335	310	265	235	195	160	140	115	90	65	515	445	410	380	350	320	280	250	215	185	160	140	115	90	460	405	375	355	325	300	260	230	195	170	155	135								
3	540	475	440	415	375	350	325	280	250	210	175	155	130	105	80	525	460	425	395	365	335	295	265	230	200	175	155	130	105	480	420	390	370	340	315	275	245	210	185	170									
4	555	490	455	430	385	365	340	295	260	220	190	170	145	120	95	540	470	440	410	375	345	305	275	245	210	180	160	135	110	90	490	430	400	385	360	325	285	255	220										
6	580	515	480	455	415	390	365	320	290	250	215	195	170	145	120	570	495	465	435	405	370	335	300	270	240	215	195	170	145	515	460	425	410	380	355	315	285	250											
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12	655	595	560	535	490	475	445	400	365	325	315	300	285	275	265	645	575	545	515	480	450	410	380	355	325	315	300	295	285	595	535	505	490	455	430														
14	675	610	575	550	505	485	460	415	385	340	325	310	300	290	280	660	590	560	530	495	465	435	405	380	350	340	330	320	310	610	555	520	505	470															
16	700	635	600	575	530	510	485	440	410	385	370	355	330	305	280	685	615	585	555	520	490	465	435	410	385	370	355	340	330	635	580	545	530																
18	725	660	625	600	555	535	510	465	435	390	375	355	330	305	280	710	640	610	580	545	515	475	435	415	385	375	355	340	330	660	605	570																	
20	750	685	650	625	580	560	535	490	460	415	385	365	340	315	290	735	665	635	605	575	540	505	445	440	410	385	365	350	685	630																			
24	800	750	705	675	635	610	585	540	510	470	435	415	410	395	785	720	685	655	605	580	535	495	490	460	435	415	410	395	735																				
1	515	450	415	385	345	325	300	255	220	180	150	125	100	75	50	500	460	400	370	335	305	265	235	205	170	150	125	100	75	450	400	360	345	310	285	245	215	185	160	140	120	110	100						
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8	605	540	505	475	435	415	390	345	315	275	245	230	205	180	155	590	525	490	460	430	400	360	330	295	265	245	225	215	190	540	485	455	435	405	380	340	310												
10	630	570	535	510	465	445	420	375	340	300	275	260	235	210	185	620	550	520	490	455	425	385	355	325	295	275	260	235	215	570	510	480	465	430	405	365													
12	655	595	560	535	490	475	445	400	365	325	315	300	285	275	265	645	575	545	515	480	450	410	380	355	325	315	300	295	285	595	535	505	490	455	430														
14	675	610	575	550	505	485	460	415	385	340	325	310	300	290	280	660	590	560	530	495	465	435	405	380	350	340	330	320	310	610	555	520	505	470															
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18	725	660	625	600	555	535	510	465	435	390	375	355	330	305	280	710	640	610	580	545	515	475	435	415	385	375	355	340	330	660	605	570																	
20	750	685	650	625	580	560	535	490	460	415	385	365	340	315	290	735	665	635	605	575	540	505	445	440	410	385	365	350	685	630																			
24	800	750	705	675	635	610	585	540	510	470	435	415	410	395	785	720	685	655	605	580	535	495	490	460	435	415	410	395	735																				
1	515	450	415	385	345	325	300	255	220	180	150	125	100	75	50	500	460	400	370	335	305	265	235	205	170	150	125	100	75	450	400	360	345	310	285	245	215	185	160	140	120	110	100						
1 1/2	520	460	420	385	355	330	305	260	230	190	155	135	110	85	60	505	440	405	375	345	310	275	240	210	180	155	135	110	85	455	400	365	350	320	295	255	225	190	165	145	125	115							
2	525	460	425	400	360	335	310	265	235	195	160	140	115	90	65	515	445	410	380	350	320	280	250	215	185	160	140	115	90	460	405	375	355	325	300	260	230	195	170	155	135								
3	540	475	440	415	375	350	325	280	250	210	175	155	130	105	80	525	460	425	395	365	335	295	265	230	200	175	155	130	105	480	420	390	370	340	315	275	245	210	185	170									
4	555	490	455	430	385	365	340	295	260	220	190	170	145	120	95	540	470	440	410	375	345	305	275	245	210	180	160	135	110	90	490	430	400	385	360	325	285	255	220										
6	580	515	480	455	415	390	365	320	290	250	215	195	170	145	120	570	495	465	435	405	370	335	300	270	240	215	195	170	145	515	460	425	410	380	355	315	285	250											
8	605	540	505	475	435	415	390	345	315	275	245	230	205	180	155	590	525	490	460	430	400	360	330	295	265	245	225	215	190	540	485	455	435	405	380	340	310												
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16	700	635	600	575	530	510	485	440	410	385	370	355	330	305	280	685	615	585	555	520	490	465	435	410	385	370	355	340	330	635	580	545	530																
18	725	660	625	600	555	535	510	465	435	390	375	355	330	305	280	710	640	610																															

GENERAL NOTES

1. LINE SPACING DIMENSIONS ARE USED ON A CLEARANCE OF 75mm BETWEEN THE OUTSIDE DIAMETER AND THE OUTSIDE DIAMETER OF PIPE WITH A MINIMUM SPACING BETWEEN ANY TWO LINES OF 100mm.
2. SIDE MOVEMENT DUE TO EXPANSION OF HOT LINES MUST BE ALLOWED FOR AND SPACING INCREASED ACCORDINGLY.
3. WHEN THE PIPE AND/OR FLANGES ARE INSULATED, THE INSULATION THICKNESS IS ADDED TO THE SPACING DIMENSION.
4. INCREASED SPACING MAY BE REQUIRED WHERE ORIFICE FLANGES ARE INVOLVED.



(PLUS INSULATION IF REQUIRED.
SEE NOTE 3.)



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.6 LINE SPACING(SLANT)

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 1 OF 1

DATE : DEC. 1995

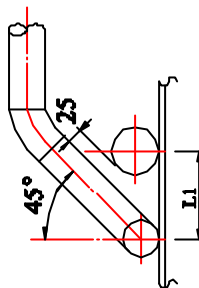


TABLE-D

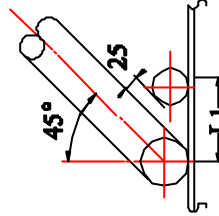


TABLE-B

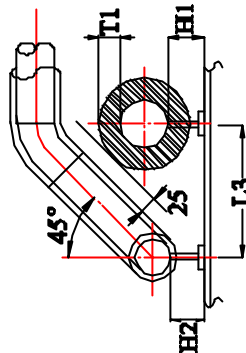


TABLE-D

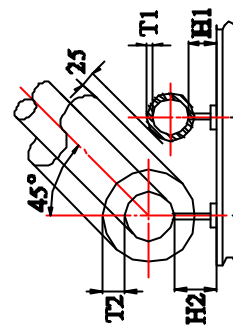


TABLE-B

(Unit : mm)

TABLE FOR SLANT PIPE SPACING

TABLE-D (L1)																								
PIPE Nominal Pipe Size												PIPE Nominal Pipe Size												
(B)	1/2	3/4	1	1.1/2	2	2.1/2	3	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	**	(B)
30	960	965	965	970	970	975	975	980	985	995	1005	1015	1025	1030	1040	1050	1065	1075	1085	1095	1105	1115	70	1/2
28	900	900	905	910	910	915	915	920	925	930	940	955	965	970	980	990	1000	1010	1025	1035	1045	75	70	3/4
26	840	840	845	850	850	855	855	860	865	870	880	890	900	910	920	930	940	950	960	970	985	80	70	1
24	780	780	785	790	795	795	800	805	810	820	830	840	850	860	870	880	890	900	910	920	90	80	75	1.1/2
22	715	720	725	730	735	735	740	745	750	760	770	780	790	800	810	820	830	840	850	860	85	75	2	
20	655	660	665	670	675	680	685	690	695	710	720	730	740	750	765	775	785	795	805	820	830	85	80	2.1/2
18	595	595	595	600	600	605	610	615	620	625	635	645	655	665	675	685	695	705	715	725	735	90	85	3
16	535	535	535	540	540	545	545	550	560	565	575	585	595	600	615	620	630	640	650	660	670	95	90	4
14	470	475	475	480	480	485	485	490	495	500	510	525	535	540	550	560	570	580	590	600	610	100	95	5
12	435	435	435	440	440	445	445	450	455	460	475	485	495	505	515	525	535	545	555	565	575	105	100	6
10	370	375	375	380	380	385	385	390	395	400	415	425	435	445	455	465	475	485	495	505	515	110	105	8
8	305	310	310	315	315	320	320	325	330	335	350	360	370	380	390	400	410	420	430	440	450	100	100	10
6	245	245	250	255	255	260	260	265	270	275	295	310	320	330	340	350	360	370	380	390	400	100	100	12
5	215	215	215	220	220	225	225	230	240	240	265	280	290	300	310	320	330	340	350	360	370	100	100	14
4	180	180	180	185	190	190	195	200	210	210	240	260	270	280	290	300	310	320	330	340	350	100	100	16
3	150	150	150	155	160	160	165	170	180	180	210	230	240	250	260	270	280	290	300	310	320	100	100	18
2.1/2	135	135	135	140	140	145	145	150	160	160	190	210	220	230	240	250	260	270	280	290	300	100	100	20
2	115	115	120	120	125	125	130	135	145	145	175	195	205	215	225	235	245	255	265	275	285	100	100	22
1.1/2	100	100	105	105	110	110	115	120	130	130	160	180	190	200	210	220	230	240	250	260	270	100	100	24
1	85	85	90	90	95	95	100	105	115	115	145	165	175	185	195	205	215	225	235	245	255	100	100	26
3/4	75	75	80	80	85	85	90	95	105	105	135	155	165	175	185	195	205	215	225	235	245	100	100	28
1/2	70	70	75	75	80	80	85	90	100	100	130	150	160	170	180	190	200	210	220	230	240	100	100	30
PIPE	30	28	26	24	22	20	18	16	14	12	10	8	6	5	4	3	2.1/2	2	1.1/2	1	3/4	1/2	PIPE	

TABLE-E (L1)																	
Nominal Pipe Size												Nominal Pipe Size					
(B)	30	28	26	24	22	20	18	16	14	12	10	8	6	5	4	3	2.1/2
30	1155	1115	1075	1035	995	955	915	875	835	795	755	715	675	635	595	555	515
28	1065	1025	985	945	905	865	825	785	745	705	665	625	585	545	505	465	425
26	975	935	895	855	815	775	735	695	655	615	575	535	495	455	415	375	335
24	885	845	805	765	725	685	645	605	565	525	485	445	405	365	325	285	245
22	795	755	715	675	635	595	555	515	475	435	395	355	315	275	235	195	155
20	705	665	625	585	545	505	465	425	385	345	305	265	225	185	145	105	65
18	615	575	535	495	455	415	375	335	295	255	215	175	135	95	55	15	5
16	525	485	445	405	365	325	285	245	205	165	125	85	45	5	5	5	5
14	435	395	355	315	275	235	195	155	115	75	35	5	5	5	5	5	5
12	345	305	265	225	185	145	105	65	25	5	5	5	5	5	5	5	5
10	255	215	175	135	95	55	15	5	5	5	5	5	5	5	5	5	5
8	165	125	85	45	5	5	5	5	5	5	5	5	5	5	5	5	5
6	75	35	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
2.1/2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
1.1/2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3/4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
1/2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
PIPE	30	28	26	24	22	20	18	16	14	12	10	8	6	5	4	3	2.1/2

TABLE-B (L1)

Corrective value for Table - D and B

T1+T2	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350
L2	0	40	75	110	145	180	215	250	285	320	355	390	425	460	495

L1 : Spacing between two non-insulated pipes with the same BOP EL.
L2 : Corrective value taking account of the area of insulation thickness.

Example : If T1 = 0 and T2 = 50,
 $L2 = 75(T1+T2-0-50-50)$
If T1 = 25 and T2 = 50,
 $L2 = 110(T1+T2-25-50-75)$

T1, T2 : Thickness of insulation
H1, H2 : Height of those or saddle
(Take "0" if piping has no shoe or saddle.)

Note :

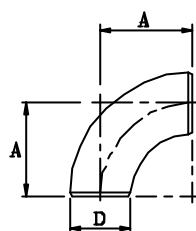
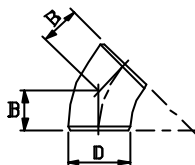
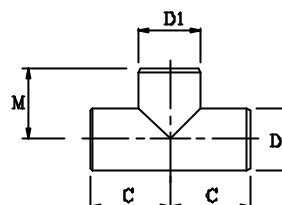
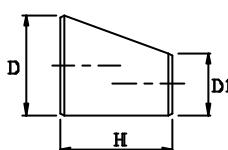
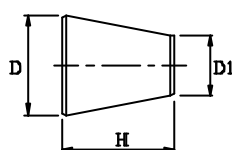
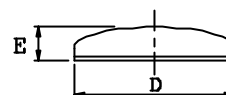
(a) L1 values may be used only where racks are narrow without enough pipe space.

(b) Values in [***] should be used the corresponding values in line spacing table (Horizontal).

Determination of spacing

- (1) For pipings of the same BOP EL without insulation, use L1
- (2) For pipings of the same BOP EL with insulation, use the values in Table.
- (3) For pipings of different BOP EL without insulation, use the formula $L3 = L1+L2$.
- (3) For pipings of different BOP EL with insulation, use the formula $L3 = L1+(H1-H2)$.

formula $L3 = L1+L2+(H1-H2)$.


90° ELBOW

45° ELBOW

TEE

REDUCER

CAP

1. Dimensions of Elbows & Caps

Unit : mm

Nominal Pipe Size (NPS)	Outside Diameter at Bevel <i>D</i>	Elbows			Caps
		Center-to-End			Length
		90° Long Radius <i>A</i>	90° - Short Radius <i>A</i>	45° Long Radius <i>B</i>	<i>E</i> (Minimum)
50	1270.0	1905.0	1270.0	789.0	388.7
52	1320.8	1981.2	1320.8	820.5	406.4
54	1371.6	2057.4	1371.6	852.2	419.3
56	1422.4	2133.6	1422.4	883.8	432.0
58	1473.2	2209.8	1473.2	915.3	444.7
60	1524.0	2286.0	1524.0	946.9	457.4

2. Dimensions of Tees

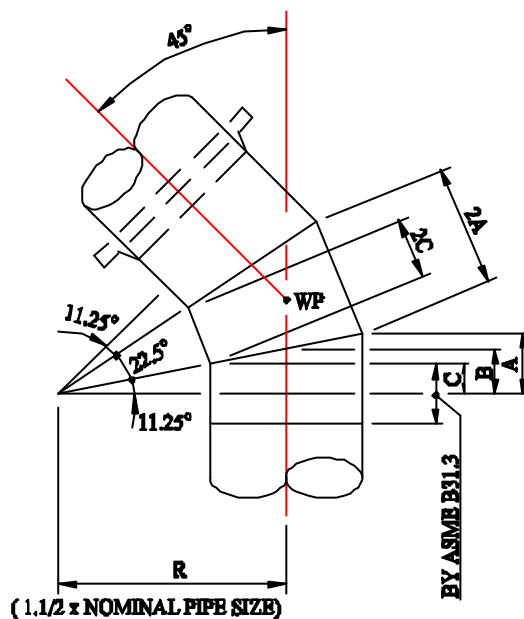
Unit : mm

Nominal Pipe Size (NPS)	Outside Diameter at Bevel <i>D</i>		Center-to-End		Nominal Pipe Size (NPS)	Outside Diameter at Bevel <i>D</i>		Center-to-End	
	Run	Outlet	Run <i>C</i>	Outlet <i>M</i>		Run	Outlet	Run <i>C</i>	Outlet <i>M</i>
50 x 50	1270.0	1270.0	1346	939.8	56 x 56	1422.4	1422.4	1498	1041.4
50 x 48	1270.0	1219.2	1294	939.8	56 x 54	1422.4	1371.6	1447	1041.4
50 x 46	1270.0	1168.4	1245	939.8	56 x 52	1422.4	1320.8	1397	1041.4
50 x 44	1270.0	1117.6	1193	939.8	56 x 50	1422.4	1270.0	1346	1041.4
50 x 42	1270.0	1066.8	1143	939.8	56 x 48	1422.4	1219.2	1294	1041.4
50 x 40	1270.0	1016.0	1091	939.8	56 x 46	1422.4	1168.4	1245	1041.4
50 x 38	1270.0	965.2	1041	939.8	56 x 44	1422.4	1117.6	1193	1041.4
50 x 36	1270.0	914.4	989	939.8	56 x 42	1422.4	1066.8	1143	1041.4
50 x 34	1270.0	863.6	939	939.8	56 x 40	1422.4	1016.0	1091	1041.4
50 x 32	1270.0	812.8	888	939.8	56 x 38	1422.4	965.2	1041	1041.4
50 x 30	1270.0	762.0	837	939.8	56 x 36	1422.4	914.4	989	1041.4
50 x 28	1270.0	711.2	786	939.8	56 x 34	1422.4	863.6	939	1041.4
50 x 26	1270.0	660.4	735	939.8					
					58 x 58	1473.2	1473.2	1549	1092.2
52 x 52	1320.8	1320.8	1397	977.9	58 x 56	1473.2	1422.4	1498	1092.2
52 x 50	1320.8	1270.0	1346	977.9	58 x 54	1473.2	1371.6	1447	1092.2
52 x 48	1320.8	1219.2	1294	977.9	58 x 52	1473.2	1320.8	1397	1092.2
52 x 46	1320.8	1168.4	1245	977.9	58 x 50	1473.2	1270.0	1346	1092.2
52 x 44	1320.8	1117.6	1193	977.9	58 x 48	1473.2	1219.2	1294	1092.2
52 x 42	1320.8	1066.8	1143	977.9	58 x 46	1473.2	1168.4	1245	1092.2
52 x 40	1320.8	1016.0	1091	977.9	58 x 44	1473.2	1117.6	1193	1092.2
52 x 38	1320.8	965.2	1041	977.9	58 x 42	1473.2	1066.8	1143	1092.2
52 x 36	1320.8	914.4	989	977.9	58 x 40	1473.2	1016.0	1091	1092.2
52 x 34	1320.8	863.6	939	977.9	58 x 38	1473.2	965.2	1041	1092.2
52 x 32	1320.8	812.8	888	977.9	58 x 36	1473.2	914.4	989	1092.2
52 x 30	1320.8	762.0	837	977.9					
					60 x 60	1524.0	1524.0	1599	1143.0
54 x 54	1371.6	1371.6	1447	1016.0	60 x 58	1524.0	1473.2	1549	1143.0
54 x 52	1371.6	1320.8	1397	1016.0	60 x 56	1524.0	1422.4	1498	1143.0
54 x 50	1371.6	1270.0	1346	1016.0	60 x 54	1524.0	1371.6	1447	1143.0
54 x 48	1371.6	1219.2	1294	1016.0	60 x 52	1524.0	1320.8	1397	1143.0
54 x 46	1371.6	1168.4	1245	1016.0	60 x 50	1524.0	1270.0	1346	1143.0
54 x 44	1371.6	1117.6	1193	1016.0	60 x 48	1524.0	1219.2	1294	1143.0
54 x 42	1371.6	1066.8	1143	1016.0	60 x 46	1524.0	1168.4	1245	1143.0
54 x 40	1371.6	1016.0	1091	1016.0	60 x 44	1524.0	1117.6	1193	1143.0
54 x 38	1371.6	965.2	1041	1016.0	60 x 42	1524.0	1066.8	1143	1143.0
54 x 36	1371.6	914.4	989	1016.0	60 x 40	1524.0	1016.0	1091	1143.0
54 x 34	1371.6	863.6	939	1016.0	60 x 38	1524.0	965.2	1041	1143.0
54 x 32	1371.6	812.8	888	1016.0					

3. Dimensions of Reducers

Unit : mm

Nominal Pipe Size (NPS)	Outside Diameter at Bevel		End-to-End <i>H</i>	Nominal Pipe Size (NPS)	Outside Diameter at Bevel		End-to-End <i>H</i>
	Large End <i>D</i>	Small End <i>D1</i>			Large End <i>D</i>	Small End <i>D1</i>	
50 x 48	1270.0	1219.2	1118	56 x 50	1422.4	1270.0	1270
50 x 46	1270.0	1168.4	1118	56 x 48	1422.4	1219.2	1270
50 x 44	1270.0	1117.6	1118	56 x 46	1422.4	1168.4	1270
50 x 42	1270.0	1066.8	1118	56 x 44	1422.4	1117.6	1270
50 x 40	1270.0	1016.0	1118	56 x 42	1422.4	1066.8	1270
50 x 38	1270.0	965.2	1118	56 x 40	1422.4	1016.0	1270
50 x 36	1270.0	914.4	1118	56 x 38	1422.4	965.2	1270
50 x 34	1270.0	863.6	1118	56 x 36	1422.4	914.4	1270
50 x 32	1270.0	812.8	1118	56 x 34	1422.4	863.6	1270
50 x 30	1270.0	762.0	1118	56 x 32	1422.4	812.8	1270
50 x 28	1270.0	711.2	1118	56 x 30	1422.4	762.0	1270
50 x 26	1270.0	660.4	1118	56 x 28	1422.4	711.2	1270
52 x 50	1320.8	1270.0	1168	58 x 56	1473.2	1422.4	1321
52 x 48	1320.8	1219.2	1168	58 x 54	1473.2	1371.6	1321
52 x 46	1320.8	1168.4	1168	58 x 52	1473.2	1320.8	1321
52 x 44	1320.8	1117.6	1168	58 x 50	1473.2	1270.0	1321
52 x 42	1320.8	1066.8	1168	58 x 48	1473.2	1219.2	1321
52 x 40	1320.8	1016.0	1168	58 x 46	1473.2	1168.4	1321
52 x 38	1320.8	965.2	1168	58 x 44	1473.2	1117.6	1321
52 x 36	1320.8	914.4	1168	58 x 42	1473.2	1066.8	1321
52 x 34	1320.8	863.6	1168	58 x 40	1473.2	1016.0	1321
52 x 32	1320.8	812.8	1168	58 x 38	1473.2	965.2	1321
52 x 30	1320.8	762.0	1168	58 x 36	1473.2	914.4	1321
52 x 28	1320.8	711.2	1168	58 x 34	1473.2	863.6	1321
52 x 26	1320.8	660.4	1168	58 x 32	1473.2	812.8	1321
				58 x 30	1473.2	762.0	1321
54 x 52	1371.6	1320.8	1219				
54 x 50	1371.6	1270.0	1219	60 x 58	1524.0	1473.2	1372
54 x 48	1371.6	1219.2	1219	60 x 56	1524.0	1422.4	1372
54 x 46	1371.6	1168.4	1219	60 x 54	1524.0	1371.6	1372
54 x 44	1371.6	1117.6	1219	60 x 52	1524.0	1320.8	1372
54 x 42	1371.6	1066.8	1219	60 x 50	1524.0	1270.0	1372
54 x 40	1371.6	1016.0	1219	60 x 48	1524.0	1219.2	1372
54 x 38	1371.6	965.2	1219	60 x 46	1524.0	1168.4	1372
54 x 36	1371.6	914.4	1219	60 x 44	1524.0	1117.6	1372
54 x 34	1371.6	863.6	1219	60 x 42	1524.0	1066.8	1372
54 x 32	1371.6	812.8	1219	60 x 40	1524.0	1016.0	1372
54 x 30	1371.6	762.0	1219	60 x 38	1524.0	965.2	1372
54 x 28	1371.6	711.2	1219	60 x 36	1524.0	914.4	1372
				60 x 34	1524.0	863.6	1372
56 x 54	1422.4	1371.6	1270	60 x 32	1524.0	812.8	1372
56 x 52	1422.4	1320.8	1270	60 x 30	1524.0	762.0	1372



45° MITERED ELBOW, 2 WELD

unit : mm

PIPE SIZE (INCH)	R	A	B	C
6	228.6	61.9	46.0	28.6
8	304.8	82.6	60.3	38.1
10	381.0	103.2	76.2	49.2
12	457.2	123.8	84.1	58.7
14	533.4	141.3	106.4	71.4
16	609.6	161.9	120.7	81.0
18	685.8	182.6	142.9	90.5
20	762.0	201.6	150.8	101.6
22	838.2	222.3	166.7	111.1
24	914.4	242.9	182.6	120.7
26	990.6	261.9	196.9	131.8
28	1066.8	282.6	212.7	141.3
30	1143.0	303.2	227.0	150.8
32	1219.2	323.9	242.9	161.9

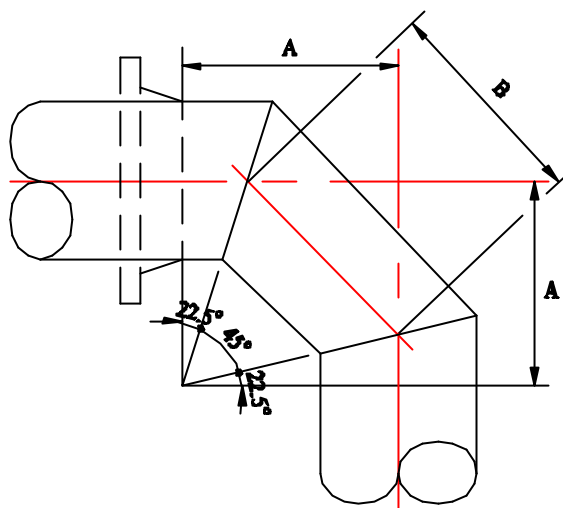
unit : mm

PIPE SIZE (INCH)	R	A	B	C
34	1295.4	342.9	257.2	171.5
36	1371.6	363.5	273.1	182.6
38	1447.8	384.2	287.3	192.1
40	1524.0	404.8	303.2	201.6
42	1600.2	423.9	319.1	212.7
48	1828.8	485.8	363.5	242.9
54	2057.4	546.1	409.6	273.1
60	2286.0	606.4	454.0	303.2
66	2514.6	666.8	500.1	333.4
72	2743.2	727.1	546.1	363.5
78	2971.8	787.4	589.0	393.7
84	3200.4	849.3	636.6	423.9
90	3429.0	909.6	682.6	454.0

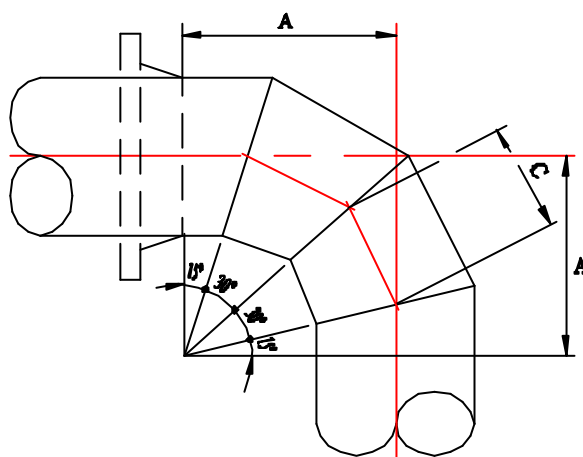


unit:mm

PIPE SIZE (INCH)	A	B	C
3	114	94	61
4	152	126	81
6	229	190	123
8	305	253	163
10	381	316	204
12	457	379	245
14	533	442	286
16	610	505	327
18	686	568	368
20	762	631	408
24	914	757	490
30	1143	947	613
36	1372	1137	735
42	1600	1326	857
48	1829	1515	980
54	2057	1704	1102
60	2286	1894	1225
72	2743	2272	1470



TWO WELD MITRE ELBOW



THREE WELD MITRE ELBOW

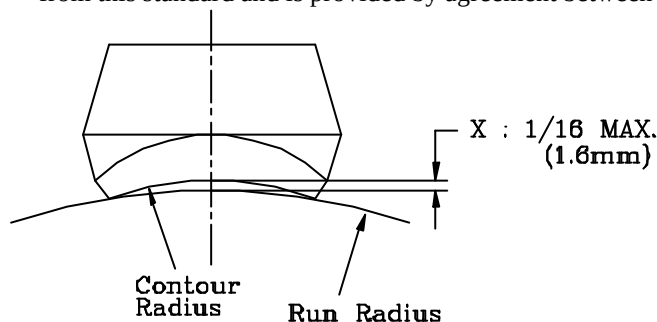
**USE ONLY WHEN REQUIRED BY SPACE
LIMITATIONS OR WHEN REQUIRED BY
PROCESS ENGINEERS FOR FLOW
CONDITIONS.**

CORRELATION OF FITTINGS CLASS WITH SCHEDULE NUMBER OR WALL DESIGNATION OF RUN PIPE CALCULATION OF RATINGS

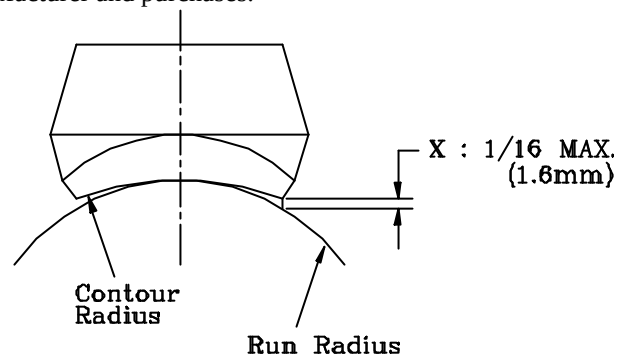
Class of Fitting	Type	Branch Size	Pipe Wall for Rating Basis ¹⁾
Standard	Buttwelding	NPS 1/8 - 24	Standard
Extra strong	Buttwelding	NPS 1/8 - 24	Extra Strong
Schedule 160	Buttwelding	NPS 1/2 - 6	Schedule 160
3000	Threaded & Socketweld	NPS 1/8 - 4	Extra Strong
6000	Threaded & Socketweld	NPS 1/2 - 2	Schedule 160

Note :

- The use of run or branch pipe wall thicknesses either thinner or thicker than shown in Table constitutes a deviation from this standard and is provided by agreement between manufacturer and purchases.



CROTCH GAP



SKIRT GAP

Fitting Consolidation Gap Allowance

STD-XS

Outlet ND	Run Pipe ND		X (mm)
	min.	max.	
1/4"	1/2"	1"	.57
	1.1/4"	36"	.55
3/8"	1/2"	3/4"	.60
	1"	2"	.56
	2.1/2"	36"	.55
1/2"	3/4"	1"	.73
	1.1/4"	2.1/2"	.65
	3"	36"	.59
3/4"	1"		.37
	1.1/4"	1.1/2"	.37
	2"	3.1/2"	.67
	4"	36"	.69
1"	1.1/4"	1.1/2"	.75
	2"	2.1/2"	.50
	3"	5"	.63
	6"	36"	.68
1.1/4"	1.1/2"		.95
	2"	2.1/2"	.95
	3"	4"	.64
	5"	8"	.59
	10"	36"	.58

XXS

Outlet ND	Run Pipe ND		X (mm)
	min.	max.	
1/2"	1"	2"	.45
	2.1/2"	24"	.37
3/4"	1"	1.1/4"	.42
	1.1/2"	3"	.53
	3.1/2"	24"	.43
1"	1.1/4"	1.1/2"	.32
	2"	3.1/2"	.60
	4"	24"	.58
1.1/4"	1.1/2"		.47
	2"	2.1/2"	.47
	3"	5"	.59
	6"	24"	.58
1.1/2"	2"		.48
	2.1/2"	3"	.48
	3.1/2"	6"	.69
	8"	24"	.49
2"	2.1/2"		.79
	3"	4"	.79
	5"	8"	.70
	10"	24"	.54

PIPING HANDBOOK

1. DIMENSION TABLES

1.10 WELDOLET

LDP-L901

REV. 1 (OCT., 2002)

PAGE : 2 OF 5

DATE : DEC., 1995

STD-XS

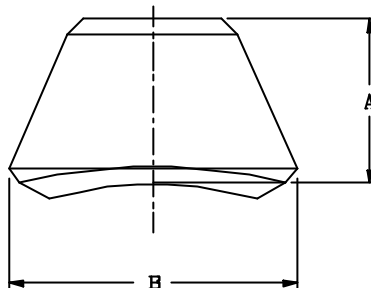
Outlet ND	Run Pipe ND		X (mm)
	min.	max.	
1.1/2"	2"		1.00
	2.1/2"	3"	1.00
	3.1/2"	5"	.93
	6"	10"	.69
	12"	36"	.59
2"	2.1/2"		.66
	3"		.66
	3.1/2"	4"	.66
	5"	6"	.58
	8"	12"	.70
	14"	36"	.79
2.1/2"	3"		.92
	3.1/2"		.92
	4"		.92
	5"	6"	.92
	8"	12"	1.05
	14"	36"	1.16
3"	3.1/2"		.90
	4"		.90
	5"		.90
	6"		.90
	8"	10"	.90
	12"	18"	.93
3.1/2"	20"	36"	.88
	4"		.81
	5"		.81
	6"		.81
	8"		.81
	10"	12"	.81
4"	14"	20"	1.14
	22"	36"	1.15
	5"		1.06
	6"		1.06
	8"		1.06
	10"	12"	1.06
5"	14"	20"	1.40
	22"	36"	1.15
	6"		.79
	8"		.79
	10"		.79
	12"	14"	.79
6"	16"	20"	1.33
	22"	30"	1.24
	32"	36"	0.35
	8"		1.12
	10"		1.12
	12"		1.12
	14"		1.12
	16"	18"	1.12
	20"	24"	1.27
	26"	36"	1.34

XXS

Outlet ND	Run Pipe ND		X (mm)
	min.	max.	
2.1/2"	3"		.66
	3.1/2"	4"	.66
	5"	6"	.59
	8"	12"	.70
	14"	16"	.16
	18"	20"	.10
3"	22"	24"	.07
	4"		.92
	5"	6"	.92
	8"	12"	1.05
	14"	16"	.24
	18"	20"	.15
4"	22"	24"	.18
	5"		.76
	6"		.76
	8"		.76
	10"	12"	.76
	14"	16"	.45
	18"	20"	.27
	22"	24"	.18

*For more Detail, Refer to MSS SP-97

BRANCH OUTLET HEIGHT – BUTTWELDING, METRIC UNITS



Unit : mm

OUTLET DN	OUTLET NPS	“A” (FACE OF FITTING TO CROTCH) ²⁾						“B” ³⁾		
		STD		XS		XXS		STD	XS	XXS
		RED.	FULL	RED.	FULL	RED.	FULL			
6	1/8	16	-	16	-	-	-	-	-	-
8	1/4	16	-	16	-	-	-	-	-	-
10	3/8	19	-	19	-	-	-	-	-	-
15	1/2	19	19	19	19	28	28	34.9	34.9	34.9
20	3/4	22	22	22	22	32	32	44.5	44.5	44.5
25	1	27	27	27	27	38	38	54	54	50.8
32	1.1/4	32	32	32	30	44	44	65.1	65.1	61.9
40	1.1/2	33	33	33	32	51	51	73	73	69.9
50	2	38	38	38	38	55	55	88.9	88.9	81
65	2.1/2	41	41	41	41	62	62	103.2	103.2	96.8
80	3	44	44	44	44	73	73	122.2	122.2	120.7
90	3.1/2	48	51	48	51	-	-	-	-	-
100	4	51	51	51	51	84	84	152.4	152.4	152.4
125	5	57	57	57	57	94	94	179.4	179.4	187.3
150	6	60	60	78	78	105	105	215.9	225.4	220.7
200	8	70	70	99	99	-	-	263.5	292.1	284.2
250	10	78	78	94	89	-	-	322.3	323.9	312.7
300	12	86	86	103	100	-	-	377.8	379.4	-
350	14	89	89	100	105	-	-	409.6	431.8	-
400	16	94	94	106	113	-	-	463.6	466.7	-
450	18	97	103	111	119	-	-	520.7	523.9	-
500	20	102	117	119	127	-	-	571.5	582.6	-
600	24	116	137	140	140	-	-	689	708	-

Notes :

1) Tolerances : 1/8 – 3/4 ±0.8mm

1 – 4 ±1.6mm

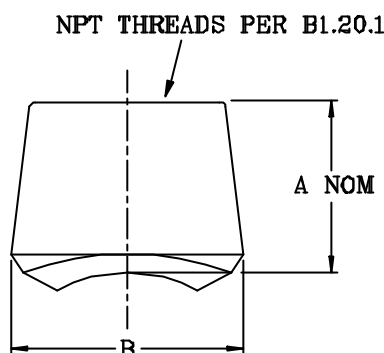
5 – 12 ±3.2mm

14 – 24 ±4.8mm

2) For more Detail, Refer to MSS SP-97.

3) TAEKWANG Manufacturer's Standard Dimensions.

BRANCH OUTLET HEIGHT – THREADED, METRIC UNITS



Unit : mm

OUTLET DN	OUTLET NPS	“A” (FACE OF FITTING TO CROTCH) ²⁾		“B” ³⁾	
		3000	6000	3000	6000
6	1/8	19	-	-	-
8	1/4	19	-	-	-
10	3/8	21	-	-	-
15	1/2	25	32	34.9	44.5
20	3/4	27	37	44.5	50.8
25	1	33	40	54	61.9
32	1.1/4	33	41	65.1	69.9
40	1.1/2	35	43	73	82.6
50	2	38	52	88.9	103.2
65	2.1/2	46	-	103.2	-
80	3	51	-	122.2	-
100	4	57	-	152.4	-

Notes :

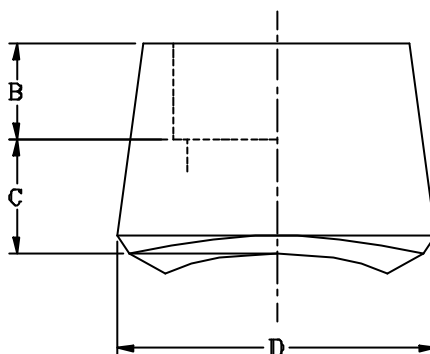
 1) Tolerances : 1/8 – 3/4 $\pm 0.8\text{mm}$

 1 – 4 $\pm 1.6\text{mm}$

2) For more Detail, Refer to MSS SP-97.

3) TAEKWANG Manufacturer's Standard Dimensions.

BRANCH OUTLET – SOCKETWELDING, METRIC UNITS



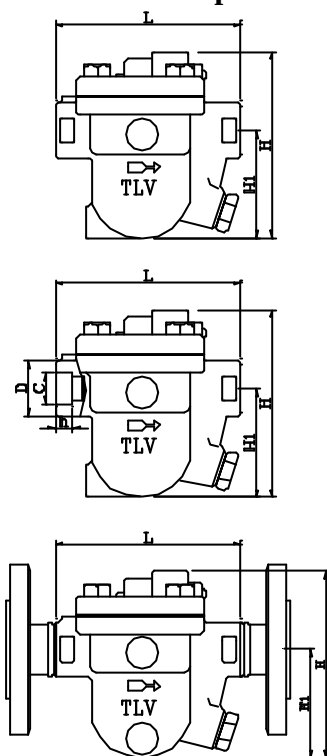
Unit : mm

OUTLET DN	OUTLET NPS	“B” MIN. ^(a)	“C” MAX. ²⁾		“D” ³⁾	
			3000	6000	3000	6000
6	1/8	10	10	-	-	-
8	1/4	10	10	-	-	-
10	3/8	10	13	-	-	-
15	1/2	10	16	24	34.9	44.5
20	3/4	13	16	25	44.5	50.8
25	1	13	22	29	54	61.9
32	1.1/4	13	22	30	65.1	69.9
40	1.1/2	13	24	32	73	82.6
50	2	16	24	37	88.9	103.2
65	2.1/2	16	25	-	103.2	-
80	3	16	30	-	122.2	-
100	4	19	30	-	152.4	-

Notes :

- 1) “B” Socket minimum depths per ASME B 16.11
- 2) For more Detail, Refer to MSS SP-97.
- 3) TAEKWANG Manufacturer’s Standard Dimensions.

Free Float Steam Trap



JH3X Screwed* (mm)

Size	L	H	H1	Weight(kg)
15	130	133	82	3
20				
25	133	146	91	3.1

*PT. Other Standards available.

JH3X Socket Welded (mm)

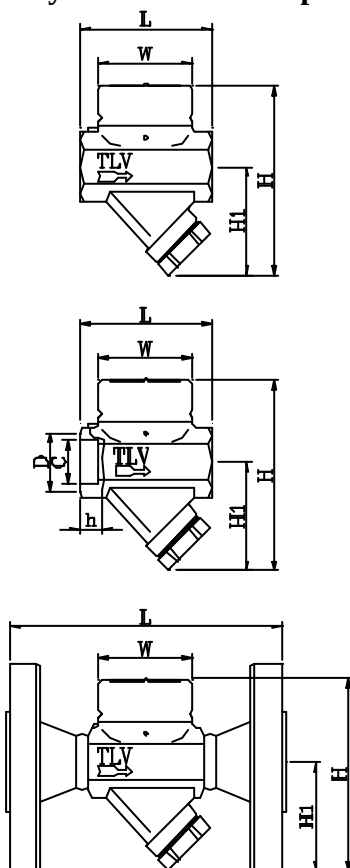
Size	L	H	H1	C	D	H	Weight(kg)
15	130	133	82	22.2	36	12	3
20				27.7		14	
25	133	146	91	34.5	44		

JH3X Flanged* (mm)

Size	L	H	H1	Weight(kg)
15	210	146	91	6
20				6.2
25				7.3

*JIS40K. Other Standards available.

Thermodynamic Steam Trap



A46S/A46SR/A46SW Screwed* (mm)

Size	L	H**	H1**	ØW	Weight(kg)
15	80	112	62 (62)	57 (67)	1.2
20					
25(25)	88(88)	117(120)			1.4(1.6)

() Model A46SW *PT, Other Standards available.

**With optional BO2, add 22mm to H and H1

A46S/A46SR/A46SW Socket Welded (mm)

Size	ØD	ØC	h	L	H**	H1**	ØW	Weight (kg)
15	30	22.2		80	112	62 (62)	57 (67)	1.2
20	36	27.7	13					
25	44	34.5		88(88)	117(120)			1.44(1.6)

() Model A46SW **With optional BO2, add 22mm to H and H1

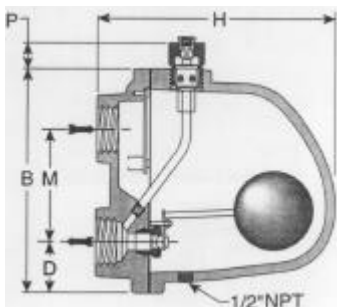
A46S/A46SR/A46SW Flanged* (mm)

Size	L	H**	H1**	ØW	Weight(kg)
15	140	112	62(62)	57	4.1
20	165				4.5
25(25)	210 (210)	117(120)		57(67)	6.2(5.8)
(32)		(120)			(7.3)
(40)				(67)	(8.8)
(50)	(220)		(10)		

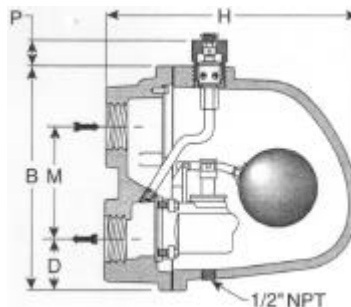
() Model A46SW *JIS 40K RF, other Standards available.

**With optional BO2, add 22mm to H and H1

Float & Thermostatic Steam Trap



Series J, F&T shown

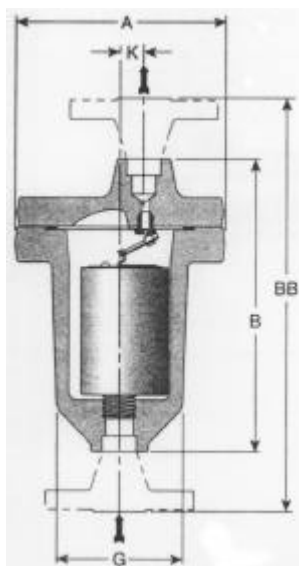


Series K, F&T shown

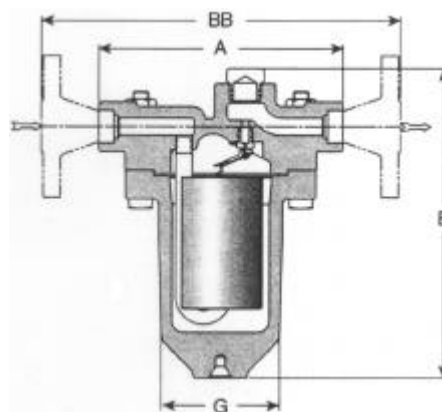
J and K Series Traps

Trap Series	J		K	
Pipe Connection	in	mm	in	mm
"B"	2	50	2-1/2	65
"C"(Width)	13-1/16	332	13-1/16	332
"D"	9-11/16	246	9-11/16	246
"H"	2-15/16	74.6	2-15/16	74.6
"M"	13-11/16	348	14-11/16	373
"P"	6-5/8	168	6-5/8	168
"P"	1-13/16	46	1-13/16	46
Weight lb(kg)	80(36.3)		87(39.5)	

Inverted Bucket Steam Traps



Model 411G Trap



Model 421 Trap

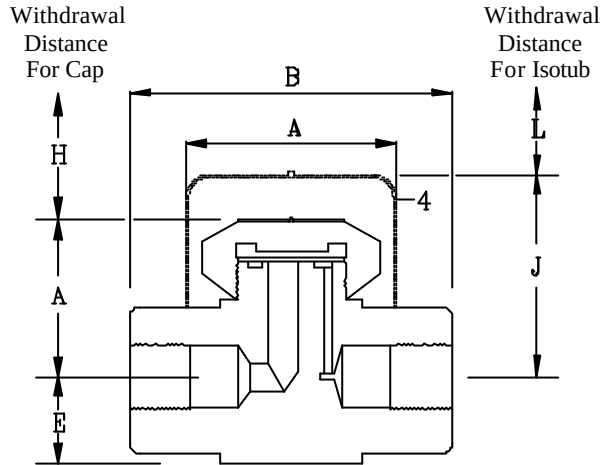
411G Bottom Inlet, Top Outlet Traps ; 421 Side Inlet, Side Outlet Traps

Add suffix "CV" to trap number for internal check valve

Model No. Screwed or SW Model No. Flanged	411G 411G-FW		421 421-FW	
	in	mm	in	mm
Pipe Connections	1/2, 3/4	15, 20	1/2, 3/4	15, 20
"A" (Diameter)	6-5/16	160	8	203
"B"(Height,Screwed or SW)	8-13/16	224	10-9/64	258
"BB"	13-15/16*	354*	11-3/4*	298*
"G" (Body OD.)	4-1/16	103	3-7/8	98
"K" (CL outlet to CL inlet)	3/4	19.0	-	-
Number of Bolts	8		8	
Weight Scr. Or SW lb(kg)	25(11.3)		27-1/2(12.6)	
Wight, Flanged lb(kg)	35(15.9)		36(16.3)	

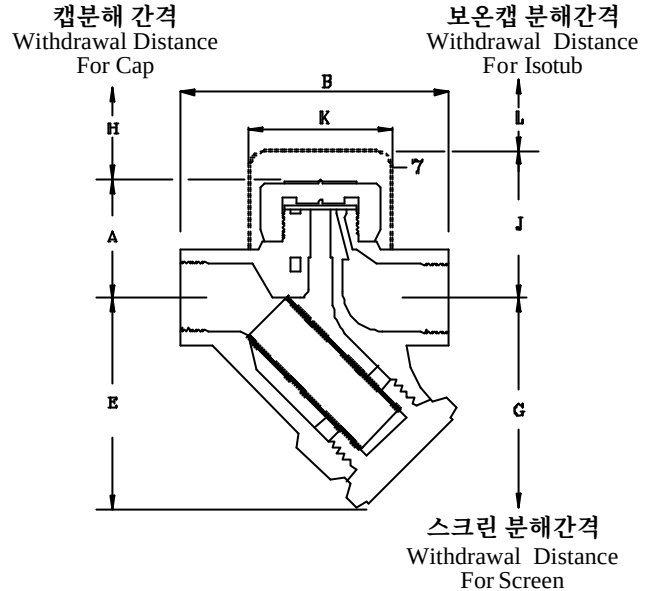
*"BB" dimensions shown are for 3/4" conn., Class 900 flanged. Consult factory for dimensions of models with other connection sizes and/or flanges.

TD 52M Thermodynamic Steam Trap



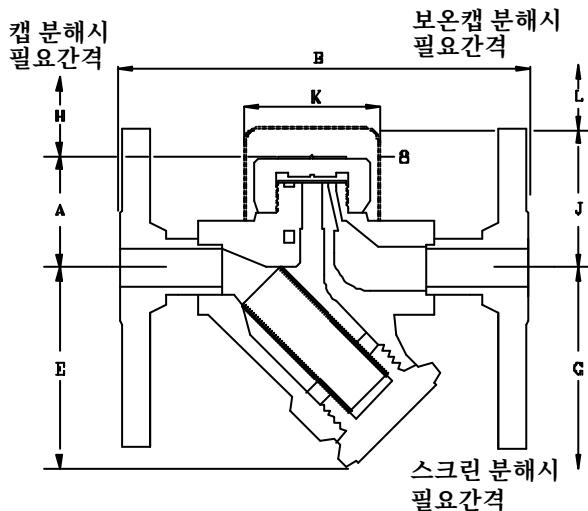
규격	A	B	E	H	J	K	L	무게
1/2LC	38 1.5	65 2.6	15 0.59	40 1.6	54 2.1	57 2.3	38 1.5	0.47kg 17ozs

TD 42 Thermodynamic Steam Trap



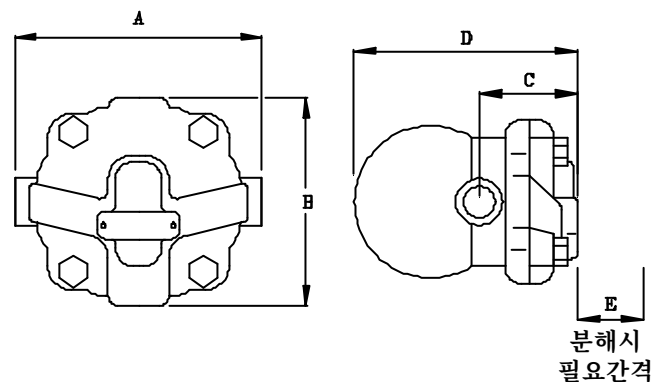
규격	A	B	E	G	H	무게(kg)
1/2LC	41	78	55	85	40	0.75 0.8
3/4	47 53	90 95	60 65	100	40	1.0 1.6

TD 32F Thermodynamic Steam Trap



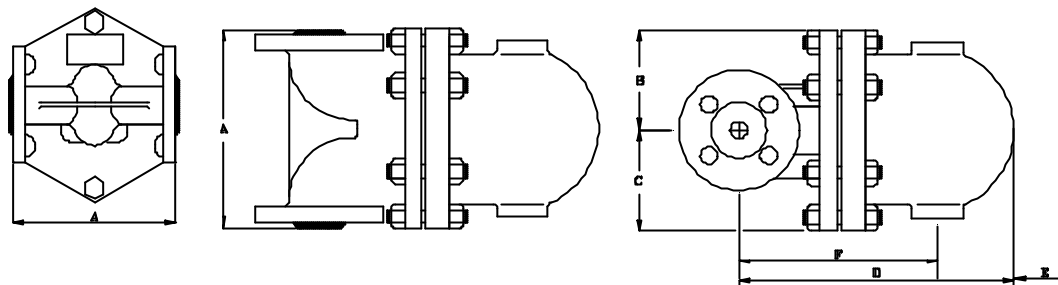
규격	A	B	E	G	H	J	K	L	무게
15LC	41 1.6	150 5.9	55 2.2	80 3.1	40 1.6	57 2.2	57 2.2	38 1.5	2.3kg 4.6lb
	41 1.6	150 5.9	55 2.2	80 3.1	40 1.6	57 2.2	57 2.2	38 1.5	2.4kg 5.3lb
20	47 1.8	150 5.9	60 2.4	95 3.7	40 1.6	63 2.5	57 2.5	38 1.5	3.1kg 6.9lb
	53 2.1	160 6.3	65 2.5	100 3.9	40 1.6	-	-	-	4.2kg 9.3lb

FT14 Ball Float Steam Trap



규격	A	B	C	D	E	F	무게(kg)
1/2LC	121	107	67	147	105	30	2.9
3/4	121	107	67	147	105	30	2.9

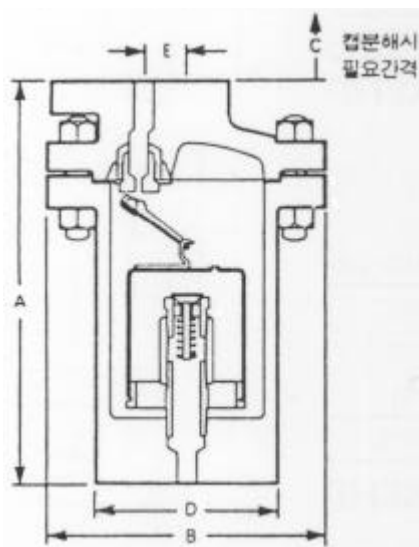
FT20/FT44 Ball Float Steam Trap



규격

구경	PN40 A	ANSI 300 A	ANSI 150 A	B	C	D	E	무 게 (kg)
15	150	209	203	80	80	215	120	10.8
20	150	209	205	80	80	225	120	10.8
25	160	212	208	115	85	282	170	15
40	230	327	321	130	115	337	200	33
50	230	320	313	141	123	347	200	43

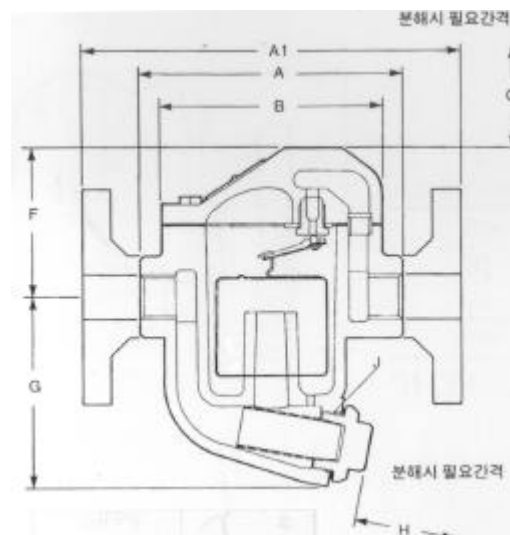
Series 600 Inverted Bucket Steam Trap



규격

구경	A	B	C	D	E	무 게 (kg)
15	270	185	203	121	28	18.1
20	270	185	203	121	28	18.1
25	299	203	229	130	36	29.5
40	401	248	305	168	45	50
50	443	301	330	213	52	79.4

HM Inverted Bucket Steam Trap



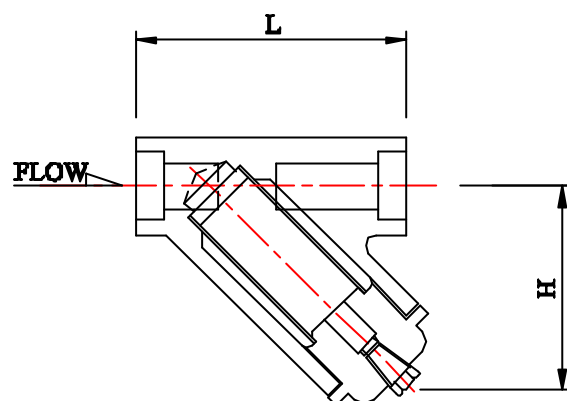
규격

구경	A	A1	B	C	F	G	H	무 게 (kg)
1/2-15	120	210	100	100	67	89	65	2.6
3/4-20	120	210	100	140	88	107	65	3.2
1-25	180	230	160	160	145	120	85	8.8



600# Y-TYPE STRAINER

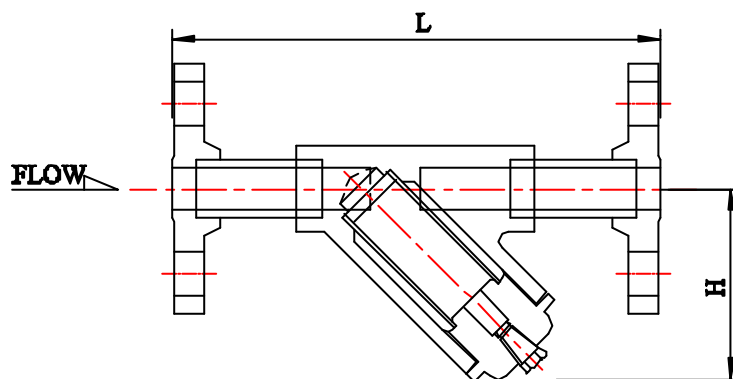
(CAST STEEL SW & SCRD)



NOM.SIZE		SPIRAX SARCO (SKY-3)		ARMSTRONG (B1SW)		JEONG WOO (JYFS)	
mm	inch	L	H	L	H	L	H
15	1/2	110	52	95	68	70	60
20	3/4	120	64	106	75	95	75
25	1	130	70	127	89	120	95
40	1.1/2	200	90	160	122	150	130
50	2	200	93	197	143	200	176

150# & 300# Y-TYPE STRAINER

(CAST STEEL)

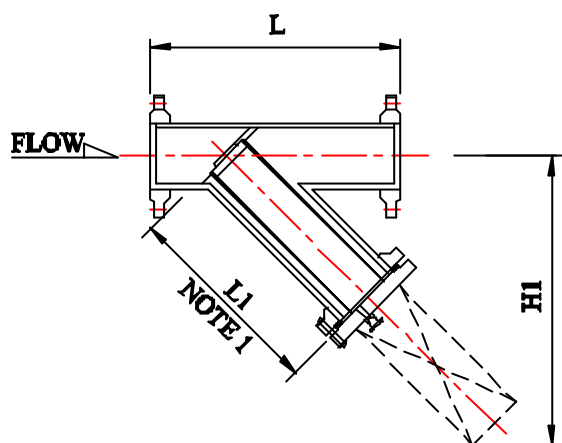


NOM.SIZE		SPIRAX SARCO (SKY-4)				ARMSTRONG (B1FL)				JEONG WOO (JYFF)			
		150		300		150		300		150		300	
mm	inch	L	H	L	H	L	H	L	H	L	H	L	H
15	1/2	205	52	215	52	175	68	184	68	190	60		
20	3/4	225	64	235	64	187	75	197	75	240	75		
25	1	240	70	250	70	216	89	226	89	240	95		
40	1.1/2	325	90	340	90	260	122	273	122	280	130		
50	2	330	93	345	93	292	143	308	143	340	176		



150# & 300# SO, RF Y-TYPE STRAINER

(PIPE TYPE)



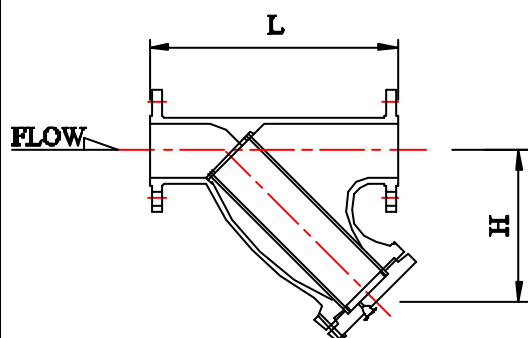
NOM. SIZE		L	L1	H1
mm	inch			
25	1	270	195	276
40	1.1/2	280	235	334
50	2	290	240	340
65	2.1/2	320	271	354
80	3	320	305	440
100	4	400	345	496
125	5	450	391	566
150	6	480	430	624
200	8	580	512	746
250	10	680	617	892
300	12	800	717	1034
350	14	930	834	1204
400	16	1000	877	1260
450	18	1100	958	1344
500	20	1140	1060	1444
600	24	1380	1224	1732

NOTE :

1. "L1" DIMENSION CAN BE CHANGED IN ACCORDANCE WITH THE REQUIREMENT FOR THE RATIOS OF FILTERING AREA & OPEN AREA TO THE PIPE CROSS SECTION AREA.

150# & 300# SO, RF Y-TYPE STRAINER

(CAST STEEL & IRON)

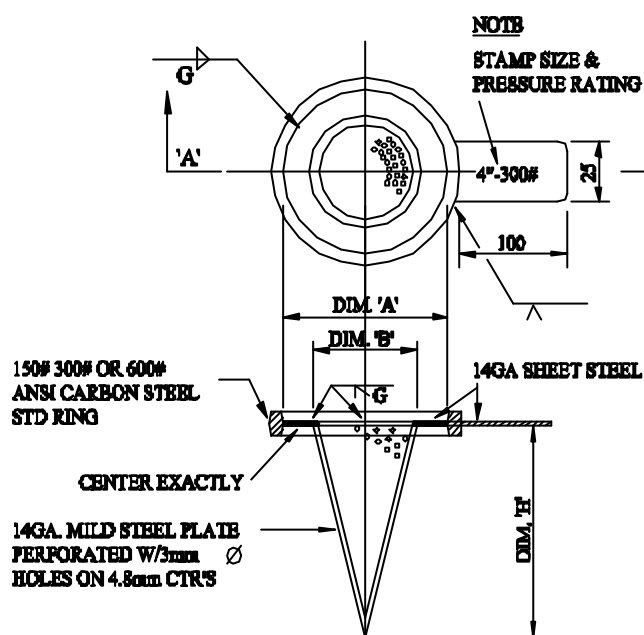


NOM. SIZE		SPIRAX SARCO (SKY-2)			ARMSTRONG (B1FL)			JEONG WOO (JYCF)		
		L		H	L		H	L		H
mm	inch	150#	300#		150#	300#		150#	300#	
40	1.1/2	240	240	92	-	-	-	240	240	133
50	2	260	260	107	-	-	-	260	260	150
65	2.1/2	270	270	111	-	-	-	270	270	150
80	3	290	360	145	-	-	-	290	290	244
100	4	335	410	195	422	438	273	335	335	289
150	6	520	520	245	575	597	400	520	520	386
200	8	580	580	324	-	-	-	580	580	460



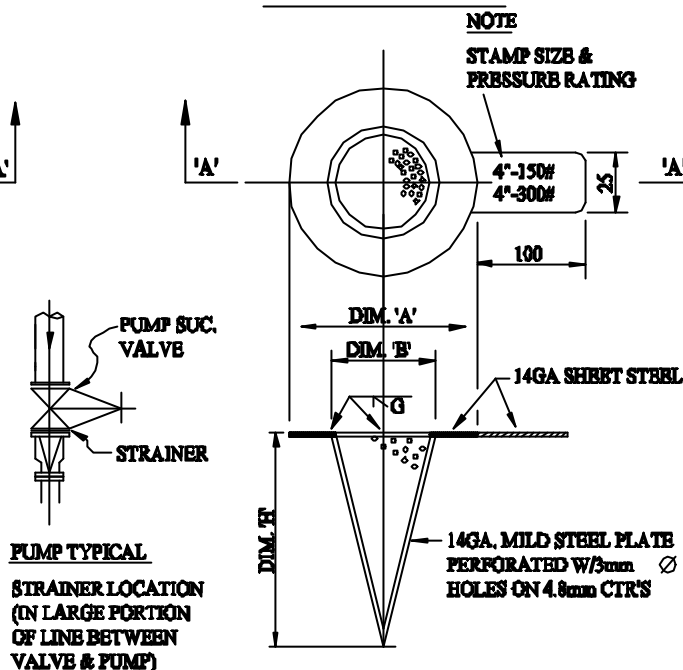
CONICAL TYPE

150#, 300#, & 600# RING JOINT



SECTION 'A'- 'A'

150# & 300# RF



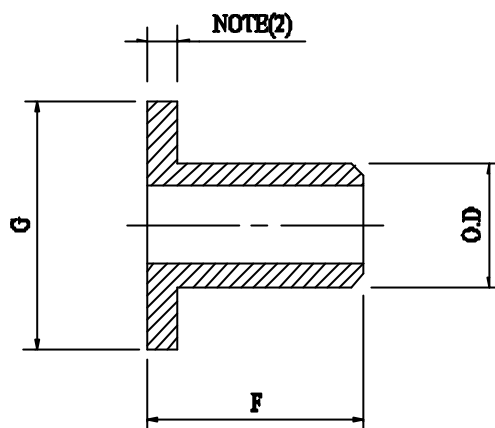
SECTION 'A'- 'A'

SCHEDULE(RING JOINT)								
PIPE SIZE (inch)	DIM 'A'		DIM 'B'	DIM 'B' RATIO FACTOR #				
	150#	300#		0.75	1.0	1.25	1.50	1.75
2	74.6	71.4	41.3	51	70	82.6	95.3	114.3
3	106.4	112.7	66.7	101.6	133.4	171.5	203.2	241.3
4	141.3	138.1	88.9	127	171.5	215.9	254	304.8
6	185.7	200	139.7	171.5	241.3	304.8	368.3	431.8
8	239.7	258.8	187.3	222.3	311.2	393.7	476.3	558.8
10	296.9	312.7	235	279.4	387.1	495.3	584.2	698.5
12	373.1	369.9	282.6	330.2	457.2	577.9	698.5	812.8
14	388.9	408	311.2	355.6	501.7	628.7	762	901.7
16	446.1	438.8	355.6	406.4	565.2	717.6	863.6	1016

SCHEDULE(RING JOINT)								
PIPE SIZE (inch)	DIM 'A'		DIM 'B'	DIM 'B' RATIO FACTOR #				
	150#	300#		0.75	1.0	1.25	1.50	1.75
2	102	108	41.3	51	70	82.6	95.3	114.3
2.1/2	121	127	54	70	95.3	114.3	139.7	177.8
3	133	146	66.7	101.6	133.4	171.5	203.2	241.3
4	171	178	88.9	127	171.5	215.9	254	304.8
6	219	248	139.7	171.5	241.3	304.8	368.3	431.8
8	276	305	187.3	222.3	311.2	393.7	476.3	558.8
10	337	359	235	279.4	387.1	495.3	584.2	698.5
12	406	419	282.6	330.2	457.2	577.9	698.5	812.8
14	448	483	311.2	355.6	501.7	628.7	762	901.7
16	511	537	355.6	406.4	565.2	717.6	863.6	1016

GENERAL NOTES

1. DIMENSIONS "B & H" ARE BASED ON SCH 80 PIPE.
2. DIMENSIONS "B & H" FOR HEAVIER THAN SCH 80 PIPE WILL HAVE TO BE CALCULATED PER JOB REQUIREMENTS.
#RATIO= $\frac{\text{OPEN AREA IN PERFORATED METAL}}{\text{INTERNAL AREA OF SCH 40 PIPE}}$
3. DIMENSIONS ENCOMPASSED WITH A HEAVY LINE ARE LGEN STANDARD RECOMMENDATIONS
OTHER DIMENSION FOR OTHER RATIO FACTORS ARE TO BE USED ONLY WITH APPROVAL.
4. ALL DIMENSIONS ARE GIVEN IN mm.



(UNIT : mm)

NOMINAL PIPE SIZE	ANSI LONG LENGTH			MSS SHORT LENGTH			JPI 150		
	O.D	F	G	O.D	F	G	O.D	F	G
1/2	21.3	76.2	34.9	21.3	50.8	34.9	21.7	50	35
3/4	26.6	76.2	42.9	26.6	50.8	42.9	27.2	50	43
1	33.4	101.6	50.8	33.4	50.8	34.0	34.0	50	51
1.1/2	48.2	101.6	73.0	48.2	50.8	73.0	48.6	50	73
2	60.3	152.4	92.1	60.3	63.5	92.1	60.5	65	92
2.1/2	73.0	152.4	104.8	73.0	63.5	104.8	76.3	65	105
3	88.9	152.4	127.0	88.9	63.5	127.0	89.1	65	127
4	114.3	152.4	157.2	114.3	76.2	157.2	114.3	75	157
5	141.3	203.2	185.7	141.3	76.2	185.7	139.8	75	186
6	168.2	203.2	215.9	168.2	88.9	215.9	162.5	90	216
8	219.0	203.2	269.9	219.0	101.6	269.9	216.3	100	270
10	273.0	254.0	323.9	273.0	127.0	323.9	267.4	125	324
12	323.8	254.0	381.0	323.8	152.4	381.0	318.5	150	381
14	355.6	304.8	412.8	355.6	152.4	412.8	355.6	150	413
16	406.4	304.8	469.9	406.4	152.4	469.9	406.4	150	470
18	457.2	304.8	533.4	457.2	152.4	533.4	457.2	150	533
20	508.0	304.8	584.2	508.0	152.4	584.2	508.0	150	584
24	609.6	304.8	692.2	609.6	152.4	692.2	609.6	150	692

Notes : (1) Dimensions are in millimeters.

(2) Minimum lap thickness shall not be less than nominal wall thickness.

(3) Relevant code.

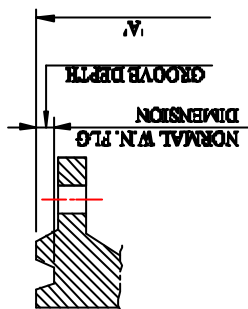
ASME : ASME B16.9

MSS : MSS SP-43

JPI : JPI-7S-15

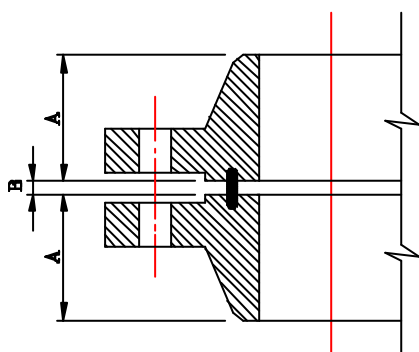
NOTES

1. DIMENSION 'A' IS NORMAL WELD NECK
FLANGE DIMENSION + GROOVE DEPTH



2. BOLT LENGTH DIMENSION SHALL BE
INCLUDED DIMENSION 'B'.

3. REFER TO JFE-78-25-72 OR ANSI
B16.20, FOR GROOVE & RING
GASKET DETAIL.



FLANGE RATING	150			300			400			600			900			1500			2500		
	RING NO.	A	B	RING NO.	A	B	RING NO.	A	B	RING NO.	A	B	RING NO.	A	B	RING NO.	A	B	RING NO.	A	B
1/2	-	54	-	R11	58	3.2	R11	57.6	3.2	R11	58	3.2	R12	66.7	4.0	R12	66.7	4.0	R13	79.4	4.0
3/4	-	58.8	-	R13	63.8	4.0	R13	63.4	4.0	R13	63.6	4.0	R14	76.2	4.0	R14	76.2	4.0	R16	85.8	4.0
1	R15	62	4.0	R16	68.3	4.0	R16	68.4	4.0	R16	68.3	4.0	R16	82.4	4.0	R16	79.4	4.0	R18	95.3	4.0
1.1/4	R17	63.6	4.0	R18	71.5	4.0	R18	73.4	4.0	R18	73.1	4.0	R18	82.4	4.0	R18	79.4	4.0	R21	103.2	4.0
1.1/2	R19	68.3	4.8	R20	74.7	4.8	R20	76.2	4.8	R20	76.2	4.8	R20	88.9	4.8	R20	88.9	4.8	R23	119.1	3.2
2	R22	69.9	4.8	R23	77.8	6.4	R23	81	4.8	R23	81	4.8	R24	109.6	3.2	R24	109.6	3.2	R26	135	3.2
2.1/2	R25	76.2	4.8	R26	84.2	6.4	R26	87.4	4.8	R26	87.4	4.8	R27	112.8	3.2	R27	112.8	3.2	R28	152.4	3.2
3	R29	76.2	4.8	R30	87.4	6.4	R30	90.5	4.8	R30	90.5	4.8	R31	109.6	4.8	R31	125.5	3.2	R32	177.8	3.2
4	R36	82.6	4.8	R37	93.7	6.4	R37	96.9	6.8	R37	109.6	4.8	R37	122.3	4.8	R39	131.8	3.2	R38	201.7	4.8
6	R43	95.3	4.8	R45	106.4	6.4	R45	111.2	6.8	R45	125.5	4.8	R45	147.7	4.8	R46	181	3.2	R47	285.8	4.8
8	R48	108	4.8	R49	119.1	6.4	R49	125.5	6.8	R49	141.3	4.8	R49	169.9	4.8	R50	223.9	4.8	R51	331.8	4.8
10	R52	108	4.8	R53	125.5	6.4	R53	131.8	6.8	R53	160.4	4.8	R53	192.1	4.8	R54	265.2	4.8	R55	486.6	6.4
12	R56	120.7	4.8	R57	138.2	6.4	R57	144.5	6.8	R57	163.6	4.8	R57	208	4.8	R58	296.9	4.8	R60	481.1	8.0
14	R59	133.4	3.2	R61	150.9	6.4	R61	157.2	6.8	R61	173.1	4.8	R62	223.9	4.8	R63	314.4	6.4			
16	R64	133.4	3.2	R65	154	6.4	R65	160.4	6.8	R65	185.8	4.8	R66	227.1	4.8	R67	328.7	8.0			
18	R68	146.1	3.2	R68	166.7	6.4	R68	173.1	6.8	R68	192.1	4.8	R70	241.3	4.8	R71	344.5	8.0			
20	R72	150.9	3.2	R73	171.5	6.4	R73	177.8	6.8	R73	200.1	4.8	R74	260.4	4.8	R75	373.1	9.6			
24	R76	158.8	3.2	R77	179.4	6.4	R77	185.8	6.8	R77	214.4	6.4	R78	308	6.4	R79	427.1	11.2			

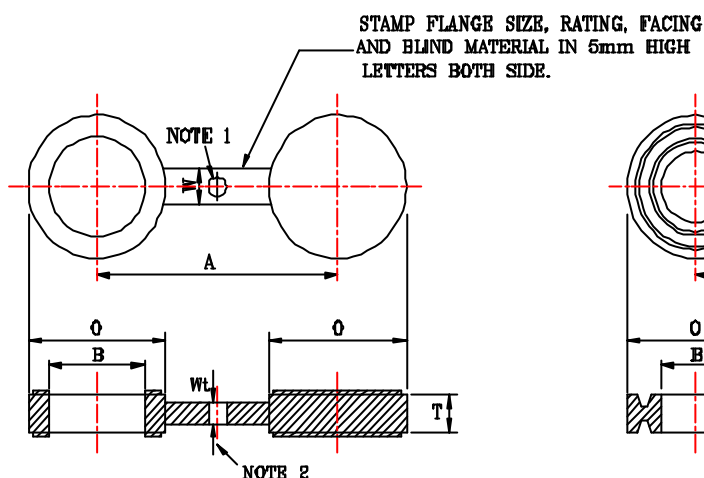


**FIGURE-8 BLANK
FOR RF FLANGE**

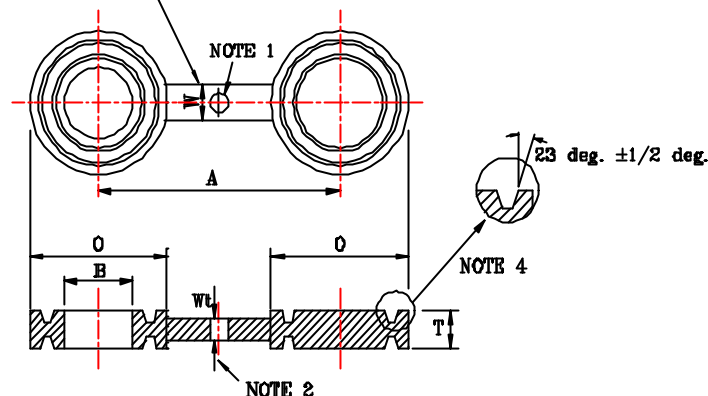
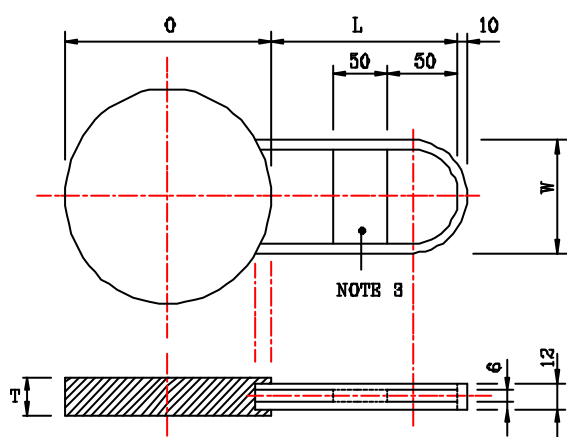
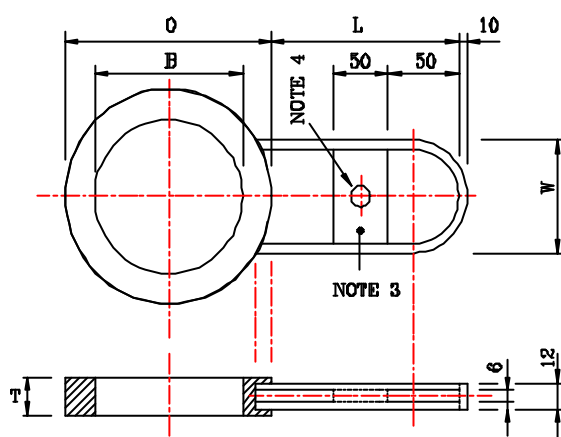


**FIGURE-8 BLANK
FOR FEMALE RJ FLANGE**



PADDLE BLANK



PADDLE SPACER

Notes :

- 1) Hole size(where required due to spacing) shall be the same as the flanged bolt hole, and located such that it will not interfere with bolting between two flanges.
- 2) The thickness of the web(or tie bar) dimension Wt shall be 0.25 in. minimum, except when T is less than 0.25 in., Wt shall be equal T (see ASME B16.48 para 3.1)
- 3) Followings shall be marked by punching on handle of all spacer and blank with 5mm(min.) letters :
 - stamped "SPACER" or "BLANK"
 - Nominal size (example : 26")
 - Flange rating (example : CL.150)
 - Material designation (example : A515-70)
 - Thickness (example : 35mm)
- 4) A hole of 10mm Dia shall be drilled as an identification-mark for spacer.

1) ASME B16.5 RF FLANGE

Size (NPS)	Class 150 Raised Face						Class 300 Raised Face						Class 600 Raised Face					
	B	O	A	L	T	W	B	O	A	L	T	W	B	O	A	L	T	W
1/2	16	44	60	-	3	38	16	51	67	-	6	38	16	51	67	-	6	38
3/4	21	54	70	-	3	38	21	64	83	-	6	38	21	64	83	-	6	38
1	27	64	79	-	3	38	27	70	89	-	6	38	27	70	89	-	6	57
1.1/4	42	73	89	-	6	38	42	79	99	-	6	38	37	79	99	-	10	57
1.1/2	48	83	99	-	6	38	48	92	114	-	6	51	43	92	114	-	10	67
2	60	102	121	-	6	51	60	108	127	-	10	51	55	108	127	-	10	57
2.1/2	73	121	140	-	6	51	73	127	149	-	10	64	67	127	149	-	13	67
3	89	133	152	-	6	64	89	146	168	-	10	64	83	146	168	-	13	67
3.1/2	102	159	178	-	10	64	102	162	184	-	13	64	96	159	184	-	16	76
4	114	171	191	-	10	64	114	178	200	-	13	64	108	191	216	-	16	76
5	141	194	216	-	10	76	141	213	235	-	16	76	135	238	267	-	19	86
6	168	219	241	-	13	76	168	248	270	-	16	76	162	264	292	-	22	86
8	219	276	298	-	13	76	219	305	330	-	22	89	212	318	349	-	28	95
10	273	337	362	-	16	102	273	359	387	-	25	102	265	397	-	175	35	100
12	324	406	432	-	19	102	324	419	-	170	28	100	315	454	-	175	41	100
14	356	448	-	170	19	100	356	483	-	170	32	100	346	489	-	180	44	100
16	406	511	-	170	22	100	406	536	-	175	38	100	397	562	-	180	51	100
18	457	546	-	170	25	100	457	594	-	180	41	100	448	610	-	185	54	100
20	508	603	-	175	28	100	508	651	-	185	44	100	497	679	-	190	64	100
24	610	714	-	175	32	100	610	772	-	190	51	100	597	787	-	200	73	100

Size (NPS)	Class 900 Raised Face						Class 1500 Raised Face						Class 2500 Raised Face					
	B	O	A	L	T	W	B	O	A	L	T	W	B	O	A	L	T	W
1/2	16	60	83	-	6	38	16	60	83	-	6	38	16	67	89	-	10	38
3/4	21	67	89	-	6	41	22	67	89	-	10	41	21	73	95	-	10	41
1	27	76	102	-	6	57	27	76	102	-	10	64	27	83	108	-	10	64
1.1/4	37	86	111	-	10	57	35	86	111	-	10	64	35	102	130	-	13	64
1.1/2	43	95	124	-	10	67	41	95	111	-	13	70	41	114	146	-	16	70
2	55	140	165	-	13	57	53	140	165	-	13	70	53	143	171	-	16	70
2.1/2	67	162	191	-	13	67	63	162	191	-	16	76	63	165	197	-	19	76
3	83	165	191	-	16	67	78	171	203	-	19	76	78	194	229	-	22	76
4	108	203	235	-	19	76	102	206	241	-	22	89	102	232	273	-	28	89
5	135	244	279	-	22	86	128	251	292	-	28	89	128	276	324	-	35	89
6	162	286	318	-	25	86	154	279	318	-	35	89	154	314	-	205	41	100
8	212	356	-	180	35	100	203	349	-	185	41	100	198	384	-	205	54	100
10	265	432	-	180	41	100	255	432	-	195	51	100	248	473	-	220	67	120
12	315	495	-	180	48	100	303	518	-	200	60	100	289	546	-	230	79	140
14	346	518	-	180	54	100	333	575	-	210	67	120	-	-	-	-	-	-
16	397	572	-	185	60	100	381	638	-	215	76	120	-	-	-	-	-	-
18	448	635	-	195	67	100	429	702	-	225	86	140	-	-	-	-	-	-
20	497	695	-	200	73	120	478	752	-	235	95	160	-	-	-	-	-	-
24	597	835	-	225	89	140	575	899	-	255	111	160	-	-	-	-	-	-

Notes :

- 1) All dimensions shown in the table are in millimeter, except nominal pipe size.
- 2) Bold letters are based on ASME B16.48.

2) ASME B16.5 FEMALE RJ FLANGES

Size (NPS)	Class 150 Ring Joint						Class 300 Ring Joint						Class 600 Ring Joint					
	B	O	A	C	T	W	B	O	A	C	T	W	B	O	A	C	T	W
1/2	-	-	-	-	-	-	21	51	67	-	16	38	21	51	67	-	19	38
3/4	-	-	-	-	-	-	27	64	83	-	19	44	27	64	83	-	22	44
1	34	64	79	-	19	51	34	70	89	-	19	51	34	70	89	-	22	51
1.1/4	42	73	89	-	19	51	42	79	99	-	22	51	42	79	99	-	22	51
1.1/2	48	83	99	-	19	57	48	90	114	-	22	57	48	90	114	-	22	57
2	60	102	121	-	19	57	60	108	127	-	25	57	60	108	127	-	28	57
2.1/2	73	121	140	-	22	57	73	127	149	-	28	57	73	127	149	-	32	57
3	89	133	152	-	22	64	89	146	168	-	28	57	89	146	168	-	32	57
3.1/2	102	154	178	-	22	64	102	159	184	-	28	64	102	159	184	-	35	64
4	114	171	191	-	22	64	114	175	200	-	32	64	114	175	216	-	35	64
5	141	194	225	-	25	70	141	210	235	-	35	70	141	210	267	-	38	70
6	168	219	241	-	25	83	168	241	270	-	35	83	168	241	292	-	44	83
8	219	273	298	-	28	95	219	302	330	-	41	95	219	302	349	-	51	95
10	273	330	362	-	32	102	273	356	387	-	44	102	273	356	-	165	57	100
12	324	406	432	-	35	121	324	413	-	160	51	100	324	413	-	165	64	100
14	356	425	-	160	35	100	356	457	-	160	54	100	356	457	-	170	67	100
16	406	483	-	160	38	100	406	508	-	165	57	100	406	508	-	170	73	100
18	457	546	-	160	41	100	457	575	-	170	60	100	457	575	-	175	79	100
20	508	597	-	165	41	100	508	635	-	175	70	100	508	635	-	180	89	100
24	610	711	-	165	48	100	610	749	-	180	79	100	610	749	-	190	105	100

Size (NPS)	Class 900 Ring Joint						Class 1500 Ring Joint						Class 2500 Ring Joint					
	B	O	A	C	T	W	B	O	A	C	T	W	B	O	A	C	T	W
1/2	21	60	83	-	22	38	21	60	83	-	22	38	21	65	89	-	25	38
3/4	27	67	89	-	22	44	27	67	89	-	25	44	27	73	95	-	28	44
1	34	71	102	-	22	51	34	71	102	-	25	54	34	83	108	-	28	54
1.1/4	42	81	111	-	25	51	42	81	111	-	25	54	42	102	130	-	35	54
1.1/2	48	92	124	-	25	64	48	92	124	-	28	57	48	114	146	-	38	60
2	60	124	165	-	32	51	60	124	165	-	35	54	60	133	171	-	41	57
2.1/2	73	137	191	-	35	67	73	137	191	-	38	57	73	149	197	-	48	60
3	89	155	191	-	35	67	89	168	203	-	44	73	89	168	229	-	51	76
4	114	181	235	-	41	73	114	202	241	-	48	76	114	203	273	-	64	83
5	141	216	279	-	44	73	141	229	292	-	54	76	141	241	324	-	73	89
6	168	241	318	-	48	73	168	248	318	-	60	79	168	279	-	195	83	100
8	219	308	-	170	57	100	219	318	-	175	73	100	219	340	-	195	99	100
10	273	362	-	170	64	100	273	371	-	185	83	100	273	425	-	210	117	120
12	324	419	-	170	73	100	324	438	-	190	102	100	324	495	-	220	133	140
14	356	467	-	170	83	100	356	489	-	200	111	120	-	-	-	-	-	-
16	406	524	-	175	92	100	406	546	-	205	124	120	-	-	-	-	-	-
18	457	594	-	185	102	100	457	613	-	215	133	140	-	-	-	-	-	-
20	508	648	-	190	111	120	508	673	-	225	143	160	-	-	-	-	-	-
24	610	772	-	215	133	140	610	794	-	245	168	160	-	-	-	-	-	-

Notes :

1) All dimensions shown in the table are in millimeter, except nominal pipe size.

2) Bold letters are based on ASME B16.48.

3) ASME B16.47 RF FLANGE

Size (NPS)	Class 150 Raised Face									
	ASME B16.47 SERIES A					ASME B16.47 SERIES B				
	B	O	L	T	W	B	O	L	T	W
26	640	771	200	Note 1	110	640	722	180	Note 1	80
28	690	828	200		110	690	772	180		80
30	740	879	200		110	740	823	180		80
32	790	936	210		110	790	877	180		80
34	845	987	210		110	845	931	185		90
36	895	1044	210		110	895	984	185		90
38	945	1108	215		120	945	1041	190		90
40	995	1159	215		120	995	1092	190		90
42	1045	1216	215		120	1045	1143	190		90
44	1090	1273	215		120	1090	1193	190		90
46	1140	1324	215		120	1140	1252	195		110
48	1195	1381	215		120	1195	1303	195		110
50	1245	1431	220		120	1245	1354	195		110
52	1295	1488	220		120	1295	1404	195		110
54	1345	1546	220		130	1345	1460	195		110
56	1395	1603	220		130	1395	1511	195		110
58	1445	1660	220		130	1445	1576	200		120
60	1500	1711	220		130	1500	1627	200		120

Size (NPS)	Class 300 Raised Face									
	ASME B16.47 SERIES A					ASME B16.47 SERIES B				
	B	O	L	T	W	B	O	L	T	W
26	635	831	220	Note 1	120	635	768	200	Note 1	90
28	685	895	220		120	685	822	200		90
30	736	949	220		120	736	882	205		90
32	787	1003	225		130	787	936	210		100
34	835	1054	225		130	835	990	210		100
36	885	1114	230		130	885	1044	215		110
38	936	1051	210		120	936	1095	215		110
40	987	1111	215		120	987	1146	215		110
42	1035	1162	215		120	1035	1196	220		110
44	1085	1215	220		130	1085	1247	220		110
46	1133	1270	225		150	1133	1314	225		120
48	1184	1320	225		150	1184	1365	225		120
50	1235	1374	230		150	1235	1416	225		120
52	1285	1425	230		150	1285	1466	225		120
54	1336	1488	235		170	1336	1527	225		120
56	1387	1539	235		170	1387	1590	240		140
58	1438	1590	235		170	1438	1652	240		140
60	1489	1641	235		170	1489	1703	240		140

Notes :

- 1) Thickness of paddle blank & spacer shall be calculated as per design condition of project.
- 2) All dimensions shown in the table are in millimeter, except nominal pipe size.
- 3) All dimensions shown in the table are based on para 304.5.3 of ASME B31.3



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

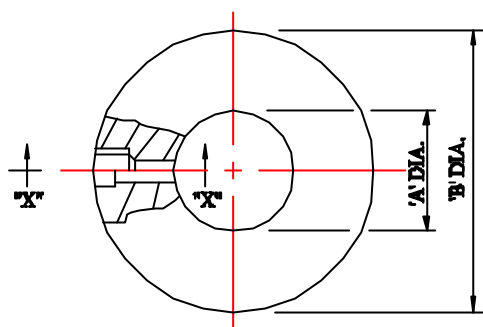
1.16 DRIP RINGS FOR RF & FF FLANGES

LDP-L901

REV. 1 (OCT, 2002)

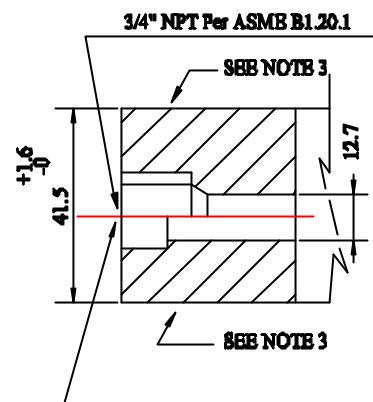
PAGE : 1 OF 1

DATE : DEC. 1995

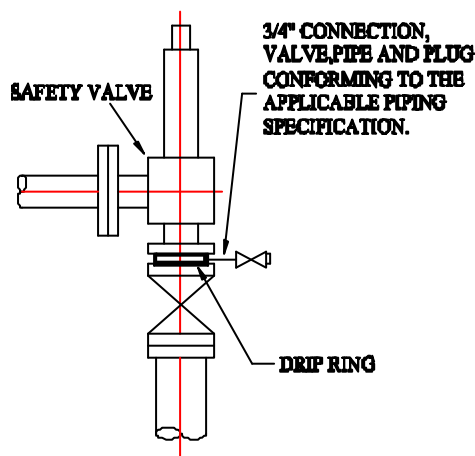


TYPE 1

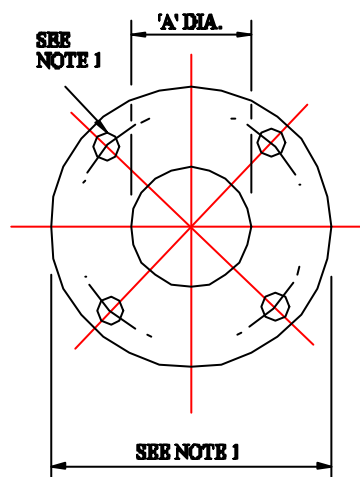
(FOR USE WITH RAISED FACE FLANGES)



SECTION "X-X"



TYPICAL ASSEMBLY



TYPE 2

(FOR USE WITH FLAT FACE FLANGES)

NOTES

1. OUTSIDE DIAMETERS AND DRILLING DIMENSIONS FOR TYPE 2 DRIP RINGS SHALL BE IN ACCORDANCE WITH ANSI B16.5 FOR FLANGES OF EQUIVALENT SIZE AND RATING.
2. PIPE CONNECTION TO BE SPECIFIED EITHER 3/4" SOCKET WELD AS SHOWN OR DRILLED AND TAPPED 3/4" NPT.
3. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH OF GASKET CONTACT FACE SHALL BE SERRATED FINISH WITH 125μ in. AARH TO 250μ in. AARH. (FOR DEFINITION OF TERM AARH, REFER TO ASME B16.5)
4. WHEN VALVES ARE LOCATED ON BOTH SIDES OF A DRIP RING THEY SHALL BE RADIALY OFFSET TO ENSURE CLEARANCE OF VALVE HANDWHEELS.

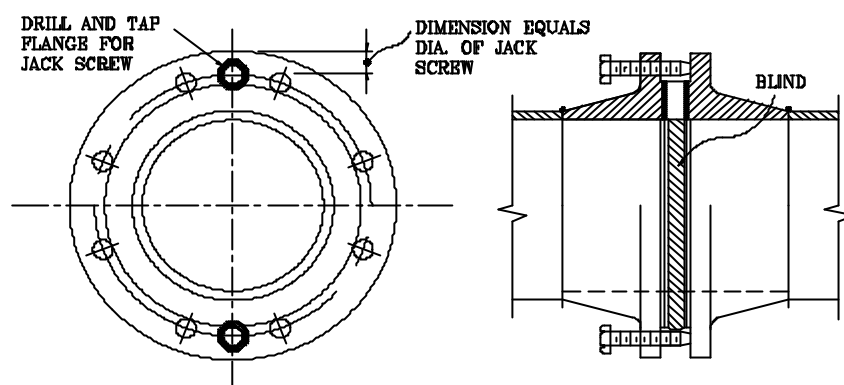
(UNIT:mm)

NOMINAL PIPE SIZE (NPS)	CLASS 150		CLASS 300		CLASS 600		CLASS 900		CLASS 1500	
	A	B	A	B	A	B	A	B	A	B
3/4	21	54	21	64	21	64	21	67	21	67
1	28	64	28	70	28	70	28	76	28	76
1.1/2	49	82	49	92	49	92	49	96	49	96
2	62	102	62	108	62	108	62	140	62	140
2.1/2	75	121	75	127	75	130	75	162		
3	91	133	91	146	91	146	91	165		
4	116	171	116	178	116	191	116	203		
6	171	219	171	248	171	264	171	286		
8	221	276	221	303	221	318	221	356		
10	276	337	276	359	276	397	276	432		
12	327	406	327	419	327	454	327	495		
14	359	448	359	483	359	489	359	518		
16	410	511	410	536	410	562	410	572		
18	469	546	469	594	469	610	469	635		
20	513	603	513	651	513	679				
24	616	714	616	772	616	787				

PIPING HANDBOOK

1. DIMENSION TABLES

1.17 JACK SCREWS SELECTION

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 1 OF 2
 DATE : DEC., 1995


1) Jack Screw Flange(for RF/FF)

PIPE SIZE (inch)	RATING					
	150# RF/FF	300# RF	600# RF	900# RF	1500# RF	2500# RF
	JACK SCREW SIZE					
1.1/2	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1
2					U5/8 x 120	U3/4 x 145
3						
4						
6	U5/8 x 70	U3/4 x 85	U3/4 x 120	U3/4 x 135	U3/4 x 170	U3/4 x 205
8	U3/4 x 75	U3/4 x 95	U3/4 x 140	U3/4 x 155	U3/4 x 190	U3/4 x 240
10	U3/4 x 80	U3/4 x 105	U3/4 x 150	U3/4 x 165	U7/8 x 220	U7/8 x 290
12	U3/4 x 85	U3/4 x 110	U3/4 x 160	U7/8 x 185	U7/8 x 245	U7/8 x 325
14	U3/4 x 90	U7/8 x 120	U7/8 x 170	U7/8 x 200	U7/8 x 260	-
16	U7/8 x 95	U7/8 x 130	U7/8 x 185	U7/8 x 210	U1 x 290	-
18	U7/8 x 105	U7/8 x 140	U7/8 x 195	U1 x 230	U1 x 315	-
20	U7/8 x 110	U1 x 145	U1 x 215	U1 x 245	U1 x 340	-
24	U1 x 120	U1 x 160	U1 x 240	U1 x 290	U1.1/8 x 380	-
26	U3/4 x Note 4	U1 x Note 4	-	-	-	-
28	U3/4 x Note 4	U1 x Note 4	-	-	-	-
30	U3/4 x Note 4	U1 x Note 4	-	-	-	-
32	U3/4 x Note 4	U1 x Note 4	-	-	-	-
34	U7/8 x Note 4	U1 x Note 4	-	-	-	-
36	U7/8 x Note 4	U1 x Note 4	-	-	-	-
38	U1 x Note 4	U1.1/8 x Note 4	-	-	-	-
40	U1 x Note 4	U1.1/8 x Note 4	-	-	-	-
42	U1 x Note 4	U1.1/8 x Note 4	-	-	-	-
44	U1 x Note 4	U1.1/8 x Note 4	-	-	-	-
46	U1 x Note 4	U1.1/8 x Note 4	-	-	-	-
48	U1 x Note 4	U1.1/8 x Note 4	-	-	-	-
50	U1.1/8 x Note 4	U1.1/4 x Note 4	-	-	-	-
52	U1.1/8 x Note 4	U1.1/4 x Note 4	-	-	-	-
54	U1.1/8 x Note 4	U1.1/4 x Note 4	-	-	-	-
56	U1.1/8 x Note 4	U1.1/4 x Note 4	-	-	-	-
58	U1.1/8 x Note 4	U1.1/4 x Note 4	-	-	-	-
60	U1.1/4 x Note 4	U1.1/4 x Note 4	-	-	-	-

PIPING HANDBOOK

1. DIMENSION TABLES

1.17 JACK SCREWS SELECTION

2) Jack Screw Flange(for RJ)

PIPE SIZE (inch)	RATING					
	150#RJ	300# RJ	600# RJ	900# RJ	1500# RJ	2500# RJ
	JACK SCREW SIZE					
1.1/2	U5/8 x 85	U5/8 x 95	U5/8 x 95	U5/8 x 115	U5/8 x 115	U3/4 x 140
2	U5/8 x 90	U5/8 x 105	U5/8 x 105	U3/4 x 140	U3/4 x 140	U3/4 x 150
3	U3/4 x 95	U3/4 x 115	U3/4 x 115	U3/4 x 140	U3/4 x 160	U3/4 x 180
4	U3/4 x 100	U3/4 x 125	U3/4 x 140	U3/4 x 150	U3/4 x 165	U3/4 x 210
6	U3/4 x 110	U3/4 x 140	U3/4 x 160	U3/4 x 175	U1 x 215	U1 x 265
8	U3/4 x 120	U3/4 x 150	U3/4 x 180	U3/4 x 190	U1 x 255	U1 x 350
10	U7/8 x 125	U7/8 x 160	U7/8 x 190	U3/4 x 205	U1.1/8 x 275	U1.1/8 x 375
12	U7/8 x 135	U7/8 x 170	U7/8 x 205	U7/8 x 220	U1.1/8 x 330	U1.1/8 x 410
14	U7/8 x 145	U7/8 x 180	U7/8 x 210	U7/8 x 250	U1.1/4 x 355	-
16	U7/8 x 150	U7/8 x 185	U7/8 x 225	U7/8 x 270	U1.1/4 x 405	-
18	U7/8 x 160	U7/8 x 195	U7/8 x 240	U7/8 x 300	-	-
20	U1 x 165	U1 x 210	U7/8 x 260	U7/8 x 315	-	-
24	U1 x 180	U1 x 230	U1.1/8 x 295	U1.1/8 x 380	-	-

Notes :

- 1) When jack screws are not listed in the table, flange spreaders shall be used.
- 2) Jack screws shall be set screw M.S.T threaded full length. Jack screws to be 180 deg apart.
- 3) Fabricator shall locate and install jack screws where noted on the piping isometric and in accordance with this drawing.
- 4) For 26" & larger, length of jack screw bolts shall be calculated as per thickness of paddle spacer & blank.
- 5) Jack screw bolt shall be Hex. cap screws bolts as per ASME B18.2.1.

1. Ball Valve(ASME B 16.10)

Face-to-Face Dimensions

Unit : mm

Valve Sizes (NPS)	Class 150		Class 300		Class 600	Class 900	Class 1500	Class 2500
	Long	Short	Long	Short	Long	Long	Long	Long
1/2	108	108	140	140	165	-	-	-
3/4	117	117	152	152	190	-	-	-
1	127	127	165	165	216	254	-	-
1.1/2	165	165	190	190	241	305	-	-
2	178	178	216	216	292	368	368	451
2.1/2	190	190	241	241	330	419	419	508
3	203	203	282	282	356	381	470	578
4	229	229	305	305	432	457	546	673
6	394	267	403	403	559	610	705	914
8	457	292	502	419	660	737	832	1022
10	533	330	568	457	787	838	991	1270
12	610	356	648	502	838	965	1130	1422
14	686	381	762	572	889	1029	1257	-
16	762	406	838	610	991	1130	1384	-
18	864	-	914	660	1092	1219	-	-
20	914	-	991	711	1194	1321	-	-
22	-	-	1092	-	1295	-	-	-
24	1067	-	1143	813	1397	1549	-	-
26	-	-	1245	-	1448	-	-	-
28	-	-	1346	-	1549	-	-	-
30	-	-	1397	-	1651	-	-	-
32	-	-	1524	-	1778 ¹⁾	-	-	-
34	-	-	1626	-	1930 ¹⁾	-	-	-
36	-	-	1727	-	2083 ¹⁾	-	-	-

Note :

1) Double Disc and Conduit only

2. Plug Valve(ASME B 16.10)

Face-to-Face Dimensions

Unit : mm

Valve Sizes (NPS)	Class 150		Class 300		Class 600	Class 900	Class 1500	Class 2500
	Regular	Short	Regular	Short	Regular	Regular	Regular	Regular
1	-	140	-	-	216	254	254	308
1.1/2	-	165	-	-	241	305	305	384
2	-	178	-	159	292	368	368	451
2.1/2	-	190	-	190	330	419	419	508
3	-	203	-	267	356	381	470	578
4	305	229	-	305	432	-	546	673
6	394	267	403	330	559	610	705	914
8	457	292	502	356	660	737	832	1022
10	533	330	568	457	787	838	991	1270
12	610	356	711	521	838	965	1130	1422
14	686	-	762	559	889	-	-	-
16	762	-	838	635	991	-	-	-
18	864	-	914	-	-	-	-	-
20	914	-	991	-	-	-	-	-
22	-	-	1092	-	-	-	-	-
24	1067	-	1143	-	-	-	-	-
26	-	-	1245	-	-	-	-	-
28	-	-	1346	-	-	-	-	-
30	-	-	1397	-	-	-	-	-
32	-	-	1524	-	-	-	-	-
34	-	-	1626	-	-	-	-	-
36	-	-	1727	-	-	-	-	-

3. Butterfly Valve(API 609)

- 1) **Category A** : Manufacture's rated cold working pressure(CWP) butterfly valves, usually with a concentric disc and seat configuration. Sizes covered are NPS 2 to NPS 48 for valves having ASME Class 125 or Class 150 flange bolting patterns.

Lug-and Wafer-Type

Unit : mm

Valve Sizes(NPS)	Face-to-Face Dimensions	Valve Sizes(NPS)	Face-to-Face Dimensions
2	43	14	78
2.1/2	46	16	102
3	46	18	114
4	52	20	127
5	56	24	154
6	56	30	165
8	60	36	200
10	68	42	251
12	78	48	276

Note : The dimensions listed for NPS 2-24 apply to valves for installation between ASME Class 125 or 150 flanges. NPS 30-48 are limited to installation between ASME Class 125 and 150 Flanges, or MSS SP-44 Class 150 flanges. These dimensions are across Body Flats(Metal-to-Metal)

- 2) **Category B** : Pressure-temperature rated butterfly valves that have an offset seat and either an eccentric or concentric disc configuration. These valves may have a seat rating less than the body rating. Sizes covered are NPS 3 to NPS 24 for Classes 150, 300, and 600.

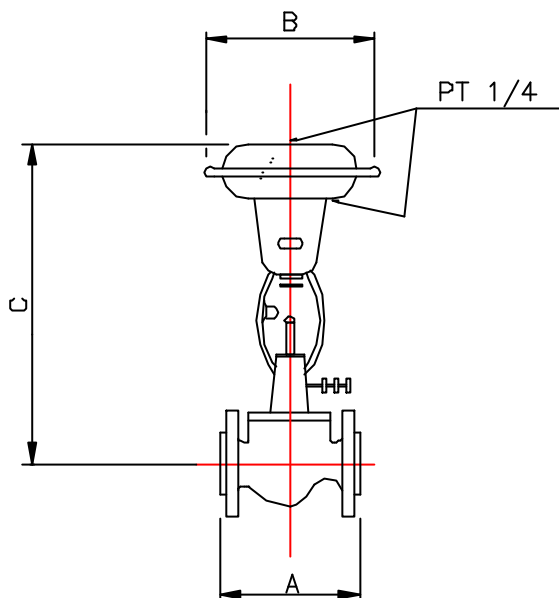
Face-to-Face Dimensions

Unit : mm

Valve Sizes (NPS)	Class 150			Class 300			Class 600		
	Lug-and Wafer-Type ¹⁾	Double Flanged		Lug-and Wafer-Type	Double Flanged		Lug-and Wafer-Type	Double Flanged	
		Long ²⁾	Short ³⁾		Long	Short		Long	Short
3	48	203	114	48	282	-	54	356	-
4	54	229	127	54	305	-	64	432	-
6	57	267	140	59	403	-	78	559	-
8	64	292	152	73	419	-	102	660	-
10	71	330	165	83	457	-	117	787	-
12	81	356	178	92	502	-	140	838	-
14	92	381	190	117	762	-	155	889	-
16	102	406	216	133	838	-	178	991	-
18	114	432	222	149	914	-	200	1092	-
20	127	457	229	159	991	-	216	1194	-
24	154	508	267	181	1143	-	232	1397	-

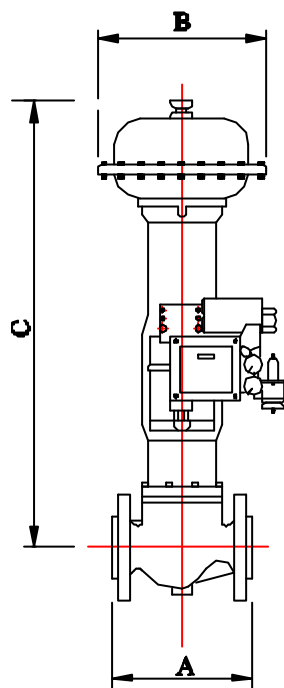
Notes :

- 1) The Dimensions listed are Valve Metal-to-Metal Dimensions.
- 2) The Dimensions listed agreed with ASME B16.10 for flanged Gate Valves.
- 3) The Dimensions listed agreed with ISO 5752 Basic Series 13.0.

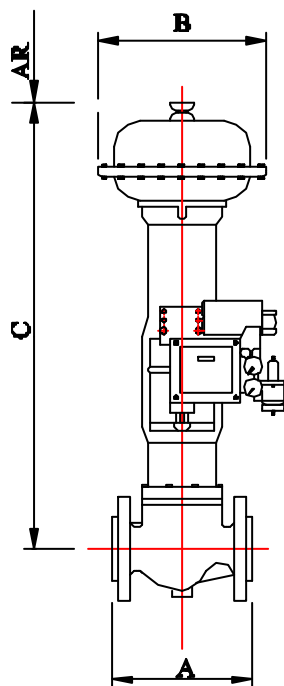

UNIT : mm

MODEL NO.	PIPE SIZE	A			B	C
		150#	300#	600#		0° TO 200° C
VSL	3/4	184	194	206	300	645
	1	184	197	210	300	645
VDC	1 1/2	222	235	251	300	695
	2	254	267	286	300	705
	2 1/2	276	292	311	350	1035
	3	298	318	337	350	1050
	4	352	368	394	350	1070
	6	451	473	508	450	1295
	8	543	568	610	520	1575
	10	673	703	752	620	2015
	12	737	775	819	620	2020

NOTES :
1.MFG - YAMATAKE - HONEWELL
2.상기 DIMENSION은 DIAPHRAGM TYPE 의 여러종류중 SIZE가 가장 작은 것을 기준으로 작성되었음.
3.MODEL 은 온도 0° C-200° C 의 범위것임.
4.이 표는 참조용으로 VENDOR 선정이 되면 사용하셔서는 안된다.



MFG : YAMATAKE HONEWELL					UNIT : mm	
MODEL NO.	PIPE SIZE (INCH)	A			B	C
		150#	300#	600#		0° C TO 200° C
VSL	3/4	184	194	206	300	645
	1	184	197	210	300	645
VDC	1.1/2	222	235	251	300	695
	2	254	267	286	300	705
	2.1/2	276	292	311	350	1035
	3	298	318	337	350	1050
	4	352	368	394	350	1070
	6	451	473	508	450	1295
	8	543	568	610	520	1575
	10	673	703	752	620	2015
	12	737	775	819	620	2020

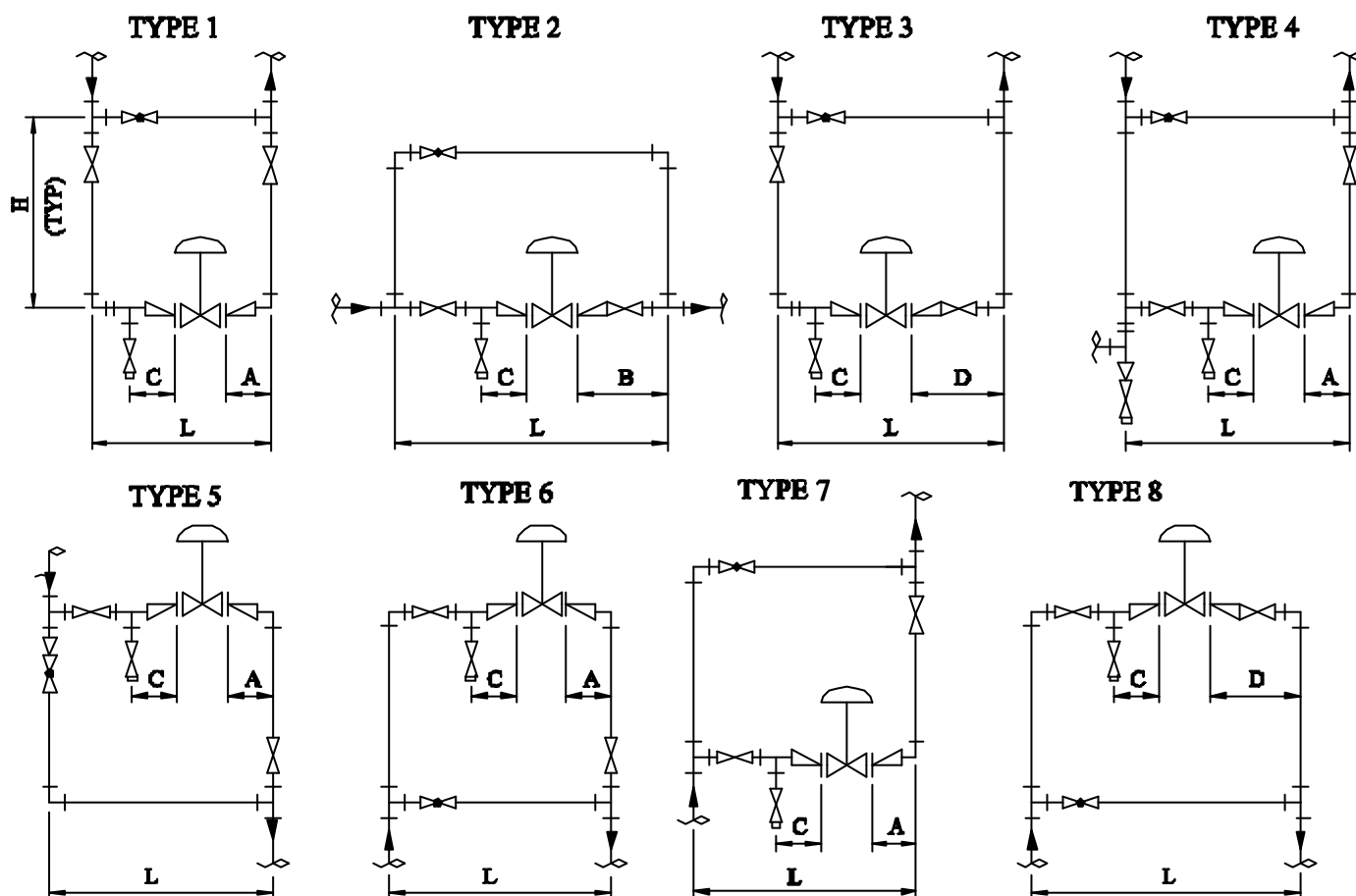


MFG : FISHER						UNIT : mm		
MODEL NO.	BODY SIZE (INCH)	A				B	C	AR
		SCR'D	150#	300#	600#			
EZ	1	210	184	197	210	289	627	127
	1.1/2	251	222	235	251	289	627	127
	2	286	254	267	286	333	759	175
ED	2.1/2	-	276	292	311	333	778	175
	3	-	298	317	337	406	955	175
	4	-	353	368	394	406	985	175
	6	-	451	473	508	473	1035	232
	8	-	543	568	610	536	1308	232

1. ACTUATOR SIZE는 SHUT-OFF PRESSURE 에 의해 결정되나 일반적으로 SMALL BODY SIZE에 SMALL ACTUATOR SIZE가 선정됨.

2. 이 표는 초기 DESIGN 하기 위한 것으로 VENDOR 선정이 된 후에는 사용하여서는 안된다.

AR = ACTUATOR REMOVAL CLEARANCE
ENVELOPE DIMENSION ARE 25



- NOTE :**
1. ALL DIMENSION ARE IN MILLIMETER
 2. THESE TABLES SHOULD BE USED FOR PLANNING PURPOSES ONLY
 3. CONTROL VALVE DIMENSIONS ARE BASED ON MASONEILAN & YAMATAKE HONEWELL

BLOCK VALVE 150 LB, CONTROL VA. 150 LB

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H	
						1	2	3,6	4,5,7	8	1,2,3,4,7	5,6,8
3/4" (SWG.)	1/2"	123	285	123	285	540	860	700	700	860	1050	450
	3/4"	99	260	99	260	510	830	670	670	830		
1" (SWG.)	1/2"	133	300	133	300	560	890	730	730	890	1050	480
	3/4"	132	300	132	300	580	910	750	750	910		
	1"	103	270	103	270	520	850	690	690	850		
1 1/2" (SWG.)	1/2"	155	345	155	345	630	1000	820	820	1000	1050	560
	3/4"	154	345	154	345	640	1020	840	840	1020		
	1"	154	345	154	345	640	1020	840	840	1020		
	1-1/2"	118	308	118	308	610	990	800	800	990		
2" (SWG.)	1/2"	248	551	248	563	850	1450	1160	1150	1470	1050	610
	3/4"	247	550	247	562	870	1470	1180	1170	1480		
	1"	247	550	247	562	870	1470	1180	1170	1480		
	1-1/2"	249	551	249	563	910	1510	1230	1220	1520		
	2"	190	443	164	455	800	1350	1060	1100	1360		

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.19 CONTROL VALVES &
TYPICAL MANIFOLD****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 4 OF 7****DATE : DEC. 1995****BLOCK VALVE 150 LB, CONTROL VA. 300 LB**

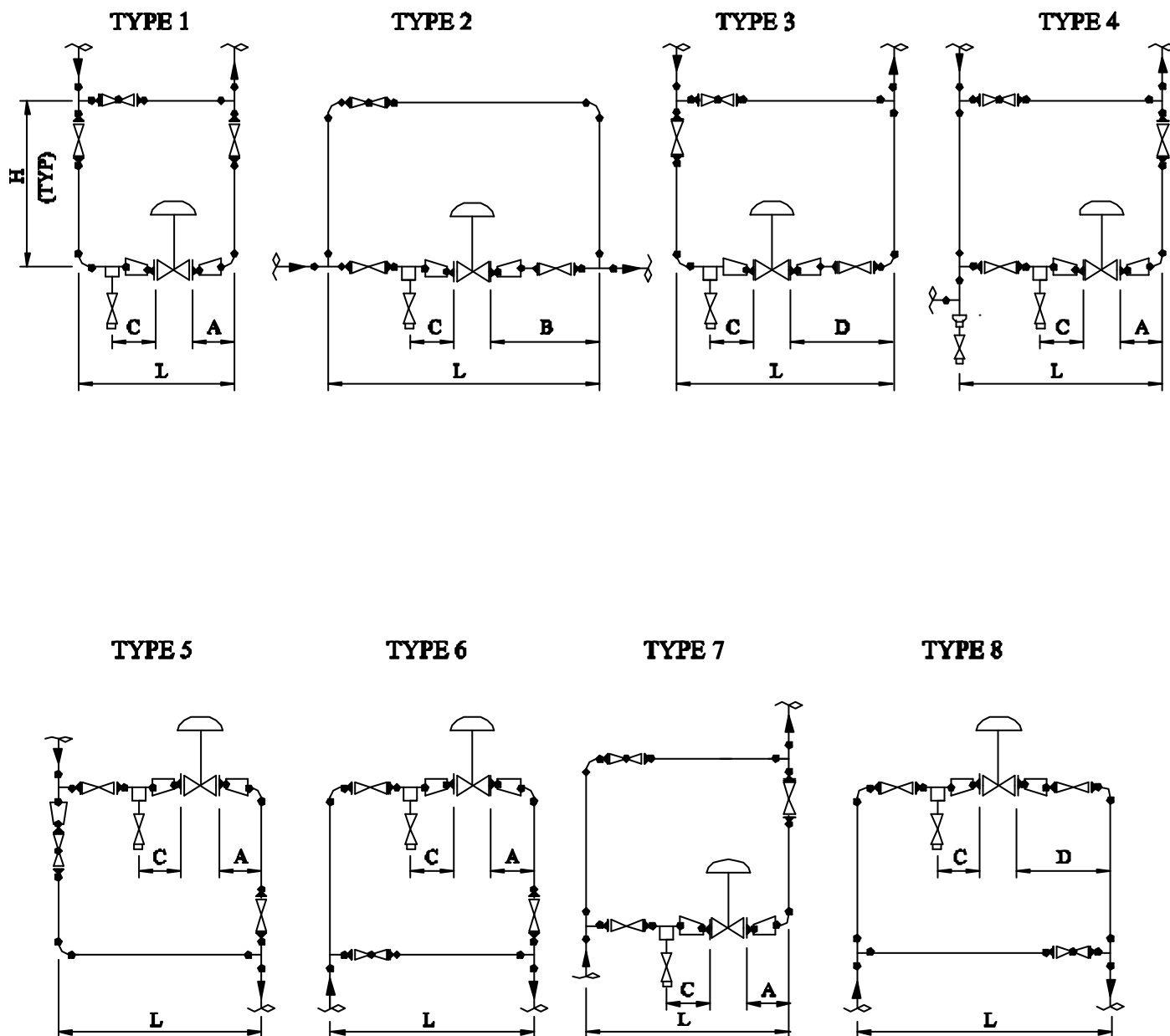
BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H	
						1	2	3,6	4,5,7	8	1,2,3,4,7	5,6,8
3/4" (SWG.)	1/2"	130	292	130	292	550	870	710	710	870	1050	450
	3/4"	109	270	109	270	540	860	700	700	860		
1" (SWG.)	1/2"	140	306	140	306	580	910	740	740	910	1050	480
	3/4"	142	310	142	310	610	940	780	780	940		
	1"	113	280	113	280	550	890	720	720	890		
1.1/2" (SWG.)	1/2"	161	352	161	352	640	1020	830	830	1020	1050	560
	3/4"	163	355	163	355	670	1050	860	860	1050		
	1"	162	355	162	355	670	1050	860	860	1050		
	1-1/2"	126	316	126	316	640	1020	830	830	1020		
2" (SWG.)	1/2"	254	560	254	572	860	1470	1180	1170	1490	1050	610
	3/4"	257	560	257	572	900	1500	1210	1200	1520		
	1"	257	560	257	572	900	1500	1210	1200	1520		
	1-1/2"	257	559	257	571	940	1540	1250	1240	1560		
	2"	196	449	170	461	820	1370	1090	1120	1390	1110	

BLOCK VALVE 300 LB, CONTROL VA. 300 LB

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H	
						1	2	3,6	4,5,7	8	1,2,3,4,7	5,6,8
3/4" (SWG.)	1/2"	130	292	130	292	550	870	710	710	870	1050	490
	3/4"	109	270	109	270	540	860	700	700	860		
1" (SWG.)	1/2"	140	306	140	306	570	910	740	740	910	1050	520
	3/4"	142	310	142	310	610	940	780	780	940		
	1"	113	280	113	280	550	890	720	720	890		
1.1/2" (SWG.)	1/2"	161	352	161	352	640	1020	830	830	1020	1050	580
	3/4"	163	355	163	355	670	1050	860	860	1050		
	1"	162	355	162	355	670	1050	860	860	1050		
	1-1/2"	126	316	126	316	640	1020	830	830	1020		
2" (SWG.)	1/2"	254	608	254	620	860	1560	1230	1220	1590	1050	650
	3/4"	257	610	257	622	900	1600	1260	1250	1620		
	1"	257	610	257	622	900	1600	1260	1250	1620		
	1-1/2"	257	610	257	622	940	1640	1300	1290	1660		
	2"	196	499	170	511	820	1470	1140	1170	1500	1110	

BLOCK VALVE 600 LB, CONTROL VA. 600 LB

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H	
						1	2	3,6	4,5,7	8	1,2,3,4,7	5,6,8
3/4" (SWG.)	1/2"	136	298	136	298	560	880	720	720	880	1050	490
	3/4"	115	276	115	276	560	880	720	720	880		
1" (SWG.)	1/2"	146	313	146	313	590	920	750	750	920	1050	570
	3/4"	148	316	148	316	630	960	800	800	960		
	1"	119	287	119	287	580	910	740	740	910		
1.1/2" (SWG.)	1/2"	168	358	168	358	650	1030	840	840	1030	1050	630
	3/4"	170	361	170	361	700	1080	890	890	1080		
	1"	170	361	170	361	700	1080	890	890	1080		
	1-1/2"	134	324	134	324	670	1050	860	860	1050		
2" (SWG.)	1/2"	262	710	262	722	880	1770	1340	1320	1790	1050	720
	3/4"	263	712	263	724	920	1820	1380	1370	1840		
	1"	263	712	263	724	920	1820	1380	1370	1840		
	1-1/2"	265	714	265	726	970	1860	1430	1420	1890		
	2"	206	605	180	617	860	1700	1270	1310	1730	1110	



- NOTES :**
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 - 2. THESE TABLES SHOULD BE USED FOR PLANNING PURPOSES ONLY**
 - 3. CONTROL VALVE DIMENSIONS ARE BASED ON MASONEILAN
& YAMATAKE HONEWELL**

**LG E&C****PIPING DISCIPLINE
PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.19 CONTROL VALVES &
TYPICAL MANIFOLD****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 6 OF 7****DATE : DEC. 1995****BLOCK VALVE 150 LB, CONTROL VA. 150 LB**

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H				
						1	2	3 ,6	4 ,5 ,7	8	1 ,2 ,3 ,4 ,7	5 ,6 ,8			
3" (SWG.)	1"	323	643	309	671	1040	1680	1390	1360	1730	1050				740
	1-1/2"	325	645	311	673	1080	1720	1430	1400	1780	1050				
3" (RED.)	2"	267	587	253	615	1000	1630	1350	1310	1690	1100				
	3"	184	504	170	532	880	1510	1230	1190	1570	1300				
4" (RED.)	2"	318	657	266	704	1100	1780	1490	1440	1870	1100				860
	3"	324	663	272	710	1160	1830	1550	1490	1930	1300				
	4"	228	567	176	614	1020	1700	1410	1360	1790	1450				
6" (RED.)	3"	439	803	310	889	1390	2120	1840	1760	2300	1300				1050
	4"	445	809	316	895	1450	2190	1900	1820	2360	1450				
	6"	318	682	189	768	1300	2030	1750	1670	2210	1750				
8" (RED.)	4"	533	906	328	1033	1630	2380	2130	2000	2630	1450				1220
	6"	546	919	341	1046	1750	2500	2250	2130	2760	1750				
	8"	407	780	202	907	1570	2310	2070	1940	2570	1800				
10" (RED.)	6"	648	1021	367	1186	1960	2710	2500	2340	3030	1750				1410
	8"	661	1034	380	1199	2080	2830	2620	2450	3150	1800				
	10"	483	856	202	1021	1850	2600	2390	2230	2930	1850				
12" (RED.)	6"	749	1135	392	1338	2160	2940	2750	2550	3340	1800				1550
	8"	762	1148	405	1351	2280	3060	2870	2670	3460	1800				
	10"	762	1148	405	1351	2410	3190	3000	2800	3590	1850				
	12"	571	957	214	1160	2090	2870	2680	2480	3270	2100				

BLOCK VALVE 150 LB, CONTROL VA. 300 LB

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H		
						1	2	3 ,6	4 ,5 ,7	8	1 ,2 ,3 ,4 ,7	5 ,6 ,8	
3" (SWG.)	1"	333	653	319	681	1070	1710	1420	1390	1770	1050	740	
	1-1/2"	333	653	319	681	1110	1750	1460	1430	1800	1050		
3" (RED.)	2"	273	593	259	621	1020	1660	1370	1340	1720	1100		
	3"	194	514	180	542	920	1550	1260	1230	1610	1300		
4" (RED.)	2"	324	663	272	710	1130	1800	1510	1460	1900	1100	860	
	3"	334	673	282	720	1200	1870	1580	1530	1970	1300		
	4"	238	577	186	624	1060	1730	1440	1390	1830	1450		
6" (RED.)	3"	449	813	320	899	1430	2160	1880	1800	2340	1300	1050	
	4"	455	819	326	905	1490	2220	1940	1860	2400	1450		
	6"	328	692	199	778	1340	2070	1790	1710	2250	1750		
8" (RED.)	4"	543	916	338	1043	1660	2410	2160	2040	2670	1450	1220	
	6"	556	929	351	1056	1790	2540	2290	2170	2800	1750		
	8"	417	790	212	917	1610	2360	2110	1990	2620	1800		
10" (RED.)	6"	658	1031	377	1196	2000	2750	2540	2380	3080	1750	1410	
	8"	671	1044	390	1209	2120	2870	2660	2500	3200	1800		
	10"	498	871	217	1036	1920	2670	2460	2290	2990	1850		
12" (RED.)	6"	759	1145	402	1348	2200	2980	2790	2590	3380	1800	1550	
	8"	772	1158	415	1361	2330	3100	2910	2720	3500	1800		
	10"	777	1163	420	1366	2470	3250	3060	2860	3650	1850		
	12"	587	973	230	1176	2160	2940	2750	2550	3340	2100		

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PROCEDURE****PIPING HANDBOOK****1. DIMENSION TABLES****1.19 CONTROL VALVES &
TYPICAL MANIFOLD****LDP-L901****REV. 1 (OCT, 2002)****PAGE : 7 OF 7****DATE : DEC. 1995****BLOCK VALVE 300 LB, CONTROL VA. 300 LB**

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H		
						1	2	3 ,6	4 ,5 ,7	8	1 ,2 ,3 ,4 ,7	5 ,6 ,8	
3" (SWG.)	1"	333	751	319	779	1070	1910	1520	1490	1960	1050	820	
	1-1/2"	333	751	319	779	1110	1940	1560	1530	2000	1050		
3" (RED.)	2"	273	691	259	719	1020	1860	1470	1440	1910	1100		940
	3"	194	612	180	640	920	1750	1360	1330	1810	1300		
4" (RED.)	2"	324	759	272	806	1130	2000	1610	1560	2090	1100	940	
	3"	334	769	282	816	1200	2070	1680	1630	2170	1300		
	4"	238	673	186	720	1060	1930	1540	1490	2020	1450		
6" (RED.)	3"	449	968	320	1054	1430	2480	2030	1960	2650	1300	1180	
	4"	455	974	326	1060	1490	2540	2090	2020	2710	1450		
	6"	328	847	199	933	1340	2390	1940	1870	2560	1750		
8" (RED.)	4"	543	1062	338	1189	1660	2710	2310	2190	2960	1450	1340	
	6"	556	1075	351	1202	1790	2840	2440	2320	3100	1750		
	8"	417	936	212	1063	1610	2660	2260	2140	2910	1800		
10" (RED.)	6"	658	1189	377	1354	2000	3070	2700	2540	3390	1750	1530	
	8"	671	1202	390	1367	2120	3190	2820	2660	3520	1800		
	10"	498	1029	217	1194	1920	2980	2610	2450	3310	1850		
12" (RED.)	6"	759	1323	402	1526	2200	3340	2970	2770	3740	1800	1700	
	8"	772	1336	415	1539	2330	3460	3090	2900	3860	1800		
	10"	777	1341	420	1544	2470	3610	3240	3040	4010	1850		
	12"	587	1151	230	1354	2160	3300	2930	2730	3700	2100		

BLOCK VALVE 600 LB, CONTROL VA. 600 LB

BLOCK VA SIZE	CONTROL VA SIZE	A	B	C	D	L					H				
						1	2	3 ,6	4 ,5 ,7	8	1 ,2 ,3 ,4 ,7	5 ,6 ,8			
3" (SWG.)	1"	339	850	325	878	1100	2110	1640	1600	2170	1050	820			
	1-1/2"	341	852	327	880	1140	2160	1680	1650	2220	1050				
3" (RED.)	2"	283	794	269	822	1060	2080	1600	1570	2140	1100				
	3"	203	714	189	742	950	1970	1490	1460	2030	1300				
4" (RED.)	2"	334	940	282	987	1170	2380	1820	1770	2470	1100	940			
	3"	343	949	291	996	1240	2450	1890	1840	2540	1300				
	4"	260	866	208	913	1130	2340	1780	1730	2430	1450				
6" (RED.)	3"	458	1183	329	1269	1460	2920	2270	2190	3090	1300	1180			
	4"	464	1189	335	1275	1530	2990	2340	2260	3160	1450				
	6"	353	1078	224	1164	1420	2880	2240	2150	3060	1750				
8" (RED.)	4"	565	1382	360	1509	1730	3380	2680	2560	3630	1450	1220			
	6"	581	1398	376	1525	1880	3520	2820	2700	3780	1750				
	8"	445	1262	240	1389	1710	3350	2650	2530	3610	1800				
10" (RED.)	6"	683	1627	402	1792	2090	3990	3200	3040	4310	1750	1530			
	8"	699	1643	418	1808	2220	4120	3330	3180	4450	1800				
	10"	540	1484	259	1649	2050	3950	3160	3000	4270	1850				
12" (RED.)	6"	784	1743	427	1946	2290	4220	3450	3260	4620	1800	1700			
	8"	800	1759	443	1962	2420	4350	3580	3390	4750	1800				
	10"	818	1777	461	1980	2600	4530	3760	3570	4930	1850				
	12"	619	1578	262	1781	2270	4200	3430	3240	4600	2100				



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

1. DIMENSION TABLES

1.20 WELD FITTING OFFSETS

LDP-L901

REV. 1 (OCT, 2002)

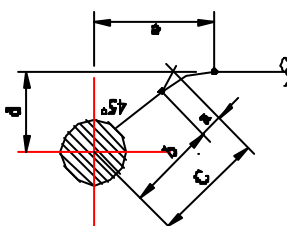
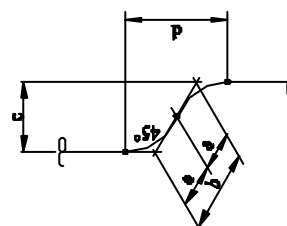
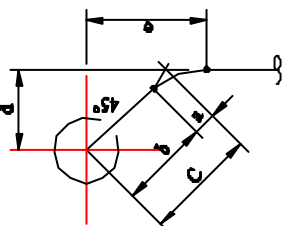
PAGE : 1 OF 1

DATE : DEC. 1995

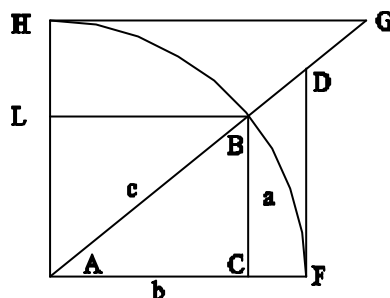
UNIT:MM

NOTE

1. WELDING CLEARANCES ARE
NOT INCLUDED.

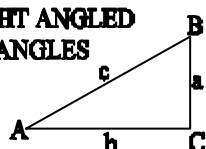
PIPE SIZE(D)		1 1/2	2	3	4	6	8	10	12	14	16	18	20	24
 TEE & STD. L.R. 45° EL.	a	29	35	51	64	95	127	159	190	222	254	286	318	381
	b	57	64	86	105	143	178	216	254	279	305	343	381	432
	c	86	99	137	168	238	305	375	444	501	559	629	699	813
	d	61	70	97	120	168	216	263	314	354	395	445	494	575
	e	90	105	148	184	263	343	424	504	576	649	731	812	956
 TWO STD. L.R. 45° ELs	a	29	35	51	64	95	127	159	190	222	254	286	318	381
	b	58	70	102	128	190	254	318	380	444	508	572	636	762
	c	41	50	72	91	134	180	225	269	314	359	404	450	539
	d	99	120	174	219	324	434	543	649	758	867	976	1086	1301
	e	29	35	51	64	95	127	159	190	222	254	286	318	381
 STD. L.R. 90° & 45° ELs	a	29	35	51	64	95	127	159	190	222	254	286	318	381
	b	57	76	114	152	229	305	381	457	533	610	686	762	914
	c	86	111	165	216	324	432	540	647	755	864	972	1080	1295
	d	61	79	117	153	229	305	382	457	534	611	687	764	916
	e	90	114	168	217	324	432	541	647	756	865	973	1082	1297

**TRIGONOMETRIC
FUNCTIONS**



$$\begin{aligned}\text{Radius AF} &= 1 \\ &= \sin^2 A + \cos^2 A = \sin^2 A \operatorname{cosec} A \\ &= \cos^2 A \sec A = \tan A \cot A \\ \text{Sine } A &= \frac{\text{opposite}}{\text{hypotenuse}} = \frac{BC}{AB} = \frac{1}{\operatorname{cosec} A} = \cos A \tan A = \sqrt{1 - \cos^2 A} = BC \\ \text{Cosine } A &= \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{AC}{AB} = \frac{1}{\sec A} = \sin A \cot A = \sqrt{1 - \sin^2 A} = AC \\ \text{Tangent } A &= \frac{\text{opposite}}{\text{adjacent}} = \frac{BC}{AC} = \frac{1}{\cot A} = \sin A \sec A = FD \\ \text{Cotangent } A &= \frac{\text{adjacent}}{\text{opposite}} = \frac{AC}{BC} = \frac{1}{\tan A} = \cos A \operatorname{cosec} A = HG \\ \text{Secant } A &= \frac{\text{hypotenuse}}{\text{adjacent}} = \frac{AB}{AC} = \frac{1}{\cos A} = AD \\ \text{Cosecant } A &= \frac{\text{hypotenuse}}{\text{opposite}} = \frac{AB}{BC} = \frac{1}{\sin A} = AG\end{aligned}$$

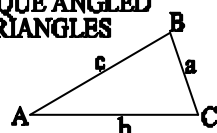
**RIGHT ANGLED
TRIANGLES**



$$\begin{aligned}a^2 &= c^2 - b^2 \\ b^2 &= c^2 - a^2 \\ c^2 &= a^2 + b^2\end{aligned}$$

KNOWN	REQUIRED					AREA
	A	B	a	b	c	
a, b	$\tan A = \frac{a}{b}$	$\tan B = \frac{b}{a}$			$\sqrt{a^2 + b^2}$	$\frac{ab}{2}$
a, c	$\sin A = \frac{a}{c}$	$\cos B = \frac{a}{c}$		$\sqrt{c^2 - a^2}$		$\frac{a \sqrt{c^2 - a^2}}{2}$
A, a		$90^\circ - A$		$a \cot A$	$\frac{a}{\sin A}$	$\frac{a^2 \cot A}{2}$
A, b		$90^\circ - A$	$b \tan A$		$\frac{b}{\cos A}$	$\frac{b^2 \tan A}{2}$
A, c		$90^\circ - A$	$c \sin A$	$c \cos A$		$\frac{c^2 \sin 2A}{4}$

**OBLIQUE ANGLED
TRIANGLES**

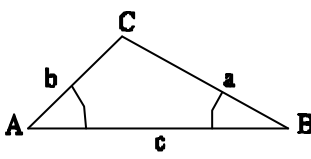
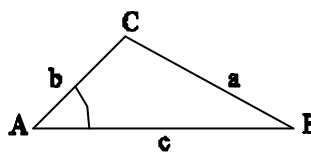
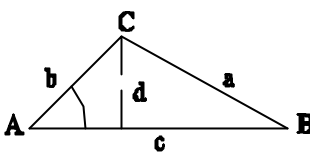
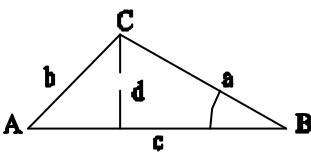
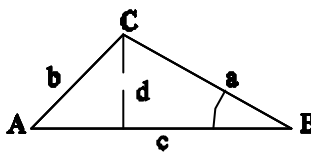
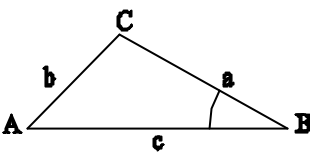
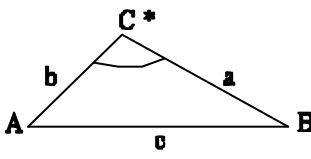
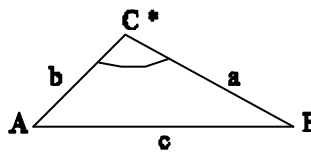
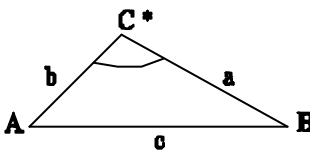
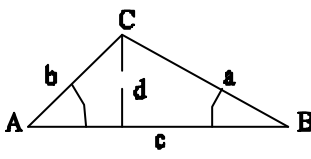
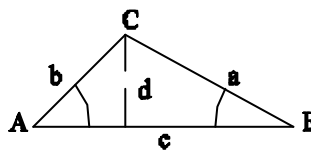
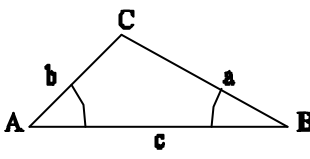
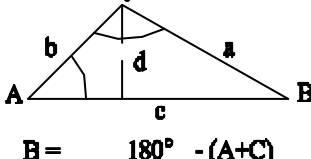
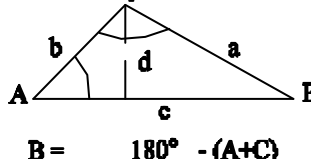
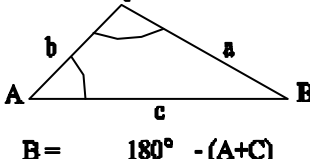


$$s = \frac{a + b + c}{2}$$

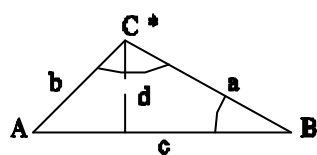
$$\begin{aligned}a^2 &= b^2 + c^2 - 2bc \cos A \\ b^2 &= a^2 + c^2 - 2ac \cos B \\ c^2 &= a^2 + b^2 - 2ab \cos C\end{aligned}$$

KNOWN	REQUIRED					AREA
	A	B	C	b	c	
a, b, c	$\cos \frac{1}{2} A = \sqrt{\frac{s(s-a)}{bc}}$	$\cos \frac{1}{2} B = \sqrt{\frac{s(s-b)}{ac}}$	$\cos \frac{1}{2} C = \sqrt{\frac{s(s-c)}{ab}}$			$\sqrt{s(s-a)(s-b)(s-c)}$
a, A, B			$180^\circ - (A+B)$	$\frac{a \sin B}{\sin A}$	$\frac{a \sin C}{\sin A}$	
a, b, A		$\sin B = \frac{b \sin A}{a}$			$\frac{b \sin C}{\sin B}$	
a, b, c	$\tan A = \frac{a \sin C}{b - a \cos C}$				$\sqrt{a^2 + b^2 - 2ab \cos C}$	$\frac{ab \sin C}{2}$



①  $\sin B = \frac{b \cdot \sin A}{a}$ $C = 180^\circ - (A+B)$ $c = \frac{a \cdot \sin C}{\sin A}$	②  $\sin C = \frac{c \cdot \sin A}{a}$ $B = 180^\circ - (A+C)$ $b = \frac{a \cdot \sin B}{\sin A}$	③  $\tan C = \frac{c \cdot \sin A}{b - (c \cdot \cos A)}$ $B = 180^\circ - (A+C)$ $a = \frac{b \cdot \sin A}{\sin B}$
④  $\sin A = \frac{a \cdot \sin B}{b}$ $C = 180^\circ - (A+B)$ $c = \frac{b \cdot \sin C}{\sin B}$	⑤  $\tan C = \frac{c \cdot \sin B}{a - (c \cdot \cos B)}$ $A = 180^\circ - (B+C)$ $b = \frac{a \cdot \sin B}{\sin A}$	⑥  $\sin C = \frac{c \cdot \sin B}{b}$ $A = 180^\circ - (B+C)$ $a = \frac{b \cdot \sin A}{\sin B}$
⑦  $\sin A = \frac{a \cdot \sin C}{b - (a \cdot \cos C)}$ $B = 180^\circ - (A+C)$ $c = \frac{a \cdot \sin C}{\sin A}$	⑧  $\sin A = \frac{a \cdot \sin C}{c}$ $B = 180^\circ - (A+C)$ $b = \frac{a \cdot \sin B}{\sin A}$	⑨  $\sin B = \frac{b \cdot \sin C}{c}$ $A = 180^\circ - (B+C)$ $a = \frac{b \cdot \sin A}{\sin B}$
⑩  $C = 180^\circ - (A+B)$ $b = \frac{a \cdot \sin B}{\sin A}$ $c = \frac{a \cdot \sin C}{\sin A}$	⑪  $C = 180^\circ - (A+B)$ $a = \frac{b \cdot \sin A}{\sin B}$ $c = \frac{a \cdot \sin C}{\sin A}$	⑫  $C = 180^\circ - (A+B)$ $a = \frac{c \cdot \sin A}{\sin C}$ $b = \frac{c \cdot \sin B}{\sin C}$
⑬  $B = 180^\circ - (A+C)$ $b = \frac{a \cdot \sin B}{\sin A}$ $c = \frac{a \cdot \sin C}{\sin A}$	⑭  $B = 180^\circ - (A+C)$ $a = \frac{b \cdot \sin A}{\sin B}$ $c = \frac{a \cdot \sin C}{\sin A}$	⑮  $B = 180^\circ - (A+C)$ $a = \frac{c \cdot \sin A}{\sin C}$ $b = \frac{a \cdot \sin B}{\sin A}$

16

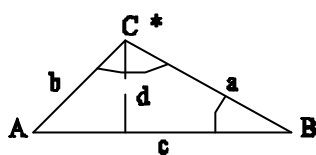


$$A = 180^\circ - (B+C)$$

$$b = \frac{a \cdot \sin B}{\sin A}$$

$$c = \frac{a \cdot \sin C}{\sin A}$$

17

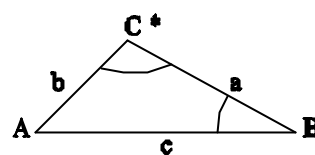


$$A = 180^\circ - (B+C)$$

$$a = \frac{b \cdot \sin A}{\sin B}$$

$$c = \frac{b \cdot \sin C}{\sin B}$$

18

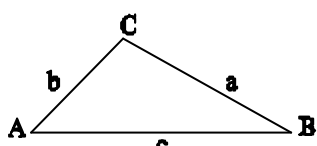


$$A = 180^\circ - (B+C)$$

$$a = \frac{c \cdot \sin A}{\sin C}$$

$$b = \frac{c \cdot \sin B}{\sin C}$$

19



$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$C = 180^\circ - (A+B)$$

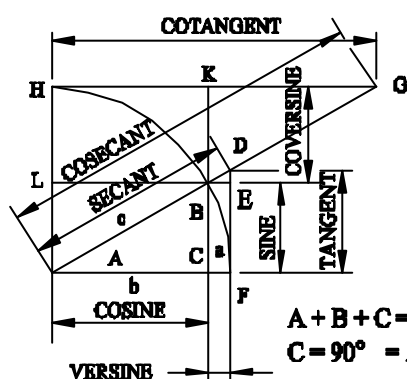
LAW OF SINES

In any triangle the sides are proportional to the sines of of the opposite angles.

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin A : \sin B = a : b, \text{ etc}$$

THE RIGHT TRIANGLE



$$a^2 + b^2 = c^2$$

$$c = \sqrt{a^2 + b^2}$$

$$a = \sqrt{(c+b)(c-b)}$$

$$b = \sqrt{(c+a)(c-a)}$$

$$A + B + C = 180^\circ$$

$$C = 90^\circ = A + B$$

$$\sin A = a/c = \cos B; \text{ when radius is unity } = a = BC$$

$$\cos A = b/c = \sin B; \text{ when radius is unity } = b = AC$$

$$\tan A = a/b = \cot B; \text{ when radius is unity } = DF$$

$$\cot A = b/a = \tan B; \text{ when radius is unity } = HG$$

$$\sec A = c/b = \csc B; \text{ when radius is unity } = AD$$

$$\csc A = c/a = \sec B; \text{ when radius is unity } = AG$$

$$\text{Vers } A = (c - b)/c = \text{Coversine } B; \text{ when radius is unity } = CF = BE$$

$$\text{Covers } A = (c - a)/c = \text{Vers } B; \text{ when radius is unity } = BK = HL$$

$$\text{Exsec } A = (c - b)/b = \text{Coexsec } B; \text{ when radius is unity } = BD$$

$$\text{Coexsec } A = (c - a)/a = \text{Exsec } B; \text{ when radius is unity } = BG$$

$$\text{Chord } A = BF$$

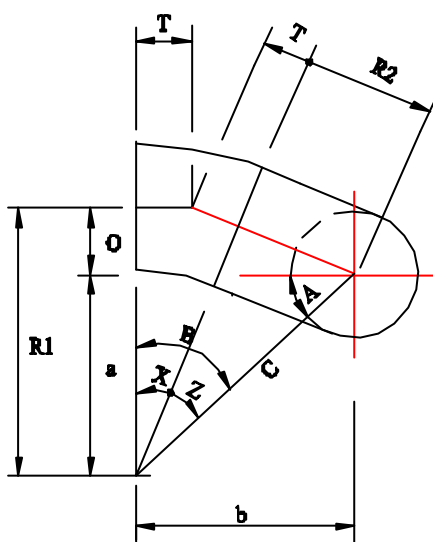
$$\text{Arc } A = B - F$$

$$\text{Area} = \frac{ab}{2}$$

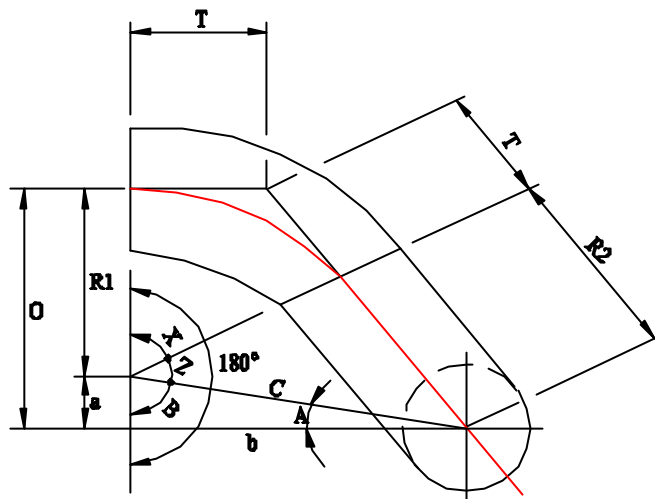
* IN THESE ABOVE DIAGRAMS THE HEAVY LINES REPRESENT KNOWN PARTS.

CONDITIONS - ONE BEND OR ELBOW MUST BE 90°
RAD II (R1 AND R2) MAY BE EQUAL OR UNEQUAL.

**CASE I - OFFSET(O) EQUAL OR LESS
THAN R1**



**CASE II - OFFSET(O) IS GREATER
THAN R1**



FORMULAS - CASE I

$$a = R1 - O$$

$$\sin A = a/c$$

$$\tan Z = R2/R1$$

$$T = R1 \times \tan X/2$$

$$C = \sqrt{R1^2 + R2^2}$$

$$B = 90^\circ - \text{ANGLE } A$$

$$X = B - Z$$

$$b = \sqrt{c^2 - a^2}$$

FORMULAS - CASE II

$$a = O - R1$$

$$\sin A = a/c$$

$$\tan Z = R2/R1$$

$$T = R1 \times \tan X/2$$

$$C = \sqrt{R1^2 + R2^2}$$

$$B = 90^\circ - A$$

$$X = 180^\circ - (B + Z)$$

$$b = \sqrt{c^2 - a^2}$$

EXAMPLES USING CASE I

GIVEN - OFFSET DESIRED = 228.6mm, R1 = 457mm (12" L.R.ELL), R2 = 305mm (12" S.R.ELL)
FIND; (a) ANGLE "X" FOR TRIM ON L.R. ELL. (b) DISTANCE "T", (c) DISTANCE "b".

SOLUTION - $a = R1 - O = 228.6$

$$C = \sqrt{R1^2 + R2^2} = \sqrt{457^2 + 305^2} = 549.4$$

$$\sin A = a/c = 228.6/549.4, A = 24^\circ - 36'$$

$$B = 90^\circ - A = 90^\circ - (24^\circ - 36') = 65^\circ - 24'$$

$$\tan Z = R2/R1 = 305/457 = 0.6667, Z = 33^\circ - 41'$$

$$X = B - Z = (65^\circ - 24') - (33^\circ - 41') = 31^\circ - 43'$$

$$T = R1 \tan(X/2) = R1 \tan(31^\circ - 43')/2 = 457 \times \tan(15^\circ - 52') = 130.2$$

$$b = \sqrt{c^2 - a^2} = \sqrt{(549.4)^2 - (228.6)^2} = 500$$

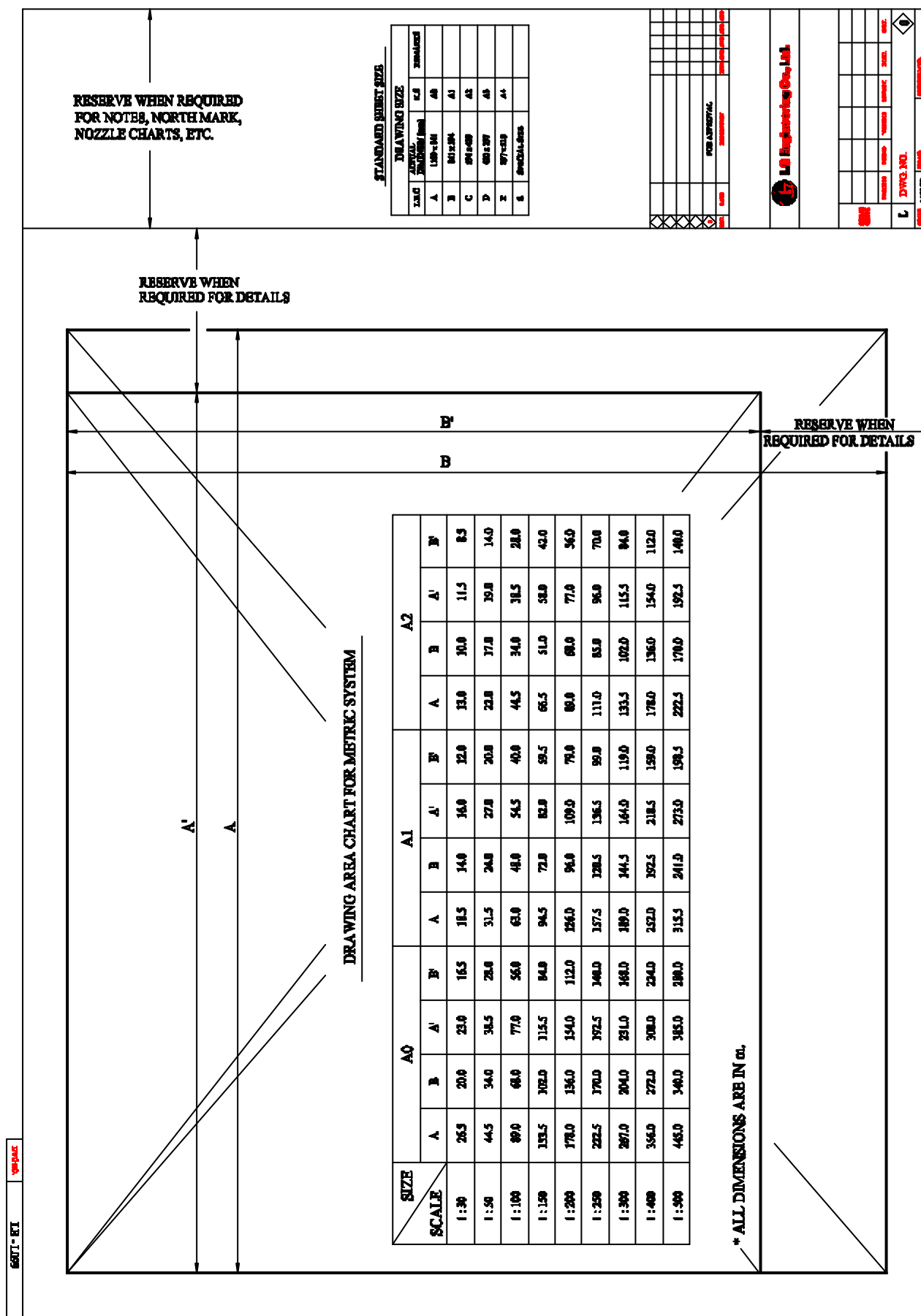
CASE II FORMULAS ARE USED IN A MANNER SIMILAR TO THE PRECEDING EXAMPLE.

PIPING HANDBOOK

1. DIMENSION TABLES

1.23 DRAWING AREA CHART

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995



PIPING HANDBOOK

1. DIMENSION TABLES

1.24 WIRE AND SHEET METAL GAGES

LDP-L901

REV. 1 (OCT., 2002)

PAGE : 1 OF 1

DATE : DEC., 1995

Values in approximate decimals of an inch. As a number or gages are in use for various shapes and metals, it is advisable to state the thickness in thousandths when specifying gage number.

Gage number	American(A.W.G.) or Brown and Sharpe (B&S) (for non-ferrous wire and sheet)*	U.S. Steel Wire(S.W.G) or Washburn and Moen Roebling or A.m. Steel and Wire Co. [A.(steel)W.G.] (for steel wire)	Birmingham(B.W.G) (for steel wire) or Stubs iron Wire (for iron or brass wire)+	U.S. Standard(for sheet and plate metal wrought iron)	Standard Birmingham(B.G) (for sheet and hoop metal)	Imperial Standard Wire Gages (S.W.G.) (British legal standard)	Gage Number
0000000	-	0.4900	-	0.500	0.6666	0.500	0000000
000000	-	0.4615	-	0.469	0.6250	0.464	000000
00000	-	0.4305	-	0.438	0.5883	0.432	00000
0000	0.460	0.3938	0.454	0.406	0.5416	0.400	0000
000	0.410	0.3625	0.425	0.375	0.5000	0.372	000
00	0.365	0.3310	0.380	0.344	0.4452	0.348	00
0	0.325	0.3065	0.340	0.312	0.3964	0.324	0
1	0.289	0.2830	0.300	0.281	0.3532	0.300	1
2	0.258	0.2625	0.284	0.266	0.3147	0.276	2
3	0.229	0.2437	0.259	0.250	0.2804	0.252	3
4	0.204	0.2253	0.238	0.234	0.2500	0.232	4
5	0.182	0.2070	0.220	0.219	0.2225	0.212	5
6	0.162	0.1920	0.203	0.203	0.1981	0.192	6
7	0.144	0.1770	0.180	0.188	0.1764	0.176	7
8	0.128	0.1620	0.165	0.172	0.1570	0.160	8
9	0.114	0.1483	0.148	0.156	0.1398	0.144	9
10	0.102	0.1350	0.134	0.141	0.1250	0.128	10
11	0.091	0.1205	0.120	0.125	0.1113	0.116	11
12	0.081	0.1055	0.109	0.109	0.0991	0.104	12
13	0.072	0.0915	0.095	0.094	0.0882	0.092	13
14	0.064	0.0800	0.083	0.078	0.0785	0.080	14
15	0.057	0.0720	0.072	0.070	0.0699	0.072	15
16	0.051	0.0625	0.065	0.062	0.0625	0.064	16
17	0.045	0.0540	0.058	0.056	0.0556	0.056	17
18	0.040	0.0475	0.049	0.050	0.0495	0.048	18
19	0.038	0.0410	0.042	0.0438	0.0440	0.040	19
20	0.032	0.0348	0.035	0.0375	0.0392	0.036	20
21	0.0285	0.0317	0.032	0.0344	0.0349	0.032	21
22	0.0253	0.0266	0.028	0.0312	0.0313	0.028	22
23	0.0226	0.0258	0.025	0.0281	0.0278	0.024	23
24	0.0201	0.0230	0.022	0.0250	0.0248	0.022	24
25	0.0179	0.0204	0.020	0.0219	0.0220	0.020	25
26	0.0159	0.0181	0.018	0.0188	0.0196	0.016	26
27	0.0142	0.0173	0.016	0.0172	0.0175	0.0164	27
28	0.0126	0.0162	0.014	0.0156	0.0156	0.0148	28
29	0.0113	0.0150	0.013	0.0141	0.0139	0.0138	29
30	0.0100	0.0140	0.012	0.0125	0.0123	0.0124	30
31	0.0089	0.0132	0.010	0.0109	0.0110	0.0116	31
32	0.0080	0.0128	0.009	0.0102	0.0098	0.0108	32
33	0.0071	0.0118	0.008	0.0094	0.0087	0.0100	33
34	0.0063	0.0104	0.007	0.0086	0.0077	0.0092	34
35	0.0056	0.0095	0.005	0.0078	0.0069	0.0084	35
36	0.0050	0.0090	0.004	0.0070	0.0061	0.0076	36
37	0.0045	0.0085	-	0.0066	0.0054	0.0068	37
38	0.0040	0.0080	-	0.0062	0.0048	0.0060	38
39	0.0035	0.0075	-	-	0.0043	0.0052	39
40	0.0031	0.0070	-	-	0.0039	0.0048	40
41	-	0.0066	-	-	0.0034	0.0044	41
42	-	0.0062	-	-	0.0031	0.0040	42
43	-	0.0060	-	-	0.0027	0.0036	43
44	-	0.0058	-	-	0.0024	0.0032	44
45	-	0.0055	-	-	0.0022	0.0028	45
46	-	0.0052	-	-	0.0019	0.0024	46
47	-	0.0050	-	-	0.0017	0.0020	47
48	-	0.0048	-	-	0.0015	0.0016	48
49	-	0.0046	-	-	0.0014	0.0012	49
50	-	0.0044	-	-	0.0012	0.0010	50

Notes : METRIC WIRE GAGE is ten times the diameter in millimeters.

*Sometimes used for iron wire.

+Sometimes used for copperplate and for plate 12 gage and heavier and for steel tubes.

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.1 ASME B31.3 OVERVIEW

1. ASME B31 Code for Pressure Piping

No.	Code Section	Contents
B31.1	Power Piping	Piping typically found in electric power generating stations, in industrial plants, geothermal heating systems, and central and direct heating and cooling systems.
B31.3	Process Piping	Piping typically found in petroleum refineries, chemical, pharmaceutical, textile, paper, semiconductor and terminals.
B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids	Piping transporting products, which are predominately liquid between plants and terminals and within terminals, pumping, regulating, and metering stations.
B31.5	Refrigeration Piping	Piping for refrigerants and secondary coolants.
B31.8	Gas Transportation and Distribution Piping Systems	Piping transporting products, which are predominately gas between sources and terminals, including compressor, regulating, and metering stations, gas gathering pipelines.
B31.9	Building Services Piping	Piping typically found in industrial, institutional, commercial, and public buildings and in multi-unit residences, which does not require the range of sizes, pressures and temperatures covered in B31.1.
B31.11	Slurry Transportation Piping Systems	Piping Transporting aqueous slurries between plants and terminals and within terminals, pumping, and regulating stations.

Note: It is owner's responsibility to select the Code Section, which most nearly applies to a proposed piping installation.

2. ASME B31.3 Process Piping

CONTENTS	PARA.	REMARK
CHAPTER I Scope and Definition		
Scope, Definition	300.1 ~ 300.3	
Status of Appendices	300.4	㉠ B31.3의 Appendices의 성격이 Code Requirements, Guidance, 또는 Supplemental Information 인지를 규정
CHAPTER II Design		
Part 1 Condition and Criteria	301 ~ 302	㉠ Temperature, Pressure Design Condition 및 Criteria ㉡ 각종 Effects (Ambient, Dynamic, Weight, Thermal 등)
Part 2 Pressure Design of Piping Components	303 ~ 304	㉠ Pipe, Curved and Mitered, Branch, Flanges and Blanks 등의 Pressure Design
Part 3 Fluid Service Requirements for Piping Components	305 ~ 309	㉠ Fluid Service(Category D, Normal Fluid, Severe Cyclic Conditions)에 따른 Piping Components의 Requirements
Part 4 Fluid Service Requirements for Piping Joints	310 ~ 318	㉠ Fluid Service(Category D, Normal Fluid, Severe cyclic Conditions)에 따른 Piping Joints의 Requirements
Part 5 Flexibility and Support	319 ~ 321	㉠ Flexibility Analysis 및 Support 설계를 위한 규정
Part 6 Systems	322	㉠ Instrument Piping/Pressure Relief 관련 규정
CHAPTER III Materials		
Limitation and required qualifications	323	㉠ Materials and Specification ㉡ Temperature(Low, Upper) Limit, Impact Test ㉢ Iron, Metallic Lining의 온도 압력에 따른 제한 조건
CHAPTER IV Standards for Piping Components		
Dimensions and Ratings of Components	326	㉠ Piping Components들의 Dimension 및 Rating 규정 ㉡ Listed Standard Table (ASME, API, AWWA, MSS)
CHAPTER V Fabrication, Assembly and Erection		
Welding	328	
Preheating	330	㉠ P-No./Wall Thickness/Tensile Strength에 따른 Preheat Temp. Table 330.1.1
Heat Treatment	331	
Etc.	332 ~ 335	㉠ Bending and Forming, Brazing and Soldering, Assembly and Erection
CHAPTER VI Inspection, Examination, and Testing		
Inspection	340	㉠ Responsibility, Rights, Qualifications of Owner's Inspector
Examination	341 ~ 344	㉠ Examination Requirements ㉡ Extent of Required Examination ㉢ Acceptance Criteria for Welds. Table 341.3.2 ㉣ Category D Fluid, Severe Cyclic Condition에 따른 Acceptance Criteria for Welds의 기준 ㉤ Type of Examination
Testing	345	㉠ Leak Test(Hydrostatic, Pneumatic, Service, Sensitive 등)
Records	346	

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.1 ASME B31.3 OVERVIEW

CONTENTS	PARA.	REMARK
CHAPTER VII Nonmetallic Piping and Piping Lined With Nonmetals		
Nonmetallic Piping and Piping Lined With Nonmetals	A300 ~ A346	(a) CHAPTER I ~VI(Base Code) 내용을 Modify한다. (b) Nonmetallic and Lined w/Nonmetals 에 대한 Provision, Requirements 등을 정의한다. (c) Sever Cyclic Condition에 대하여서는 Provision이 없다.
CHAPTER VIII Piping for Category M Fluid Service		
Piping for Category M Fluid Service	M300 ~ M345	(a) CHAPTER I ~VI(Base Code) 내용을 Modify한다.
	MA300 ~ MA346	(b) CHAPTER VII 내용을 Modify한다.
CHAPTER IX High Pressure Piping		
High Pressure Piping	K300 ~ K346	(a) CHAPTER I ~VI(Base Code) 내용을 Modify한다.
Appendices		
Appendix A	Allowable Stresses and Quality Factors for Metallic Piping and Bolting Materials	
Appendix B	Stress Tables and Allowable Pressure Tables for Nonmetals	
Appendix C	Physical Properties of Piping Materials	
Appendix D	Flexibility and Stress Intensification Factors	
Appendix E	Reference Standards	
Appendix F	Precautionary Considerations	
Appendix G	Safeguarding	
Appendix H	Sample Calculations for Branch Reinforcement	
Appendix J	Nomenclature	
Appendix K	Allowable Stresses for High Pressure Piping	
Appendix L	Aluminum Alloy Pipe Flanges	
Appendix M	Guide to classifying Fluid Services	
Appendix Q	Quality System Program	
Appendix V	Allowable Variations in Elevated Temperature Service	
Appendix X	Metallic Bellows Expansion Joints	
Appendix Z	Preparation of Technical Inquiries	

Definitions (Para. 300.2)**1. Category D Fluid Service**

A fluid service in which all the following apply

- (1) the fluid handled is nonflammable, nontoxic, and not damaging to human tissues as defined in para. 300.2
- (2) the design gage pressure does not exceed 1035 kPA (150psi, 10.5kg/cm²)
- (3) the design temperature is from -29°C (-20°F) through 186°C(366°F)

2. Category M Fluid Service

A fluid service in which the potential for personnel exposure is judged to be significant and in which a single exposure to a very small quantity of a toxic fluid, caused by leakage, can produce serious Irreversible harm to persons on breathing or bodily contact, even when prompt restorative measures are taken.

3. High Pressure Fluid Service

A fluid service for which the owner specifies the use of Chapter IX for piping design and construction ; see also para.K300.

4. Normal Fluid Service

A fluid service pertaining to most piping covered by this Code, I.e., not subject to the rules for Category D, Category M, or High Pressure Fluid Service.

5. Severe Cyclic Conditions

Conditions applying to specific piping components or joints in which S_e computed in accordance with para.319.4.4 exceeds 0.8 S_a (as defined in para.302.3.5), and the equivalent number of cycles (N in para.302.3.5) exceeds 7000; or other conditions which the designer determines will produce an equivalent effect.

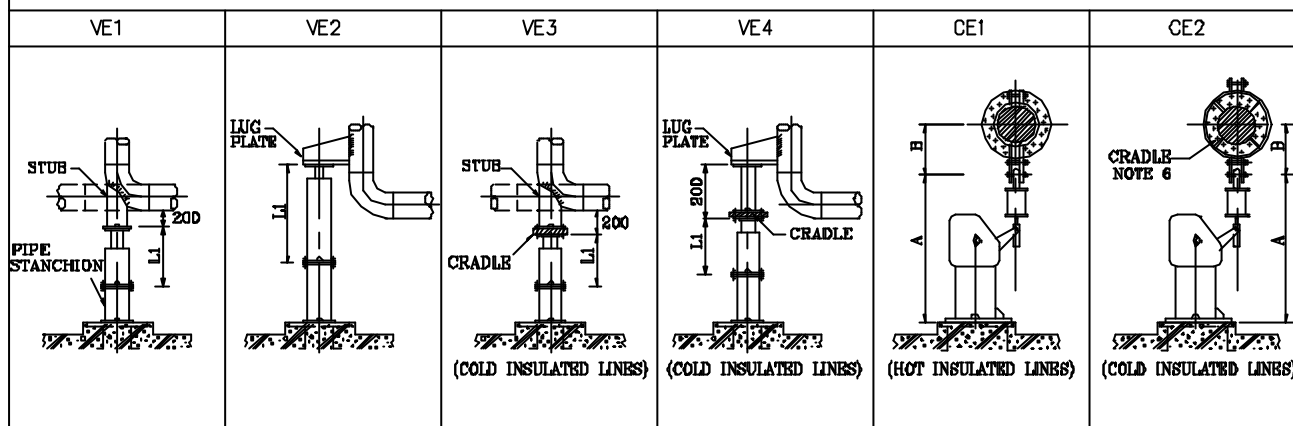
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.2. SPRING SELECTION DWG

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 1 OF 4
 DATE : DEC., 1995

VARIABLE/CONSTANT TYPE SPRING



SPRING SIZE	VE1			VE2			VE3			VE4			SPRING SIZE	CE1 /CE2	CLA- MP SIZE	CE1	CE2
	VSS	VSM	VSL	VSS	VSM	VSL	VSS	VSM	VSL	VSS	VSM	VSL		A (mm)		B (mm)	
	L1 (mm)																
0	220	320	550	220	320	550	220	320	550	220	320	550	1~5	1000	3/4"	65	65
1	220	320	550	220	320	550	220	320	550	220	320	550	6~10	1000	1"	65	65
2	220	340	590	220	340	590	220	340	590	220	340	590	11~15	1000	1.1/2"	105	105
3	240	340	590	240	340	590	240	340	590	240	340	590	16~20	1000	2"	160	160
4	240	350	610	240	350	610	240	350	610	240	350	610	21~25	1300	3"	175	175
5	240	350	610	240	350	610	240	350	610	240	350	610	26~30	1300	4"	200	200
6	270	380	660	270	380	660	270	380	660	270	380	660	31~35	1300	5"	210	210
7	270	380	660	270	380	660	270	380	660	270	380	660	36~40	1500	6"	235	235
8	300	420	740	300	420	740	300	420	740	300	420	740	41~45	1500	8"	260	260
9	300	440	740	300	440	740	300	440	740	300	440	740	46~50	1500	10"	305	305
10	300	440	750	300	440	750	300	440	750	300	440	750	51~55	1800	12"	330	330
11	320	440	750	320	440	750	320	440	750	320	440	750	56~60	1800	14"	360	360
12	320	460	790	320	460	790	320	460	790	320	460	790	61~65	1800	16"	390	390
13	340	500	860	340	500	860	340	500	860	340	500	860	66~70	-	18"	410	410
14	360	530	920	360	530	920	360	530	920	360	530	920	71~75	-	20"	440	440
15	370	530	920	370	530	920	370	530	920	370	530	920	76~80	-	24"	490	490
16	410	580	1030	410	580	1030	410	580	1030	410	580	1030	81~85	-	26"	530	530
17	430	640	1150	430	640	1150	430	640	1150	430	640	1150	86~90	-	28"	560	560
18	480	660	1140	480	660	1140	480	660	1140	480	660	1140	91~95	-	30"	585	585
19	520	730	1270	520	730	1270	520	730	1270	520	730	1270	96~100	-	32"	785	785
20	560	780	1380	560	780	1380	560	780	1380	560	780	1380	101~105	-	34"	825	825
21	620	860	1520	620	860	1520	620	860	1520	620	860	1520	106~110	-	36"	885	885
22	700	1050	1900	700	1050	1900	700	1050	1900	700	1050	1900	-	-	38"	900	900

Notes :

1. All dimensions are in mm except spring size unless otherwise noted.
2. These tables should be used only for preliminary support & hanger design and be checked by vendor.
3. These tables are based on unison data.
4. Data listed above are minimum requirements.
5. VSS(short type), VSM(media type), VSL(long type)
6. Clamp size is different from pipe size according to cold insulation thickness.
7. Spring size and type shall be provided by stress engineer.

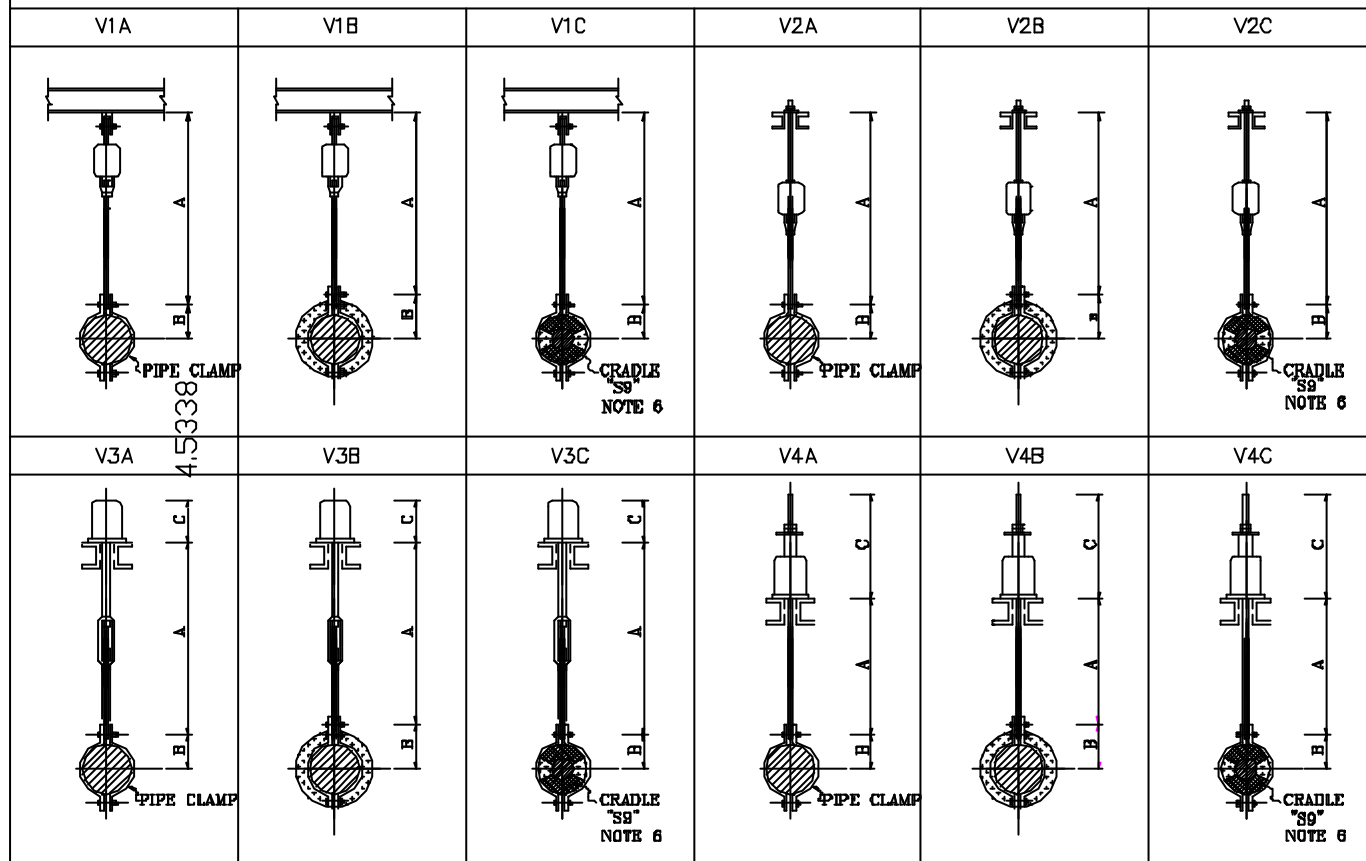
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.2. SPRING SELECTION DWG

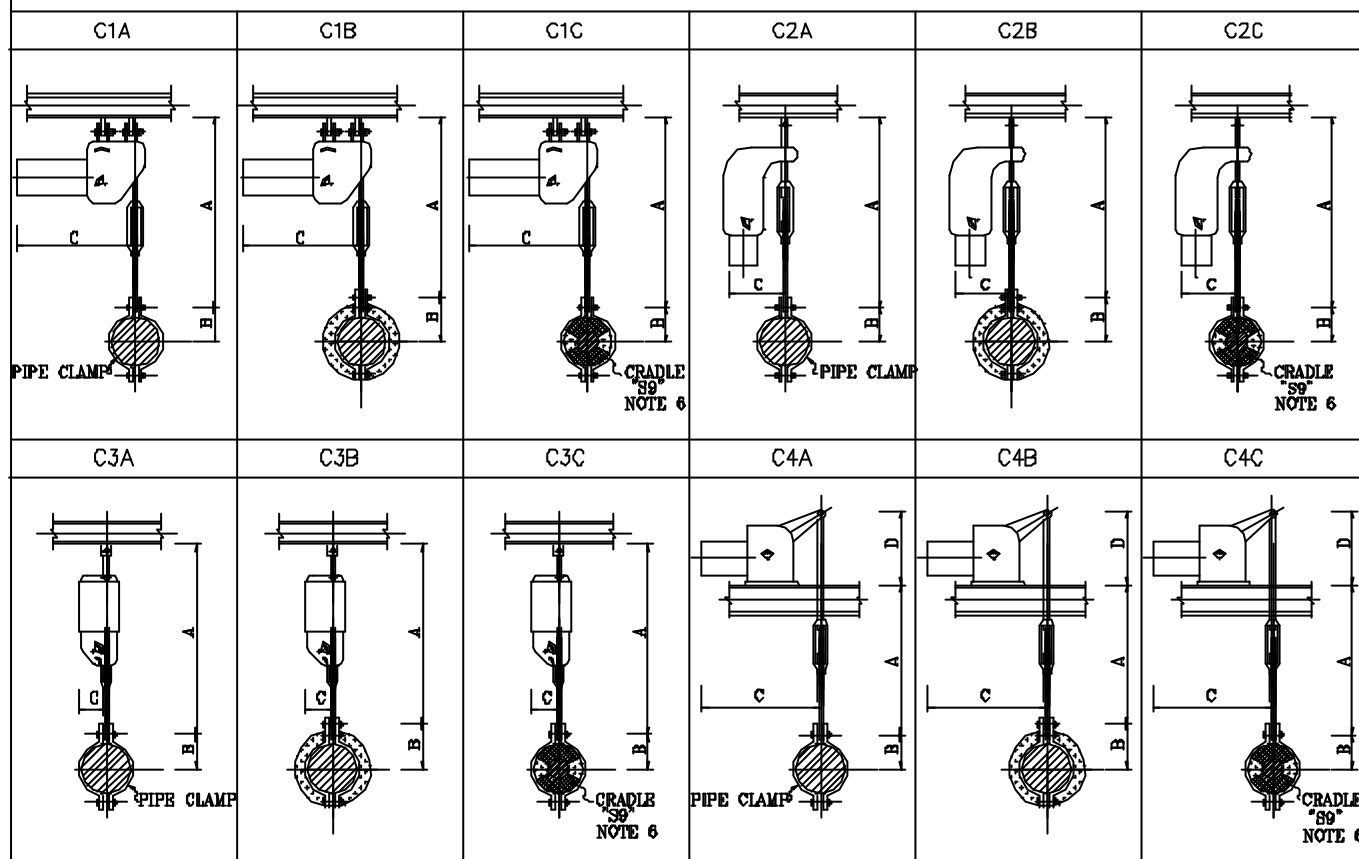
 LDP-L901
REV. 1 (OCT., 2002)
PAGE : 2 OF 4
DATE : DEC., 1995

VARIABLE TYPE SPRING



SPRING SIZE	V1A/V1B/V1C			V2A/V2B/V2C			V3A/V3B/V3C			V4A/V4B/V4C			V3A/V3B/V3C			V4A/V4B/V4C			CLA MP SIZE	V1/2/ 3/4A	V1/2/ 3/4B	V1/2/ 3/4C
	VSS	VSM	VSL	VSS	VSM	VSL	VSS	VSM	VSL	VSS	VSM	VSL	VSS	VSM	VSL	VSS	VSM	VSL				
	A (mm)												C (mm)							B (mm)		
0	550	650	900	850	950	1200	700	700	700	500	500	500	188	273	479	188	273	479	3/4"	35	65	35
1	550	650	900	850	950	1200	700	700	700	500	500	500	193	273	479	193	273	479	1"	40	65	40
2	550	650	900	850	950	1200	700	700	700	500	500	500	198	293	519	198	293	519	1.1/2"	55	105	55
3	550	650	900	850	950	1200	700	700	700	500	500	500	198	293	519	198	293	519	2"	60	160	60
4	550	650	900	850	950	1200	700	700	700	500	500	500	198	303	539	198	303	539	3"	75	175	75
5	550	650	900	850	950	1200	700	700	700	500	500	500	198	303	539	198	303	539	4"	95	200	95
6	550	650	1000	850	950	1300	700	700	700	500	500	500	222	327	583	222	327	583	5"	110	210	110
7	550	650	1100	850	950	1300	700	700	700	500	500	500	222	327	583	222	327	583	6"	125	235	125
8	600	750	1100	900	1050	1400	700	700	700	500	500	500	247	367	663	247	367	663	8"	150	260	150
9	600	750	1100	900	1050	1400	700	700	700	500	500	500	252	367	654	252	367	654	10"	200	305	200
10	600	750	1100	900	1050	1400	700	700	700	500	500	500	252	373	662	252	373	662	12"	225	330	225
11	600	750	1100	900	1050	1400	700	700	700	500	500	500	267	373	664	267	373	664	14"	245	360	245
12	700	800	1200	1000	1100	1500	700	700	700	500	500	500	285	405	717	285	405	717	16"	280	390	280
13	700	800	1200	1000	1100	1500	700	700	700	500	500	500	301	444	792	301	444	792	18"	310	410	310
14	800	900	1300	1100	1200	1600	700	700	700	500	500	500	340	490	868	340	490	868	20"	350	440	350
15	800	900	1300	1100	1200	1600	700	700	700	500	500	500	361	507	888	361	507	888	24"	400	490	400
16	800	1000	1400	1100	1300	1700	700	700	700	500	500	500	406	568	995	406	568	995	26"	430	530	430
17	850	1100	1700	1150	1400	2000	700	700	700	500	500	500	452	647	1138	452	647	1138	28"	450	560	450
18	950	1100	1700	1250	1400	2000	700	700	700	500	500	500	483	647	1109	483	647	1109	30"	480	585	480
19	950	1300	1900	1250	1600	2200	700	700	700	500	500	500	532	732	1264	532	732	1264	32"	505	785	505
20	1200	1400	2000	1500	1700	2300	700	700	700	500	500	500	586	805	1396	586	805	1396	34"	545	825	545
21	1200	1500	2200	1500	1800	2500	700	700	700	500	500	500	631	898	1548	631	898	1548	36"	565	885	565
22	1300	1600	2500	1600	1900	2800	700	700	700	500	500	500	751	1064	1872	751	1064	1872	38"	700	900	700

CONSTANT TYPE SPRING



SPRING SIZE	C1A/B/C	C2A/B/C	C3A/B/C	C4A/B/C	C1A/B/C	C2A/B/C	C3A/B/C	C4A/B/C	C4A/B/C	CLAMP SIZE	C1/2/3/4A	C1/2/3/4B	C1/2/3/4C
	A (mm)				C (mm)				D (mm)		B (mm)		
1~5	500	700	1000	1000	400	300	300	400	205	3/4"	35	65	35
6~10	500	700	1000	1000	400	300	300	400	205	1"	40	65	40
11~15	500	700	1000	1000	500	300	300	500	250	1.1/2"	55	105	55
16~20	500	700	1000	1000	500	300	300	500	250	2"	60	160	60
21~25	600	1000	1300	1000	500	350	350	500	360	3"	75	175	75
26~30	600	1000	1300	1000	700	350	350	700	360	4"	95	200	95
31~35	600	1000	1300	1000	700	350	350	700	360	5"	110	210	110
36~40	800	1200	1500	1000	1000	400	400	1000	395	6"	125	235	125
41~45	800	1200	1500	1000	1000	400	400	1000	395	8"	150	260	150
46~50	800	1200	1500	1000	1000	400	400	1000	395	10"	200	305	200
51~55	950	1650	1950	1000	1300	500	500	1300	502	12"	225	330	225
56~60	950	1650	1950	1000	1300	500	500	1300	502	14"	245	360	245
61~65	950	1650	1950	1000	1300	500	500	1300	502	16"	280	390	280
66~70	1200	2200	2500	1000	1600	650	650	1600	683	18"	310	410	310
71~75	1200	2200	2500	1000	1600	650	650	1600	683	20"	350	440	350
76~80	1200	2200	2500	1000	1600	650	650	1600	810	24"	400	490	400
81~85	1200	2200	2500	1000	1600	650	650	1600	810	26"	430	530	430
86~90	2000	1400	1700	1000	1900	900	900	1900	865	28"	450	560	450
91~95	2000	1400	1700	1000	1900	900	900	1900	865	30"	480	585	480
96~100	2000	1800	2100	1000	2500	1000	1000	2500	940	32"	505	785	505
101~105	2000	1800	2100	1000	2500	1000	1000	2500	940	34"	545	825	545
106~110	2000	1800	2100	1000	2500	1000	1000	2500	940	36"	565	885	565
										38"	700	900	700

VARIABLE TYPE SPRING

Notes :

1. All dimensions are in mm except spring size unless otherwise noted.
2. These tables should be used only for preliminary support & hanger design and be checked by vendor.
3. These tables are based on unison data.
4. Data listed above are minimum requirements.
5. VSS(short type), VSM(medium type), VSL(long type)
6. Clamp size is different from pipe size according to cold insulation thickness
7. Spring size and type shall be provided by stress engineer.

CONSTANT TYPE SPRING

Notes :

1. All dimensions are in mm except spring size unless otherwise noted.
2. These tables should be used only for preliminary support & hanger design and be checked by vendor.
3. These tables are based on unison data.
4. Data listed above are minimum requirements.
5. Clamp size is different from pipe size according to cold insulation thickness.
6. Spring size and type shall be provided by stress engineer.

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.3 ALLOWABLE PIPE SPAN(C.S)

Unit : m

SIZE	SCH	Deflection (mm)	UNINSULATED LINE		INSULATED LINE					
			EMPTY PIPE	WATER FILLED PIPE	EMPTY PIPE			WATER FILLED PIPE		
					50mm INSUL.	100mm INSUL.	150mm INSUL.	50mm INSUL.	100mm INSUL.	150mm INSUL.
1/2"	40	16.0	3.9	3.8	3.0	2.4	2.0	3.0	2.4	2.0
	80	16.0	3.8	3.8	3.1	2.5	2.1	3.0	2.5	2.1
3/4"	40	16.0	4.4	4.2	3.5	2.8	2.4	3.5	2.8	2.4
	80	16.0	4.4	4.2	3.6	2.9	2.5	3.6	2.9	2.5
1"	40	16.0	5.0	4.7	4.1	3.4	2.9	4.0	3.4	2.9
	80	16.0	4.9	4.7	4.2	3.5	3.1	4.1	3.5	3.0
1.1/2"	40	16.0	6.1	5.7	5.2	4.5	3.9	5.0	4.4	3.9
	80	16.0	6.0	5.7	5.3	4.6	4.1	5.2	4.5	4.0
	160	16.0	5.9	5.7	5.3	4.7	4.2	5.2	4.7	4.2
	XXS	16.0	5.7	5.6	5.3	4.8	4.3	5.2	4.7	4.3
2"	40	16.0	6.8	6.3	6.0	5.2	4.6	5.7	5.1	4.5
	80	16.0	6.7	6.4	6.1	5.4	4.8	5.9	5.3	4.8
	160	16.0	6.6	6.4	6.1	5.6	5.0	6.0	5.5	5.0
	XXS	16.0	6.4	6.3	6.1	5.6	5.1	6.0	5.5	5.1
3"	40	16.0	8.3	7.6	7.6	6.9	6.3	7.1	6.6	6.1
	80	16.0	8.2	7.7	7.7	7.1	6.5	7.3	6.8	6.3
	160	16.0	8.0	7.7	7.7	7.2	6.7	7.4	7.0	6.6
	XXS	16.0	7.9	7.7	7.6	7.2	6.7	7.4	7.1	6.7
4"	40	16.0	9.4	8.5	8.8	8.1	7.4	8.1	7.6	7.1
	80	16.0	9.3	8.7	8.8	8.3	7.7	8.3	7.9	7.4
6"	40	16.0	11.5	10.1	10.9	10.2	9.6	9.8	9.4	8.9
	80	16.0	11.4	10.5	11.0	10.4	9.9	10.2	9.8	9.4
8"	20	16.0	13.2	11.1	12.5	11.7	11.0	10.8	10.4	10.0
	30	16.0	13.2	11.3	12.5	11.8	11.1	10.9	10.5	10.1
	40	16.0	13.2	11.4	12.6	11.9	11.3	11.1	10.7	10.4
	80	16.0	13.0	11.9	12.6	12.2	11.7	11.6	11.3	10.9
10"	20	16.0	14.8	12.1	14.0	13.2	12.5	11.7	11.4	11.0
	30	16.0	14.8	12.4	14.1	13.4	12.7	12.1	11.7	11.4
	40	16.0	14.7	12.6	14.1	13.5	12.9	12.4	12.0	11.7
	80	16.0	14.6	13.2	14.2	13.8	13.3	13.0	12.7	12.4
12"	20	16.0	16.2	12.8	15.3	14.5	13.7	12.5	12.2	11.8
	30	16.0	16.1	13.3	15.4	14.7	14.1	13.0	12.7	12.4
	40	16.0	16.1	13.7	15.5	14.9	14.3	13.4	13.1	12.8
	80	16.0	15.9	14.4	15.5	15.1	14.7	14.1	13.9	13.6
14"	20	16.0	16.9	13.7	16.2	15.4	14.7	13.4	13.1	12.8
	40	16.0	16.8	14.3	16.3	15.7	15.2	14.0	13.8	13.5
16"	20	16.0	18.1	14.3	17.3	16.6	15.9	14.1	13.8	13.5
	40	16.0	18.0	15.3	17.5	17.0	16.4	15.0	14.8	14.5
18"	20	16.0	19.2	14.9	18.4	17.6	16.9	14.7	14.4	14.1
	40	16.0	19.1	16.2	18.6	18.1	17.6	16.0	15.7	15.5
20"	20	16.0	20.2	15.9	19.5	18.8	18.1	15.7	15.5	15.2
	40	16.0	20.1	17.0	19.7	19.2	18.7	16.8	16.5	16.3
24"	20	16.0	22.2	17.0	21.4	20.7	20.0	16.7	16.5	16.3
	40	16.0	22.1	18.5	21.6	21.2	20.7	18.3	18.1	17.9

Notes :

- Pipe material is A53 Gr.B and insulation material is perlite.
- Design temperature is 100°C for uninsulated line and 200°C for insulated line.
- If concentrated load exists such as valve then consult with stress engineer.

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.3 ALLOWABLE PIPE SPAN(S.S)

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 2 OF 5
 DATE : DEC., 1995

Unit : m

SIZE	SCH	Deflection (mm)	UNINSULATED LINE		INSULATED LINE					
			EMPTY PIPE	WATER FILLED PIPE	EMPTY PIPE			WATER FILLED PIPE		
					50mm INSUL.	100mm INSUL.	150mm INSUL.	50mm INSUL.	100mm INSUL.	150mm INSUL.
1/2"	40S	16.0	3.9	3.8	3.0	2.4	2.0	3.0	2.4	2.0
	80S	16.0	3.8	3.7	3.0	2.4	2.1	3.0	2.4	2.1
3/4"	40S	16.0	4.4	4.2	3.5	2.8	2.4	3.4	2.8	2.4
	80S	16.0	4.3	4.2	3.6	2.9	2.5	3.5	2.9	2.5
1"	40S	16.0	4.9	4.7	4.1	3.4	2.9	4.0	3.3	2.9
	80S	16.0	4.8	4.7	4.2	3.5	3.0	4.1	3.5	3.0
1.1/2"	5S	16.0	6.1	5.3	4.8	3.9	3.3	4.5	3.8	3.3
	10S	16.0	6.1	5.5	5.1	4.3	3.7	4.8	4.1	3.6
	40S	16.0	6.0	5.6	5.2	4.4	3.9	5.0	4.3	3.8
	80S	16.0	5.9	5.6	5.3	4.6	4.0	5.1	4.5	4.0
2"	5S	16.0	6.9	5.7	5.5	4.5	3.9	5.0	4.3	3.8
	10S	16.0	6.8	6.1	5.8	4.9	4.3	5.4	4.7	4.2
	40S	16.0	6.7	6.2	5.9	5.2	4.6	5.6	5.0	4.5
	80S	16.0	6.7	6.3	6.0	5.4	4.8	5.8	5.2	4.7
3"	5S	16.0	8.4	6.8	7.0	6.0	5.3	6.2	5.6	5.1
	10S	16.0	8.3	7.1	7.3	6.4	5.7	6.6	6.0	5.4
	40S	16.0	8.2	7.5	7.5	6.8	6.2	7.1	6.5	6.0
	80S	16.0	8.1	7.6	7.6	7.0	6.4	7.2	6.7	6.3
4"	40S	16.0	9.3	8.4	8.7	8.0	7.4	8.0	7.5	7.0
	80S	16.0	9.2	8.6	8.8	8.2	7.6	8.3	7.8	7.4
6"	40S	16.0	11.4	10.0	10.8	10.1	9.5	9.7	9.3	8.8
	80S	16.0	11.3	10.4	10.8	10.3	9.8	10.1	9.7	9.3
8"	5S	16.0	13.2	9.7	11.7	10.6	9.7	9.3	8.9	8.5
	10S	16.0	13.2	10.2	12.0	11.0	10.2	9.8	9.4	9.0
	40S	16.0	13.0	11.3	12.4	11.8	11.2	11.0	10.6	10.2
	80S	16.0	12.9	11.7	12.5	12.0	11.5	11.5	11.2	10.8
10"	5S	16.0	14.7	10.8	13.4	12.3	11.4	10.5	10.1	9.7
	10S	16.0	14.7	11.2	13.6	12.6	11.7	10.9	10.5	10.1
	40S	16.0	14.6	12.5	14.0	13.4	12.8	12.2	11.9	11.6
	80S	16.0	14.5	12.9	14.1	13.6	13.1	12.7	12.4	12.0
12"	5S	16.0	16.1	11.7	14.8	13.7	12.8	11.4	11.1	10.7
	10S	16.0	16.0	12.0	14.9	13.9	13.0	11.7	11.4	11.0
	40S	16.0	15.9	13.4	15.3	14.7	14.1	13.1	12.8	12.5
	80S	16.0	15.8	13.8	15.4	14.9	14.4	13.6	13.3	13.0
14"	5S	16.0	16.8	12.1	15.5	14.4	13.5	11.8	11.5	11.1
	10S	16.0	16.8	12.5	15.7	14.7	13.8	12.2	11.9	11.6
16"	5S	16.0	18.0	12.7	16.7	15.5	14.6	12.5	12.2	11.9
	10S	16.0	18.0	13.0	16.8	15.8	14.8	12.8	12.5	12.2
18"	5S	16.0	19.1	13.2	17.7	16.5	15.6	12.9	12.7	12.4
	10S	16.0	19.1	13.5	17.8	16.8	15.8	13.3	13.0	12.7
20"	5S	16.0	20.1	14.0	18.8	17.7	16.7	13.7	13.5	13.2
	10S	16.0	20.1	14.4	19.0	17.9	17.0	14.1	13.9	13.6
24"	5S	16.0	22.1	15.2	20.8	19.7	18.8	15.0	14.8	14.5
	10S	16.0	22.0	15.6	20.9	19.9	19.1	15.4	15.2	14.9

Notes :

1. Pipe material is A312 TP304 and insulation material is perlite.
2. Design temperature is 100°C for uninsulated line and 200°C for insulated line.
3. If concentrated load exists such as valve then consult with stress engineer.

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.3 ALLOWABLE PIPE SPAN(PVC)

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 3 OF 5
 DATE : DEC., 1995

SIZE	SCH	PIPE SPAN (M)					
		BARE PIPE			PIPE+WATER FILLED		
		DESIGN TEMP(°C)			DESIGN TEMP(°C)		
		15(60°F)	40(100°F)	60(140°F)	15(60°F)	40(100°F)	60(140°F)
1/2"	40	1.5	1	1	1	1	1
	80	1.5	1	1	1	1	1
3/4"	40	1.5	1.5	1	1	1	1
	80	1.5	1.5	1.5	1	1	1
1"	40	1.5	1.5	1.5	1	1	1
	80	2	1.5	1.5	1.5	1	1
1-1/4"	40	2	2	1.5	1.5	1.5	1
	80	2	2	2	1.5	1.5	1.5
1-1/2"	40	2	2	2	1.5	1.5	1.5
	80	2	2	2	1.5	1.5	1.5
2"	40	2	2	2	1.5	1.5	1.5
	80	2	2	2	1.5	1.5	1.5
3"	40	2	2	2	1.5	1.5	1.5
	80	2.5	2.5	2	2	2	1.5
4"	40	2.5	2.5	2.5	2	2	2
	80	3	2.5	2.5	2.5	2	2
6"	40	3	3	2.5	2.5	2.5	2
	80	3	3	3	2.5	2.5	2.5
8"	40	3	3	3	2.5	2.5	2.5
	80	3.5	3.5	3	3	3	2.5
10"	40	3.5	3.5	3	3	3	2.5
	80	4	4	3.5	3.5	3.5	3
12"	40	4	4	3.5	3.5	3.5	3
	80	4.5	4	4	4	3.5	3.5

Notes :
1. Material

1) PVC (Poly Vinyl Chloride)PIPE : ASTM D1785

2) CPVC (Chlorinated Poly Vinyl Chloride) PIPE : ASTM F441

2. Reference data

1) data based on manufacture's (by R&G SLOANE MANUF.CO.,INC.)

2) specific gravity : PVC (1.4), CPVC (1.54)

3) Max. Temp.(°C) : PVC (60°C(140°F)), CPVC (100°C(210°F))

 4) Max. Press(kg/cm²) : PVC (13), CPVC (10)

3. If Concentrated load exists such as Valve, then Consult with Stress Engineer.



PIPING HANDBOOK

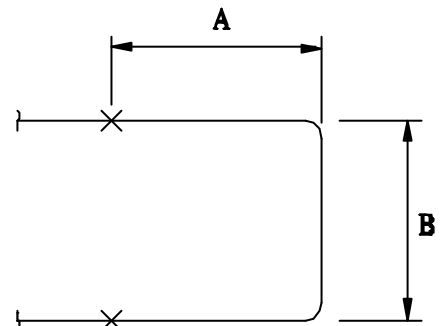
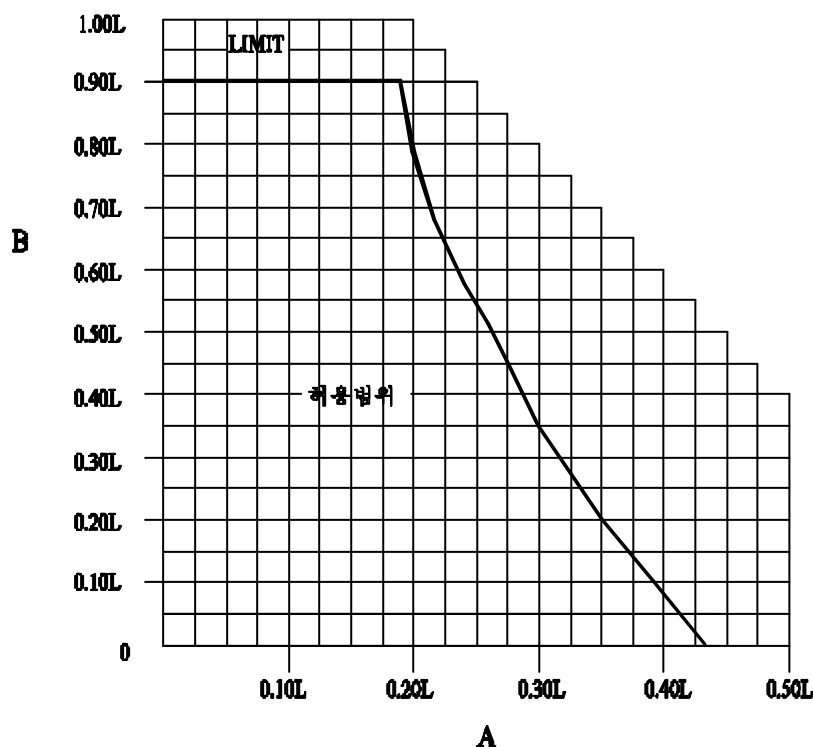
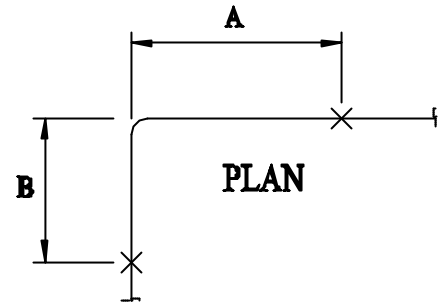
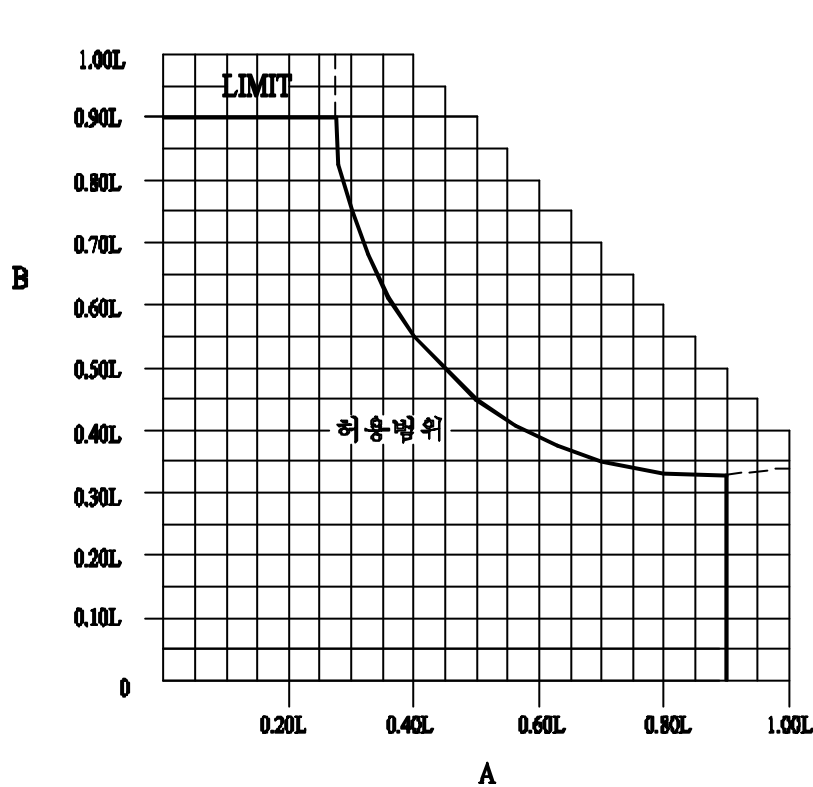
2. PIPING DESIGN REFERENCES

2.3 ALLOWABLE PIPE SPAN

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 4 OF 5
DATE : DEC. 1995

"L형, ㄷ형"

OVER-HANG FOR PIPES AT CORNERS

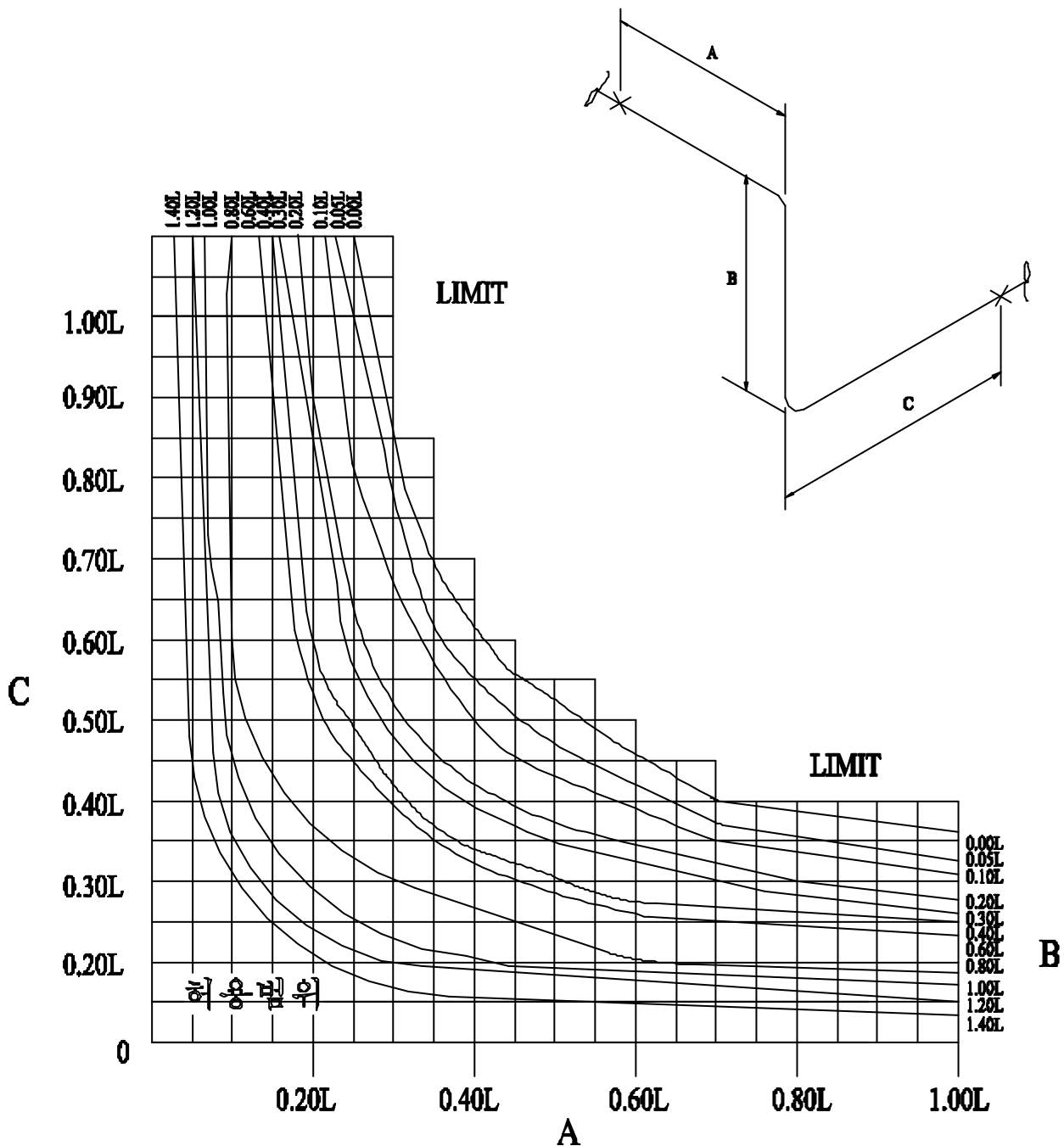


NOTE : "L" 은 직판경우의 ORDINARY SPAN 을 나타냄.



"ㄱ형"

OVER-HANG FOR PIPES AT CORNERING



NOTE: "L" 은 직관경우의 ORDINARY SPAN 을 나타냄.



LG E&C

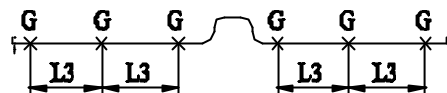
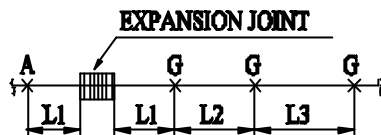
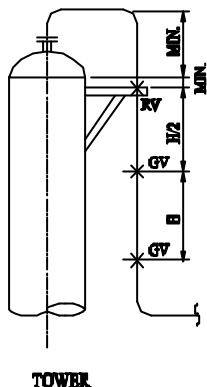
**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.4 MAX. GUIDE SPAN

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995



UNIT:M

VERTICAL	NOMINAL SIZE	HORIZONTAL		
H	(Inch)	L1	L2	L3
4	1/2	-	L1 X 3	MAX. GUIDE SPAN X(2~3)
4	1	-		
4.5	1.1/2	-		
5.5	2	0.2		
5.5	2.1/2	0.25		
6.5	3	0.3		
7.5	4	0.4		
9	5	0.5		
10	6	0.6		
10	8	0.8		MAX. GUIDE SPAN X(3~4)
11	10	1.0		
12	12	1.2		
12.5	14	1.4		
13	16	1.6		
13.5	18	1.8		
14	20	2.0		
14	22	2.2		
15	24	2.4		
	26	2.6		
	28	2.8		
	30	3.0		
	32	3.8		
	42	4.2		
	48	4.3		
	54	5.4		
	60	6.0		

NOTES : 1. EXPANSION LOOP 등과 같이 열하중에 의한 변위를 제한할 경우에는

STRESS 해석 담당자와 협의하여 GUIDE 위치를 결정함.

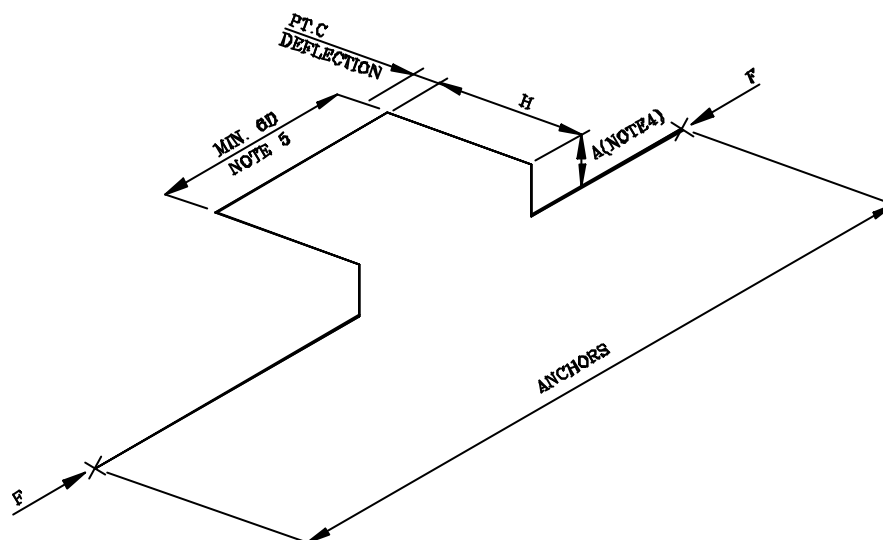
2. VERTICAL LINE 에서 RESTING 및 GUIDE 의 설치높이가

지상으로 부터 20m 이상이 되면 WIND FORCE 을 고려하여 GUIDE
SPAN 을 결정한다 (H/2)

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.5 RACK PIPING LOOP ARM ANCHOR



EXPANS. BETWEEN ANCHORS (mm)	NOM. PIPE SIZE	H LOOP DIMENSION (mm)	F ANCHOR FORCE (kg)	PT.C COLD DEFL. Note 3 (mm)	H LOOP DIMENSION (mm)	F ANCHOR FORCE (kg)	PT.C COLD DEFL. Note 3 (mm)	H LOOP DIMENSION (mm)	F ANCHOR FORCE (kg)	PT.C COLD DEFL. Note 3 (mm)
		SCH 20			STD			SCH 40		
50	3	2000	150	15	2000	150	15	2000	150	15
	4	2000	300	15	2000	300	15	2000	300	15
	6	2500	500	11	2500	500	11	2500	500	11
	8	2500	700	9	2500	1050	10	2500	1050	10
	10	2700	850	8	2700	1550	9	2700	1550	9
	12	2700	1150	8	2700	2200	9	2700	2450	9
	14	2700	1850	9	2700	2500	9	3000	2550	8
	16	3000	1850	8	3000	2500	8	3500	2900	7
	18	3200	1950	8	3200	2650	8	4200	2900	6
	20	3500	2600	8	3500	2600	8	4700	3000	6
75	24	3700	2950	8	3700	2950	8	6000	2900	5
	3	2500	150	18	2500	150	18	2500	150	18
	4	3000	200	14	3000	200	14	3000	200	14
	6	3200	450	12	3200	450	12	3200	450	12
	8	3500	550	9	3500	750	10	3500	750	10
	10	3700	700	8	3700	1200	9	3700	1200	9
	12	4000	750	8	4000	1450	8	4000	1650	9
	14	4000	1250	8	4000	1700	9	4000	2150	9
	16	4000	1550	9	4000	2100	9	4500	2600	8
	18	4000	1900	9	4000	2500	9	5200	2800	7
100	20	4000	2950	10	4000	2950	10	6000	2700	7
	24	4500	2950	9	4500	2950	9	7200	2950	6
	3	3200	150	19	3200	150	19	3200	150	19
	4	3500	200	16	3500	200	16	3500	200	16
	6	4000	400	12	4000	400	12	4000	400	12
	8	4500	400	10	4500	600	10	4500	600	10
	10	4500	600	9	4500	1050	10	4500	1050	10
	12	4700	700	9	4700	1350	9	4700	1550	10
	14	4700	1200	9	4700	1600	10	4700	2050	10
	16	5000	1300	9	5000	1750	9	5000	2750	10
	18	5000	1600	9	5000	2100	10	6000	2750	8
	20	5000	2500	10	5000	2500	10	6700	2800	8
	24	5200	2950	11	5200	2950	11	8200	2950	7

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

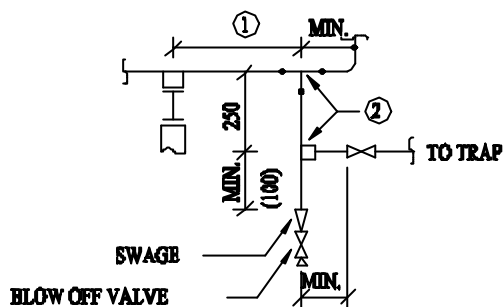
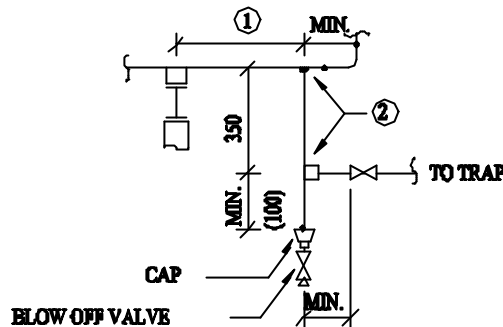
2.5 RACK PIPING LOOP ARM ANCHOR

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 2 OF 2
 DATE : DEC., 1995

EXPANS. BETWEEN ANCHORS (mm)	NOM. PIPE SIZE	H LOOP DIMENSION (mm)	F ANCHOR FORCE (kg)	PT.C COLD DEFL. Note 3 (mm)	H LOOP DIMENSION (mm)	F ANCHOR FORCE (kg)	PT.C COLD DEFL. Note 3 (mm)	H LOOP DIMENSION (mm)	F ANCHOR FORCE (kg)	PT.C COLD DEFL. Note 3 (mm)
		SCH 20			STD			SCH 40		
125	3	3700	100	20	3700	100	20	3700	100	20
	4	4200	150	16	4200	150	16	4200	150	16
	6	5000	300	12	5000	300	12	5000	300	12
	8	5200	400	9	5200	550	11	5200	550	11
	10	5500	500	9	5500	850	10	5500	850	10
	12	6000	550	8	6000	1000	9	6000	1150	9
	14	6000	900	9	6000	1200	9	6000	1500	9
	16	6000	1100	9	6000	1500	9	6200	2200	10
	18	6000	1350	10	6000	1800	10	6500	2900	9
	20	6000	2100	10	6000	2100	10	7500	2750	9
	24	6000	2700	11	6000	2700	11	9200	2900	8
150	3	4200	100	21	4200	100	21	4200	100	21
	4	4700	150	17	4700	150	17	4700	150	17
	6	5500	300	13	5500	300	13	5500	300	13
	8	6000	350	11	6000	500	11	6000	500	11
	10	6200	450	10	6200	800	11	6200	800	11
	12	6500	550	9	6500	1000	10	6500	1150	10
	14	6700	850	10	6700	1150	10	6700	1450	10
	16	7000	950	9	7000	1300	10	7000	2000	10
	18	7000	1150	10	7000	1550	10	7200	2800	10
	20	7000	1850	11	7000	1850	11	8000	2900	10
	24	7200	2200	11	7200	2200	11	-	-	-
175	3	4700	100	22	4700	100	22	4700	100	22
	4	5500	150	17	5500	150	17	5500	150	17
	6	6200	250	14	6200	250	14	6200	250	14
	8	7000	300	11	7000	400	11	7000	400	11
	10	7000	400	10	7000	700	11	7000	700	11
	12	7500	450	9	7500	850	10	7500	1000	10
	14	7500	750	10	7500	1050	10	7500	1300	10
	16	7500	950	10	7500	1300	10	7500	2050	11
	18	7500	1150	11	7500	1550	11	7700	2800	11
	20	7500	1850	11	7500	1850	11	8500	2950	10
	24	7700	2200	12	7700	2200	12	-	-	-
200	3	5200	100	23	5200	100	23	5200	100	23
	4	6000	100	18	6000	100	18	6000	100	18
	6	7000	250	14	7000	250	14	7000	250	14
	8	7500	300	11	7500	400	12	7500	400	12
	10	8000	350	10	8000	600	11	8000	600	11
	12	8200	450	10	8200	800	10	8200	950	11
	14	8200	750	10	8200	950	11	8200	1250	11
	16	8200	900	11	8200	1200	11	8200	1900	11
	18	8200	1100	11	8200	1450	11	8500	2700	11
	20	8500	1600	12	8500	1600	12	9200	2850	11
	24	8500	2050	13	8500	2050	13	-	-	-

Notes :

- Table 은 Miter 등이 아닌 Welding Elbow 를 기준으로 작성됨.
- Table 의 Anchor Force 는 Thermal Force 임 (Friction Force 는 제외)
- Actual Deflection = Cold Deflection + Hx (Expansion/m) (Pipe Line 이 Grouping 될 시에는 충분한 여유를 주어야 함.)
- Table 은 Min. 값을 기준으로 작성됨.
- D = Nominal Pipe dimension

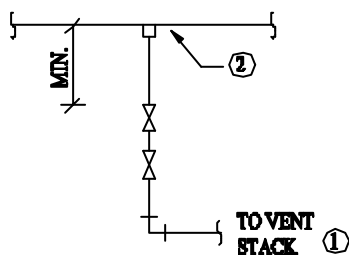
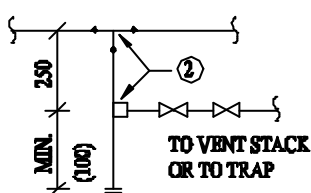
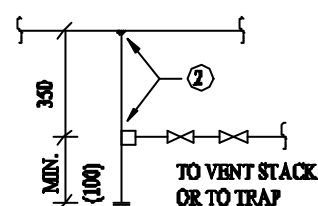
STEAM
DRIP POT
3/4" - 3" HEADER

4" AND LARGER HEADER

DRIP POT & VALVE SIZE

HEADER SIZE	DRIP POT SIZE	BLOWOFF VALVE SIZE	LINE SIZE TO TRAP
4" & SMALLER	LINE SIZE	1"	3/4"
6" & LARGER	ONE HALF OF HEADER SIZE (MIN. SIZE=4")	1.1/2"	1"

NOTES

- ① LOCATE DRIP POT TO CLEAR SUPPORT, CONSIDERING HEADER THERMAL GROETH.
- ② THE BRANCH TYPE SHALL BE AS SPECIFIED ON PIPING MATERIAL SPECIFICATION.

STEAM DESIGN PRESSURE 100kg/cm² AND LOWER

**TO TRANSFER THE STEAM
(ON PIPE WAY)**

FOR EQUIPMENT
3/4" - 2.1/2" HEADER

3" AND LARGER HEADER

DRIP POT & VALVE SIZE

HEADER SIZE	DRIP POT SIZE	LINE SIZE TO VENT STACK	LINE SIZE TO TRAP
3" & SMALLER	LINE SIZE	1" (HEADER SIZE UP TO 1" : LINE SIZE)	3/4"
4" & LARGER	3"	1.1/2"	1"

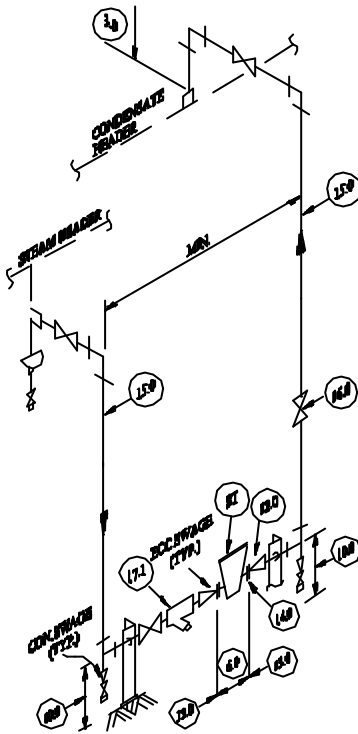
NOTES

- ① IN GENERAL, THE INSTALLATION OF STEAM TRAP IS NOT REQUIRED FOR HIGH PRESSURE STEAM.
- ② THE BRANCH TYPE SHALL BE AS SPECIFIED ON PIPING MATERIAL SPECIFICATION.

STEAM DESIGN PRESSURE HIGHER THAN 100kg/cm²

INVERTED BUCKET TRAP (TRI)

TR1A





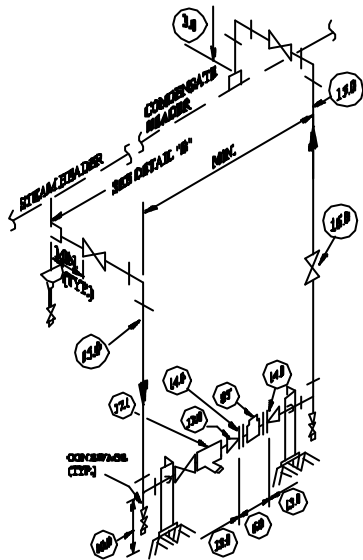
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

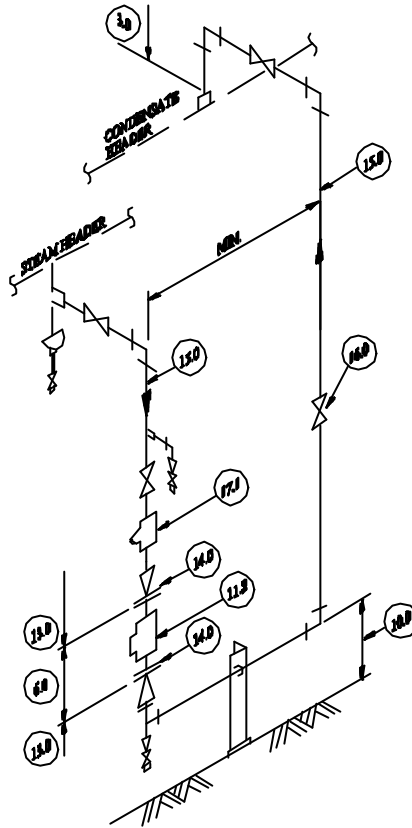
2.6 STEAM TRAP & DRIP POT

THERMODYNAMIC TRAP (TR3)

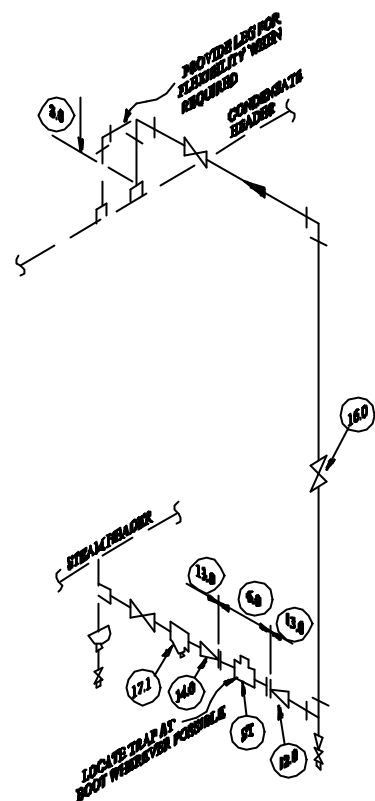
TR3A



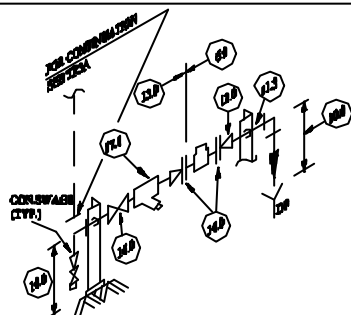
TR3B



TR3C



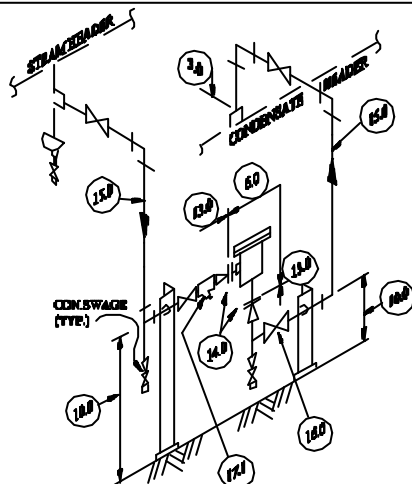
TR3D



USE IN FREEZING CLIMATES

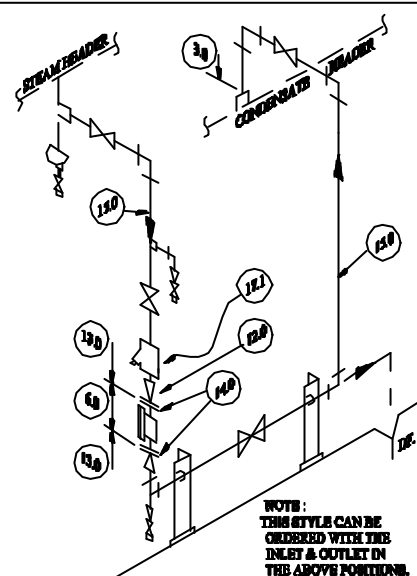
THERMOSTATIC TRAP

TR4A



FOR FREEZING CONDITIONS INSTALL TRAP IN VERTICAL POSITION.
FOR NONFREEZING CONDITIONS TRAP MAY BE INSTALLED IN
HORIZONTAL POSITION WHEN SOURCE IS LOW.

TR4B



NOTE :
THIS STYLE CAN BE
ORDERED WITH THE
INLET & OUTLET IN
THE ABOVE POSITION.

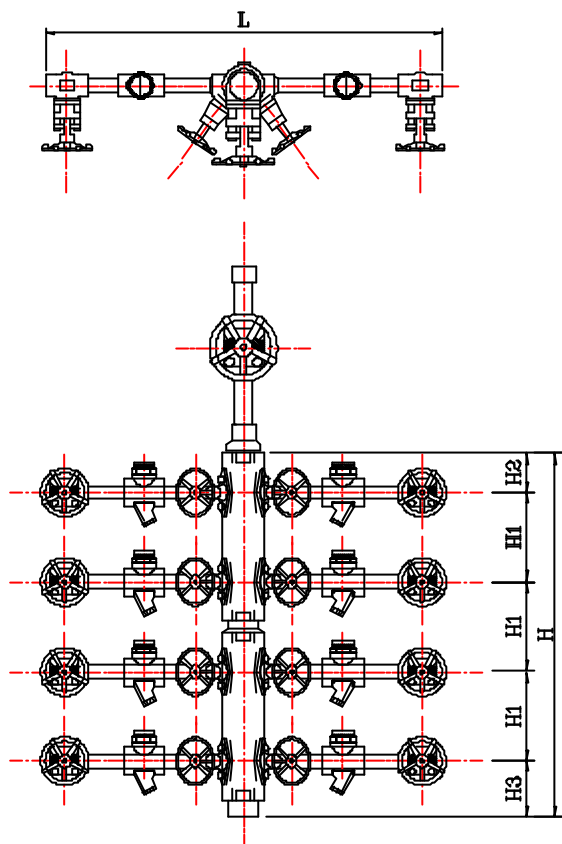
NOTES

- 1.0 THIS STANDARD SHALL BE USED FOR SELECTION AND APPLICATION ONLY.
FOR DETAILS SEE ISOMETRIC DRAWING.
- 2.0 ALL MATERIAL TO BE PER PROJECT PIPING MATERIAL SPECIFICATION.
- 3.0 THE LINE CLASSIFICATION ON ORIGINATING LINE SHALL BE CARRIED THROUGH THE STEAM TRAP UP TO THE CONDENSATE HEADER.
- 4.0 STEAM TRAPS SHALL BE LOCATED BELOW AND AS CLOSE TO THE EQUIPMENT OR LINE BEING DRAINED AS POSSIBLE.
- 5.0 INSULATION TO BE PER PROJECT INSULATION SPECIFICATION.
- 6.0 DO NOT INSULATE FLANGES OR TRAP PIPING BETWEEN THE BREAK OUT FLANGES UNLESS OTHERWISE SPECIFIED.
- 7.0 TRAPS SHALL BE ACCESSIBLE FROM GRADE PLATFORM OR PORTABLE LADDER. TRAPS LOCATED IN PIPEWAYS ARE CONSIDERED ACCESSIBLE.
- 8.0 TRAPS (OTHER THAN A THERMODYNAMIC TYPE) WILL NOT OPERATE WHEN THE TOP OF THE TRAP IS ABOVE THE EQUIPMENT CONNECTION BEING DRAINED, BECAUSE IT'S PRIME CAN NOT BE MAINTAINED.
REFER TO DETAIL "A" FOR METHODS OF INSTALLATION THERMODYNAMIC TRAPS WHEN NECESSARY MAY BE INSTALLED ABOVE THE EQUIPMENT BEING DRAINED WITHOUT ALTERING THE TRAP.
- 9.0 IN GENERAL, STEAM TRAPS SHALL BE PROVIDED AT LOW POINTS AND AT ALL DEAD ENDS OF STEAM HEADERS.
MAXIMUM SPACING FOR STEAM TRAPS DRAINING INTERVAL OF STEAM HEADERS SHALL BE:
 - 9.1 SATURATED STEAM : 75m
 - 9.2 SUPERHEATED STEAM: 150m
- 10.0 MINIMUM DISTANCE FROM GRADE TO STEAM TRAP PIPING SHALL BE 150MM.
- 11.0 FREEZING CLIMATES :
 - 11.1 PIPING SHALL BE AS SHORT AS POSSIBLE BUT ALLOW FOR THERMAL EXPANSION.
 - 11.2 PROVIDE GRAVITY DRAINAGE TO AND FROM TRAP BY MOUNTING TRAP IN VERTICAL WITH FLOW DOWN WHENEVER POSSIBLE.
 - 11.3 AVOID DISCHARGING CONDENSATE DIRECTLY TO OPEN DRAINS WITHIN OPERATING AREAS.
- 12.0 SWAGE AS REQUIRED FOR REDUCTION FROM LINE SIZE.
- 13.0 INSULATE TRAP INLET AND OUTLET PIPING TO HEADER IN FREEZING CLIMATES. IN NON-FREEZING CLIMATES INSULATE FOR SAFETY PER CONTRACT REQUIREMENTS. NO INSULATION REQUIRED DOWNSTREAM OF TRAP WHEN DISCHARGE IS OPEN ENDED.
- 14.0 BREAK OUT CONNECTIONS TO BE AS CLOSE TO TRAP AS POSSIBLE.
- 15.0 PROVIDE PROPER SUPPORT AND GUIDING OF VERTICAL RUNS WITH CONSIDERATION GIVEN TO THERMAL EXPANSION.
- 16.0 WHERE HEADER BLOCK VALVE IS NOT READILY ACCESSIBLE, A TRAP ISOLATION BLOCK VALVE SHALL BE PROVIDED AND LOCATED AS SHOWN.
- 17.0 DETAIL NOTES
 - 17.1 Y-STRAINERS ARE NOT REQUIRED IF TRAP IS FURNISHED WITH AN INTERNAL STRAINER, CHECK VENDOR DATA AND/OR SPECIFICATIONS.
 - 17.2 THE STEAM TRAP PIPING (FROM DRIP PORT TO CONDENSATE HEADER) SHALL BE DESIGNED WITH CONSIDERATION FOR FLEXIBILITY DUE TO HEADER THERMAL GROWTH.
 - 17.3 ALTERNATE ROUTING OF EQUALIZING LINE TO STEAM SUPPLY TO BE USED ONLY WHERE NO OTHER ALTERNATIVE IS AVAILABLE. CHECK WITH CONTROL SYSTEMS ENGINEER.
- 18.0 EQUALIZING LINE SHALL BE INSTALLED ONLY WHERE THE EQUALIZING LINE MARKED ON THE P&ID.

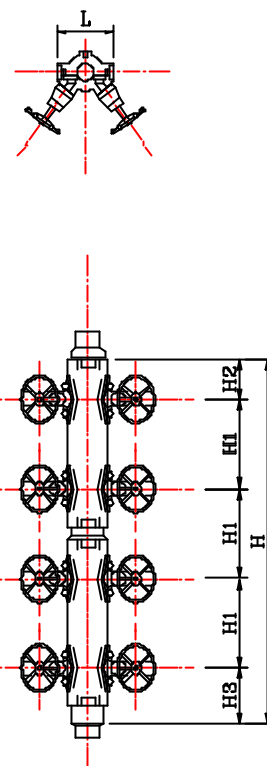
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.7 READY-MADE STEAM MANIFOLD

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 1 OF 1
 DATE : DEC., 1995


Condensate Return Manifold



Steam Supply Manifold

1. Condensate Return Manifold Dimension

MANUFACTURER	MODEL NO	H	H1	H2	H3	L	INLET (inch)	OUTLET (inch)	DRAIN (inch)	OPER.PRESS. (Max.)(kg/cm ²)	OPER.TEMP. (°C)
TLV	TSM-A4	330	160	70	100	720	1/2	1.1/2	1/2	-	-
	TSM-A8	650	160	70	100	720	1/2	1.1/2	1/2		
	TSM-A12	970	180	70	100	720	1/2	1.1/2	1/2		
ARMSTRONG	CCA-204	287	203	-	-	713	1/2	1.1/2	3/4	28	399
	CCA-208	611	203	-	-	713	1/2	1.1/2	3/4		
	CCA-212	935	203	-	-	713	1/2	1.1/2	3/4		
SPIRAX-SARCO	MSC04-CC	330	160	85	85	698	1/2	1.1/2	1/2	41.5	253
	MSC08- CC	650	160	85	85	698	1/2	1.1/2	1/2		
	MSC12- CC	970	160	85	85	698	1/2	1.1/2	1/2		

2. Steam Supply Manifold Dimension

MANUFACTURER	MODEL NO	H	H1	H2	H3	L	INLET (inch)	OUTLET (inch)	DRAIN (inch)	OPER.PRESS. (Max.)(kg/cm ²)	OPER.TEMP. (°C)
TLV	TSM-A4	330	160	70	100	112	1.1/2	1/2	1/2	20	425
	TSM-A8	650	160	70	100	112	1.1/2	1/2	1/2		
	TSM-A12	970	160	70	100	112	1.1/2	1/2	1/2		
ARMSTRONG	MSD-04	287	162	-	-	114	1.1/2	1/2	3/4	32	400
	MSD-08	611	162	-	-	114	1.1/2	1/2	3/4		
	MSD-12	935	162	-	-	114	1.1/2	1/2	3/4		
SPIRAX-SARCO	MSC04-SD	330	160	85	85	110	1.1/2	1/2	1/2	41.5	253
	MSC08-SD	650	160	85	85	110	1.1/2	1/2	1/2		
	MSC12-SD	970	160	85	85	110	1.1/2	1/2	1/2		

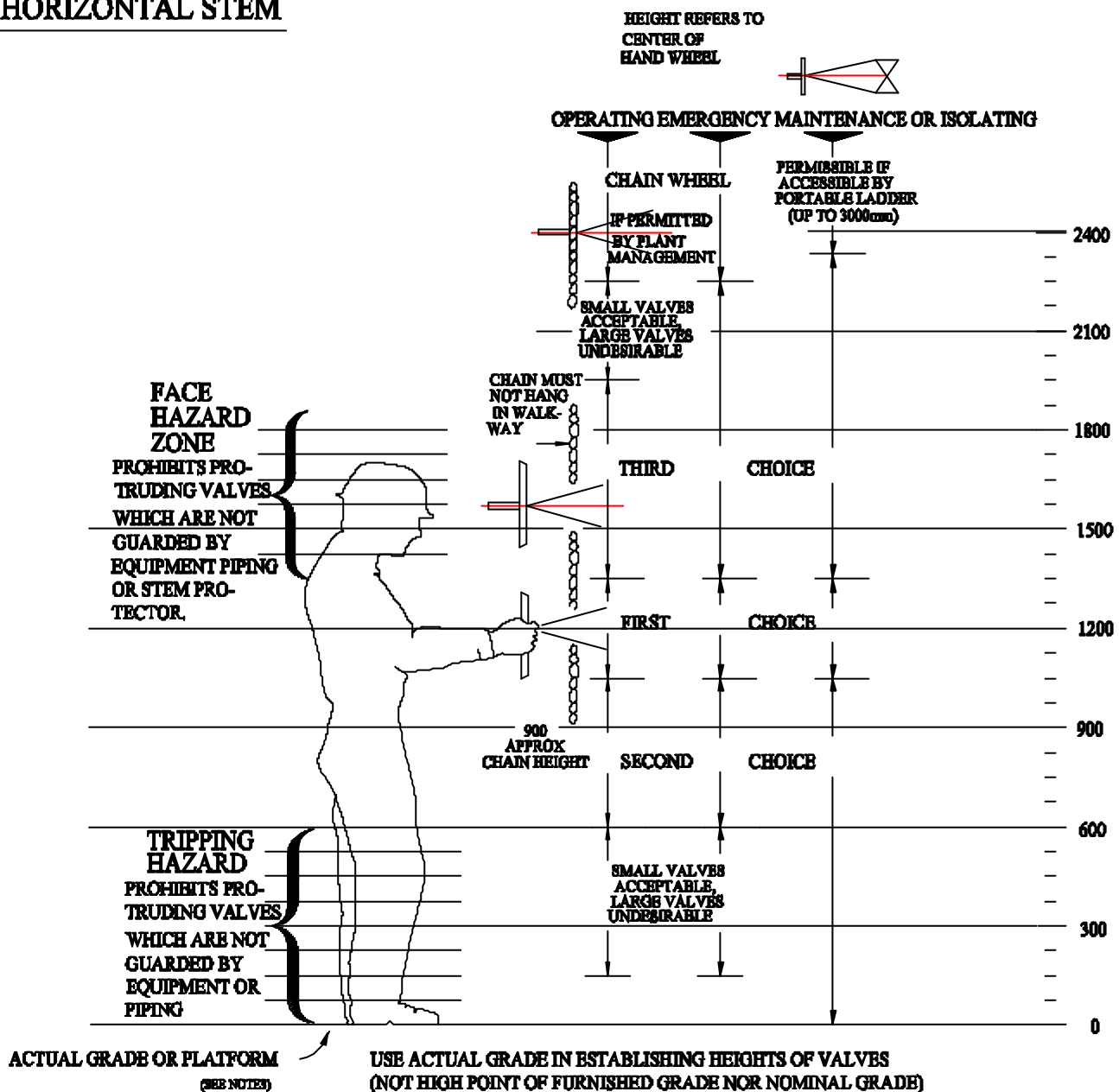


PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.8 VALVE OPERATION HEIGHT

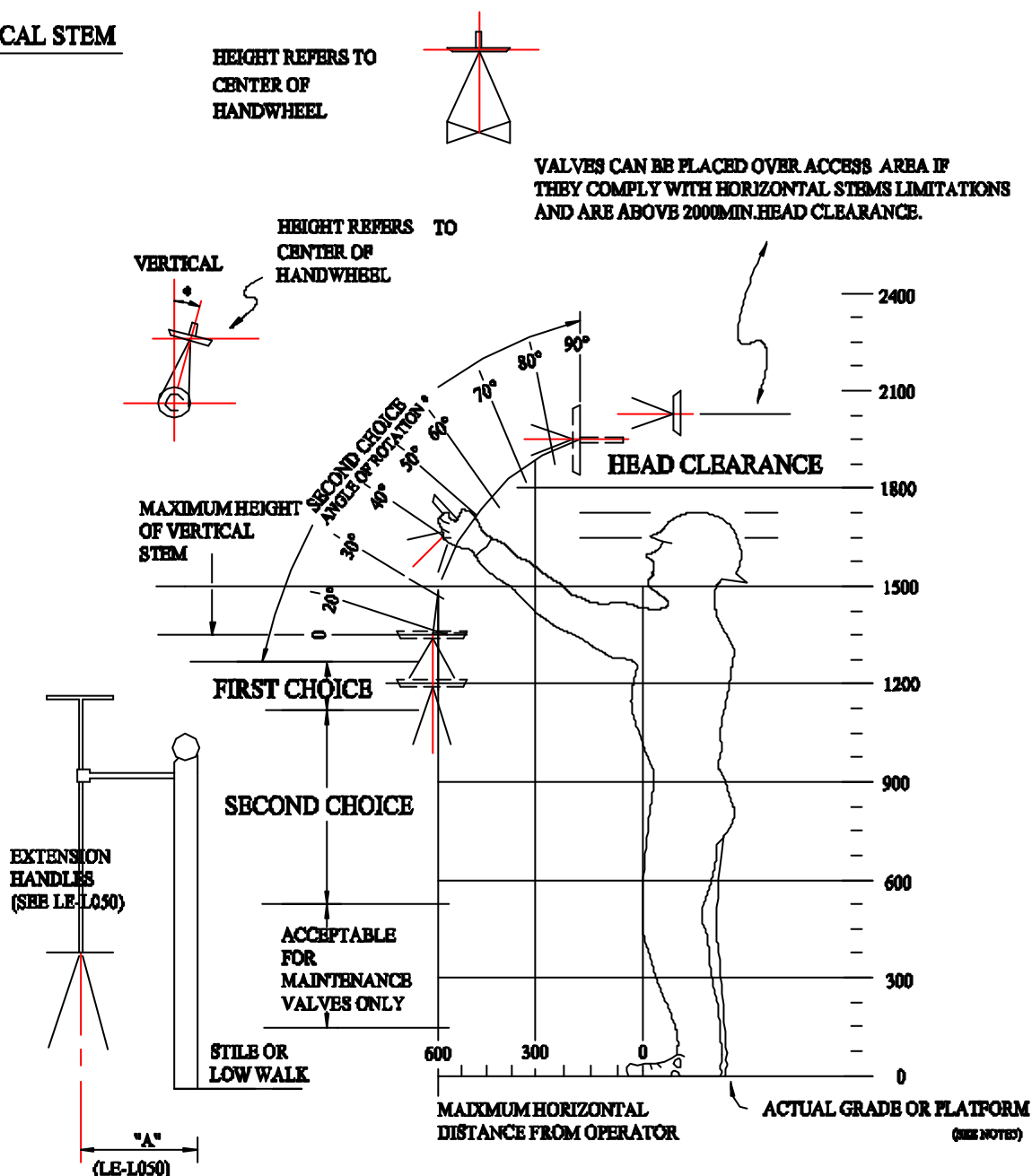
HORIZONTAL STEM



NOTES

- WHENEVER OTHER DESIGN CONSIDERATIONS PERMIT, VALVES ARE BEST INSTALLED WITH THE STEM POINTING STRAIGHT UP (VERTICAL STEM), SINCE THIS POSITION GREATLY FACILITATES IN PLACE MAINTENANCE (LUBRICATION OF SCREW, INSPECTION, REPACKING)
- VALVES MAY ROTATED AS FAR AS THE HORIZONTAL POSITION WITH NO GREAT DECREASE IN MAINTENANCE CONVENIENCE; BUT SHOULD NOT BE INSTALLED WITH THE STEM DOWNWARD SINCE THE BONNET ACTS AS A TRAP FOR ABRASIVE SEDIMENT AND WATER WHICH MAY FREEZE UNDER ADVERSE CLIMATIC CONDITIONS.
- SAFETY REQUIRES THAT VALVES BE PLACED OVER HIGH (3000 OR MORE) PLATFORMS, RATHER THAN ADJACENT TO THEM.

VERTICAL STEM



NOTES

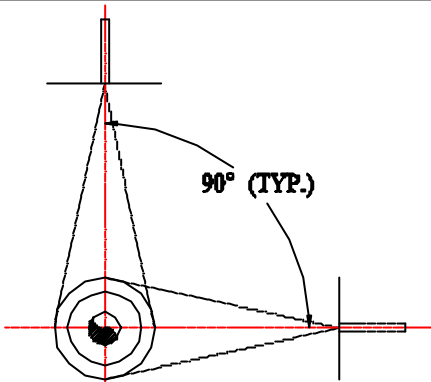
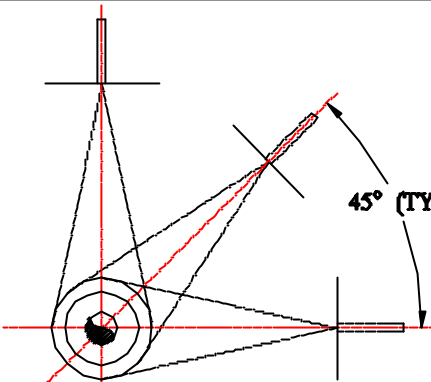
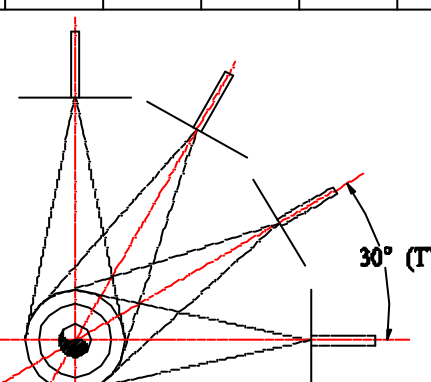
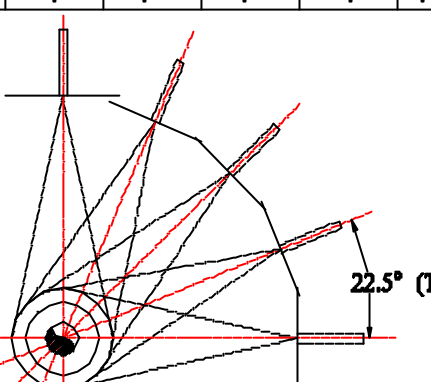
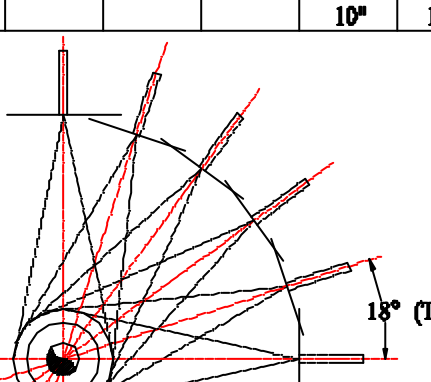
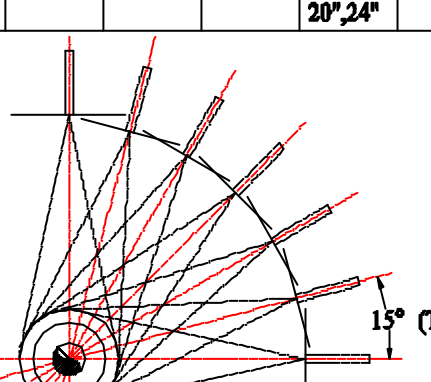
1. WHENEVER OTHER DESIGN CONSIDERATIONS PERMIT, VALVES ARE BEST INSTALLED WITH THE STEM POINTING STRAIGHT UP (VERTICAL STEM), SINCE THIS POSITION GREATLY FACILITATES IN PLACE MAINTENANCE. (LUBRICATION OF SCREW, INSPECTION, REPACKING)
2. VALVES MAY ROTATED AS FAR AS THE HORIZONTAL POSITION WITH NO GREAT DECREASE IN MAINTENANCE CONVENIENCE; BUT SHOULD NOT BE INSTALLED WITH THE STEM DOWNWARD SINCE THE BONNET ACTS AS A TRAP FOR ABRASIVE SEDIMENT AND WATER WHICH MAY FREEZE UNDER ADVERSE CLIMATIC CONDITIONS.
3. SAFETY REQUIRES THAT VALVES BE PLACED OVER HIGH (3000 OR MORE) PLATFORMS, RATHER THAN ADJACENT TO THEM.



PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

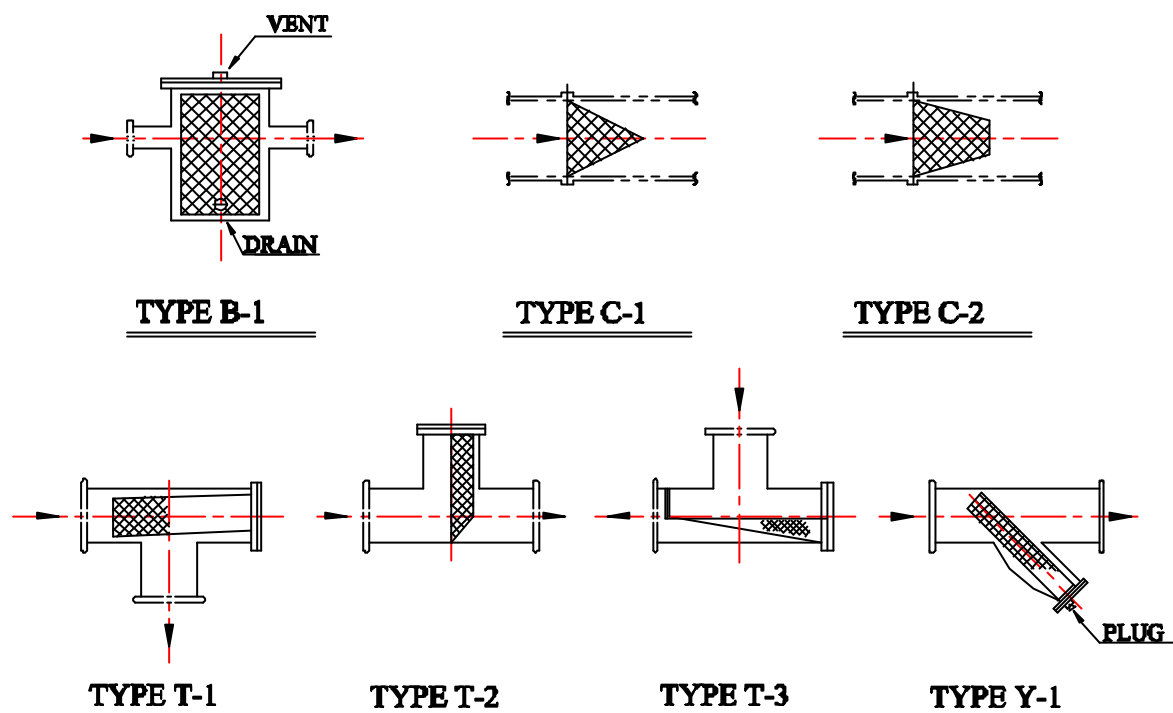
2.9 VALVE HANDWHEEL ORIENTATION

											
THROUGH 4						THROUGH 8					
150#	300#	600#	900#	1500#	2500#	150#	300#	600#	900#	1500#	2500#
1/2"~1,1/2"						4"	2"	2"	2"	2"	2"
2"						6"	3"	3"	3"	3"	3"
3"						8"	4"	4"	4"	4"	4",6"
											
THROUGH 12						THROUGH 16					
150#	300#	600#	900#	1500#	2500#	150#	300#	600#	900#	1500#	2500#
10"	6"	6"	6"	6"	8"	16"	10"	10"	10"	12",14"	
12"	8"	8"	8"	8"	10"	18"	12"			16",18"	
14"				10"	12"					20",24"	
											
THROUGH 20						THROUGH 24					
150#	300#	600#	900#	1500#	2500#	150#	300#	600#	900#	1500#	2500#
20"	14"	12",14"	12",14"				18"	20"			
24"	16"	16"	16",18"				20"	24"			
		18"	20",24"				24"				

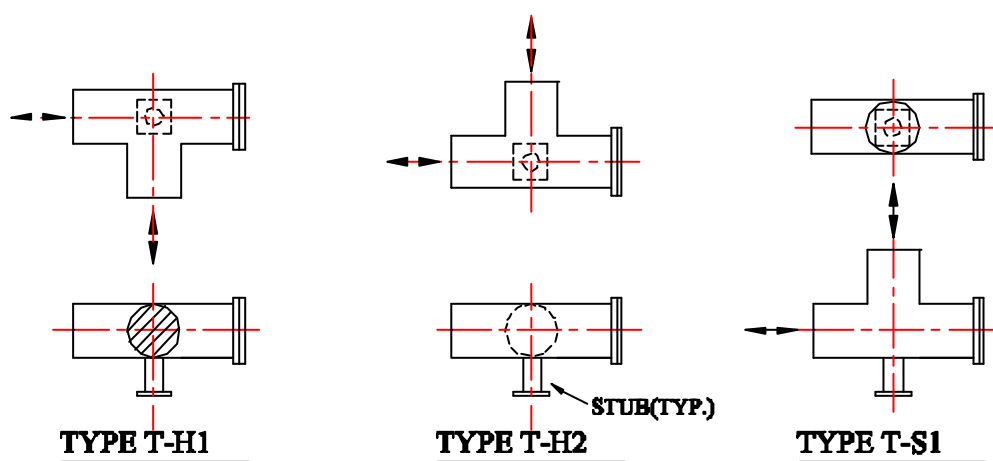
DRAWING LIST

1. STRAINER	1 SHEET
2. QUICK COUPLING	1 SHEET
3. FLEX HOSE(NON-METAL)	1 SHEET
4. FLEXIBLE JOINT HOSE(METAL)	1 SHEET
5. FLEXIBLE JOINT END TYPE(METAL)	1 SHEET
6. UTILITY HOSE RACK(TYPE "A")	1 SHEET
7. UTILITY HOSE RACK(TYPE "B")	1 SHEET
8. SAMPLE COOLER	1 SHEET
9. SAMPLER	1 SHEET
10. DRAIN COLLECTOR FOR SAMPLING	1 SHEET
11. SPECIAL BEND	1 SHEET
12. EMERGENCY SHOWER&EYE WASHER	1 SHEET
13. MOVABLE PLATFORM	1 SHEET
14. EXHAUST HEAD	1 SHEET
15. SWARTOUT TYPE EXHAUST HEADS(FLANGED)	1 SHEET
16. SWARTOUT TYPE EXHAUST HEADS(THREADED)	1 SHEET
17. VENT STACK	1 SHEET
18. SPECIAL BOSSES	1 SHEET
19. PAD NOZZEL	1 SHEET
20. CHAIN WHEEL	1 SHEET
21. VALVE HANDWHEEL EXTENSION SPINDLE(1)	1 SHEET
22. VALVE HANDWHEEL EXTENSION SPINDLE(2)	1 SHEET
23. VALVE HANDWHEEL EXTENSION SPINDLE(3)	1 SHEET

1. STRAINER



INSTRUCTION TO VENDOR (STRAINER TYPE)



INSTRUCTION TO VENDOR (SUPPORT TYPE FOR T-1 & T-3)

NOTES

1. TAG NO. SHALL BE FITTED ON THE STRAINER.
2. THE FOLLOWING ACCESSORIES FOR "T" TYPE STRAINER SHALL BE INCLUDED AS A PART OF THE REQUIREMENT AS REQUIRED.
 - i) HINGE (FOR 10" AND LARGER)
 - ii) SADDLE FOR SUPPORT.



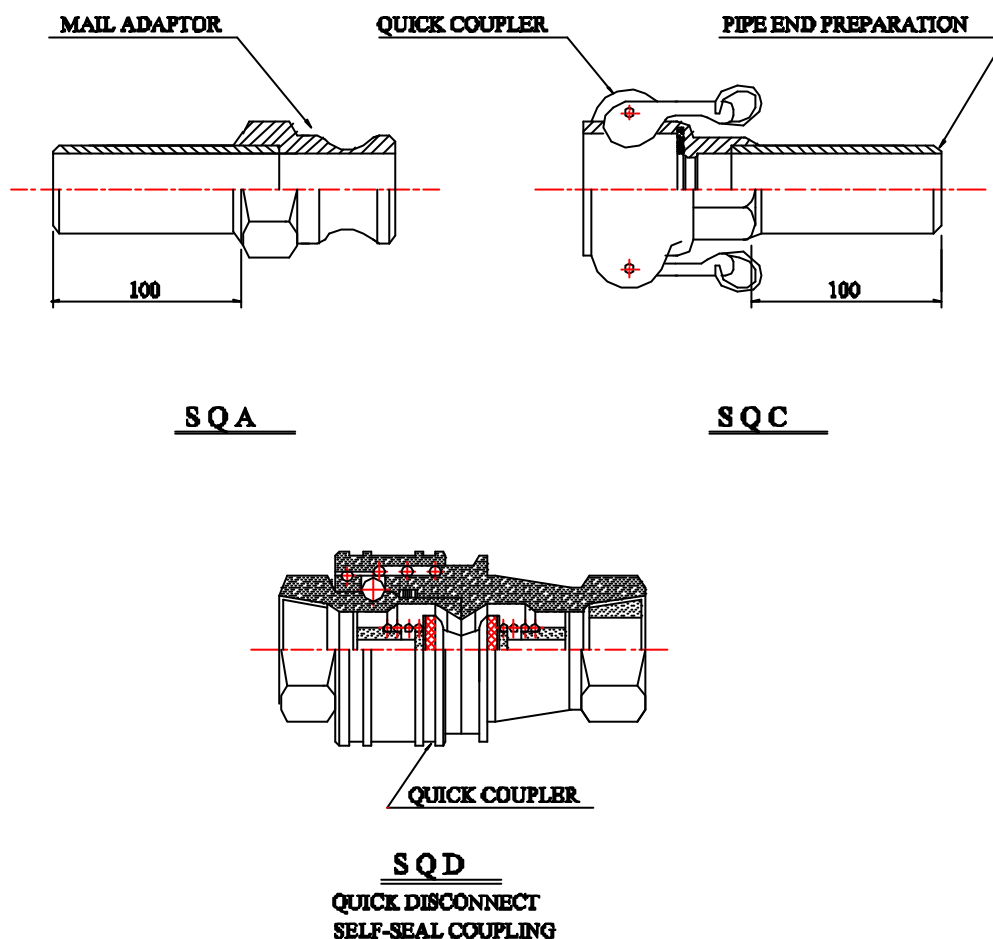
LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK
2. PIPING DESIGN REFERENCES
2.10 SPECIAL ITEMS

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 3 OF 24
DATE : DEC. 1995

2. QUICK COUPLING

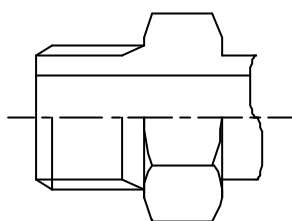


NOTES

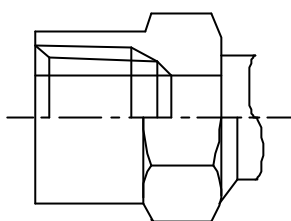
1. WELDING PREPARATION SHALL BE IN ACCORDANCE WITH ANSI B16.25.
FE : PLAIN END BE : BEVELED END
2. TAG NO. SHALL BE FITTED ON THE COUPLING.

3. FLEX. HOSE(NON-METAL)

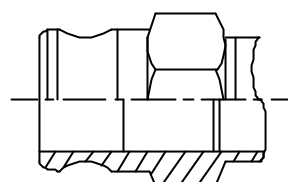
TYPE OF END CONNECTION



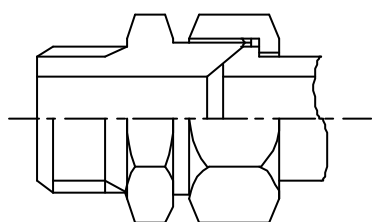
MALE NPT(W/O UNION)
TYPE MA



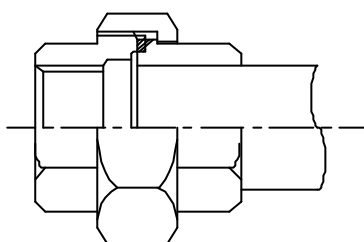
FEMALE NPT(W/O UNION)
TYPE EA



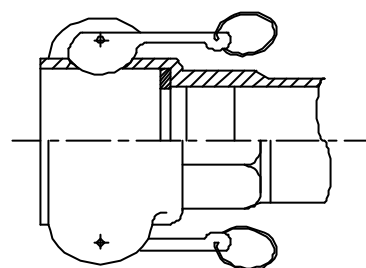
QUICK COUPLING ADAPTER
TYPE QA



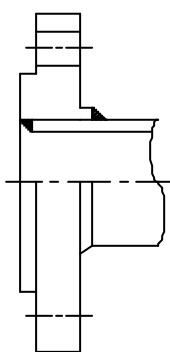
MALE NPT(W/UNION)
TYPE MU



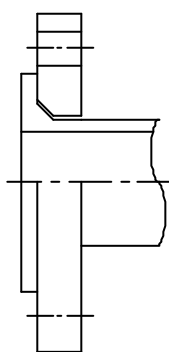
FEMALE NPT(W/UNION)
TYPE EU



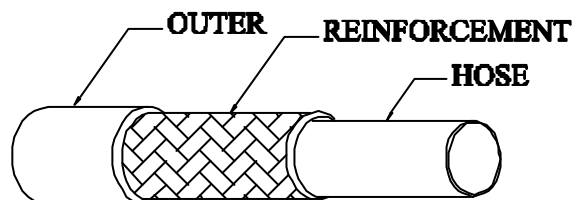
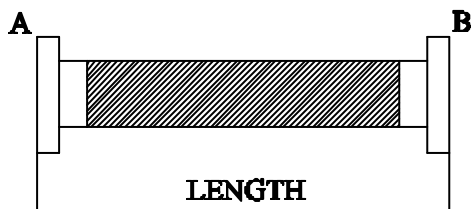
QUICK COUPLER
TYPE QC



FLANGE SLIP-ON
TYPE FS

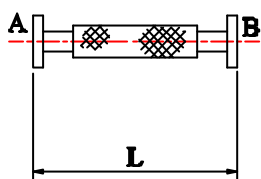


FLANGE LAP-JOINT
TYPE FL

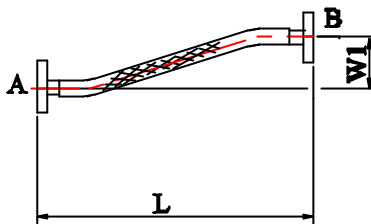


4. FLEXIBLE JOINT HOSE(METAL)

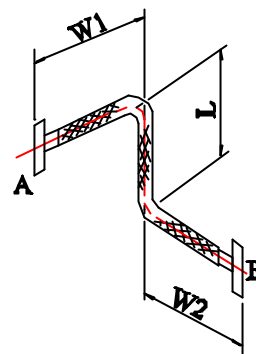
TYPE OF INSTALLATION



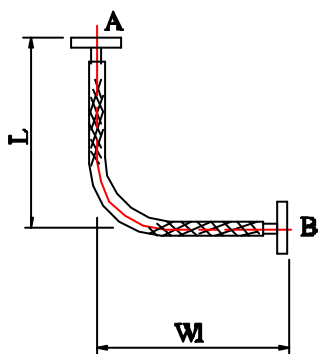
TYPE-"H"



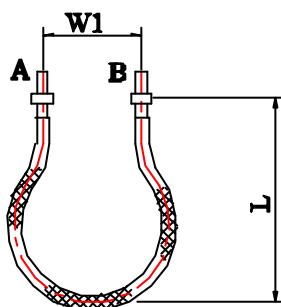
TYPE-"HO"



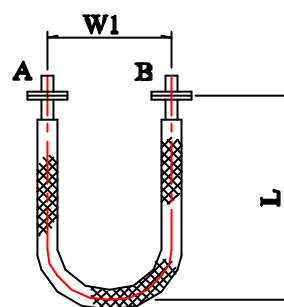
TYPE-"OF"



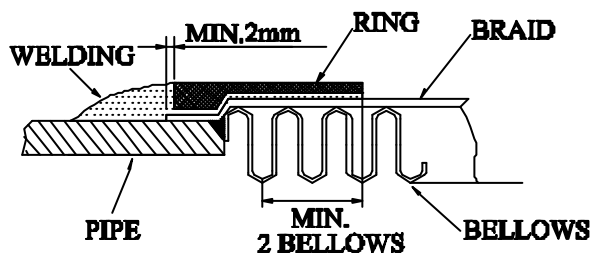
TYPE-"L"



TYPE-"U"



TYPE-"V"



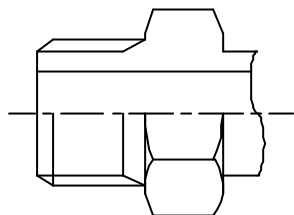
WELDING DETAIL

NOTE:

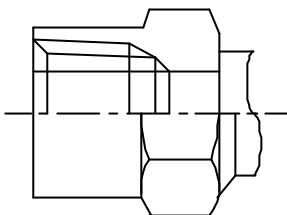
1. TAG NO. PLATE SHALL BE FITTED ON THE FLEXIBLE JOINT.

5. FLEXIBLE JOINT END TYPE(METAL)

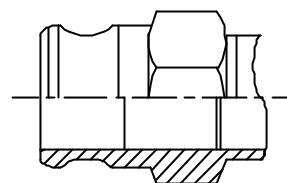
TYPE OF END CONNECTION



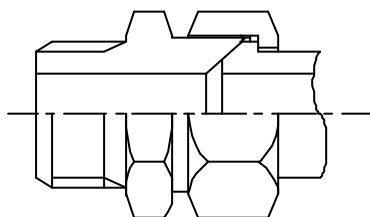
MALE NPT(W/O UNION)
TYPE MA



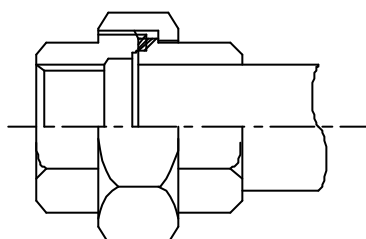
FEMALE NPT(W/O UNION)
TYPE EA



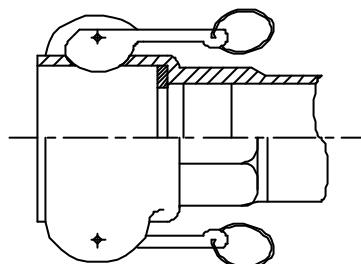
QUICK COUPLING ADAPTER
TYPE QA



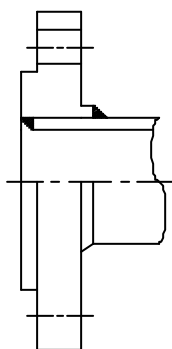
MALE NPT(W/UNION)
TYPE MU



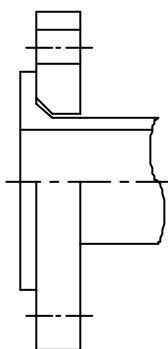
FEMALE NPT(W/UNION)
TYPE EU



QUICK COUPLER
TYPE QC



FLANGE SLIP-ON
TYPE FS



FLANGE LAP-JOINT
TYPE FL

**LG E&C**PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

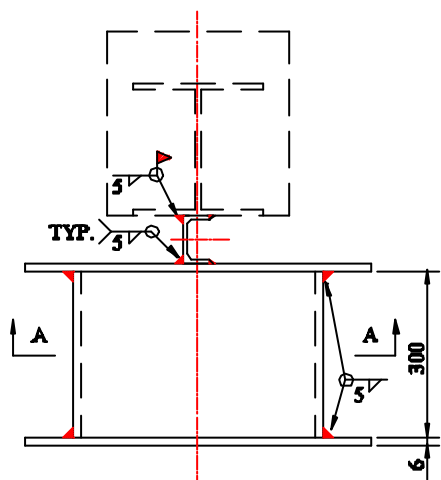
2. PIPING DESIGN REFERENCES

2.10 SPECIAL ITEMS

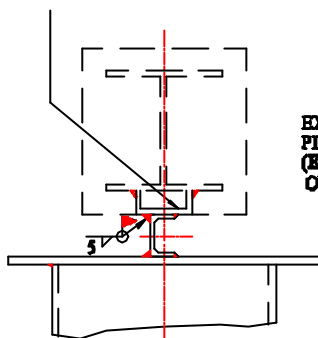
LDP-L901
REV. 1 (OCT, 2002)
PAGE : 7 OF 24
DATE : DEC. 1995

6. UTILITY HOSE RACK(TYPEA1/A2/A3/A4)

AT CONCRETE COLUMNS:
FIELD DRILL AND INSTALL
M20x170x2 HAWK BOLTS
AT STEEL COLUMN
FIELD WELD CHANNEL
BRACKET TO COLUMN

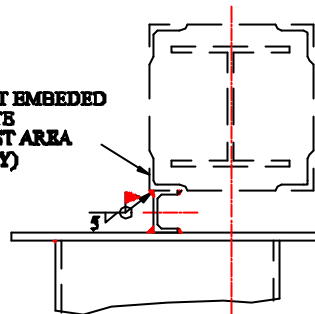


AT FIRE PROOFED COLUMNS:
(NEW)
FIELD WELD CHANNEL TO
COLUMN. C102x51x10(C4x7.25)
250 LONG



**AT FIRE PROOFED
COLUMNS; (EXIST)**

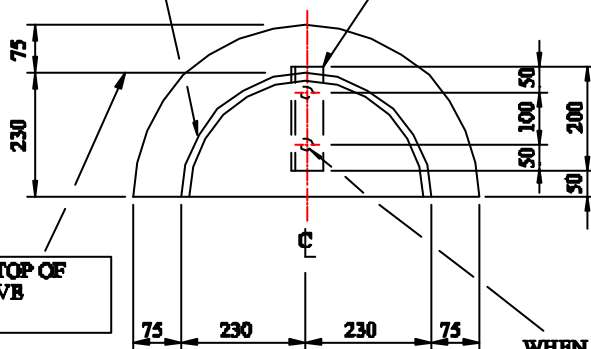
EXIST EMBEDDED
PLATE
(EXIST AREA
ONLY)



HALF SECTION OF 18"
SCH20 PIPE 300 LONG
(MATERIAL BY LGR&C)

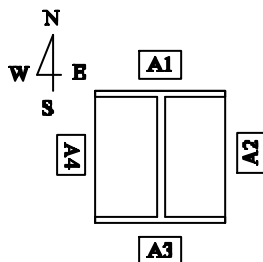
CHANNEL C102x51x10(C4x7.25)x200 LONG
WELDED TO HOSE RACK

INSTALL WITH TOP OF
DRUM 1200 ABOVE
H.P. PAVING



SECTION 'A-A'

WHEN ATTACHING RACKS
TO CONCRETE COLUMNS
FIELD DRILL 2 HOLES
26mm DIAMETER.



ORIENTATION

MATERIAL SUPPLY AND FABRICATION SHALL BE
PERFORMED BY CONSTRUCTION SUBCONTRACTOR.

TYPE A1/A2/A3/A4



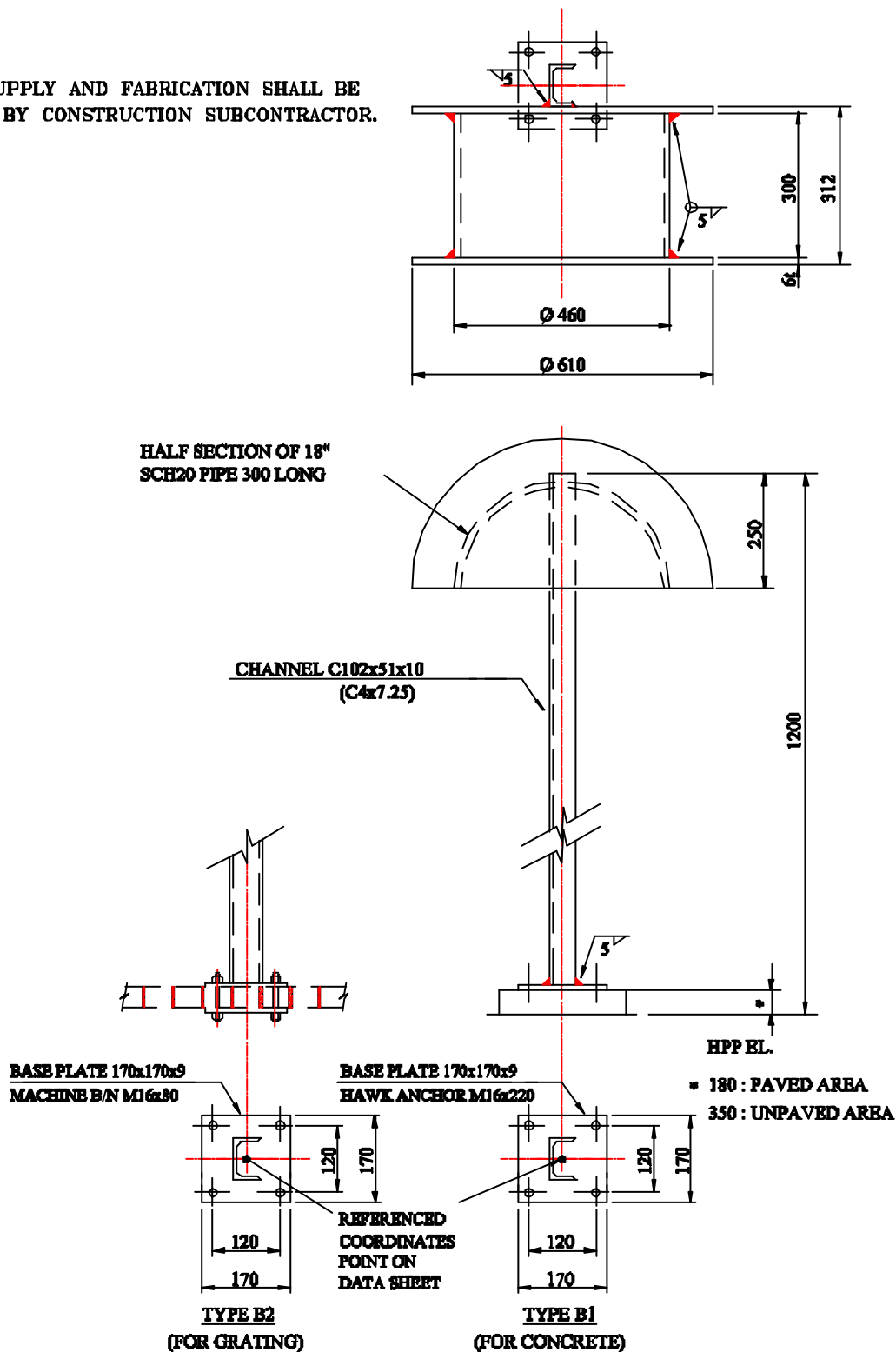
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.10 SPECIAL ITEMS

7. UTILITY HOSE RACK (TYPE B1/B2)

MATERIAL SUPPLY AND FABRICATION SHALL BE PERFORMED BY CONSTRUCTION SUBCONTRACTOR.



**LG E&C**PIPING DISCIPLINE
PROCEDURE

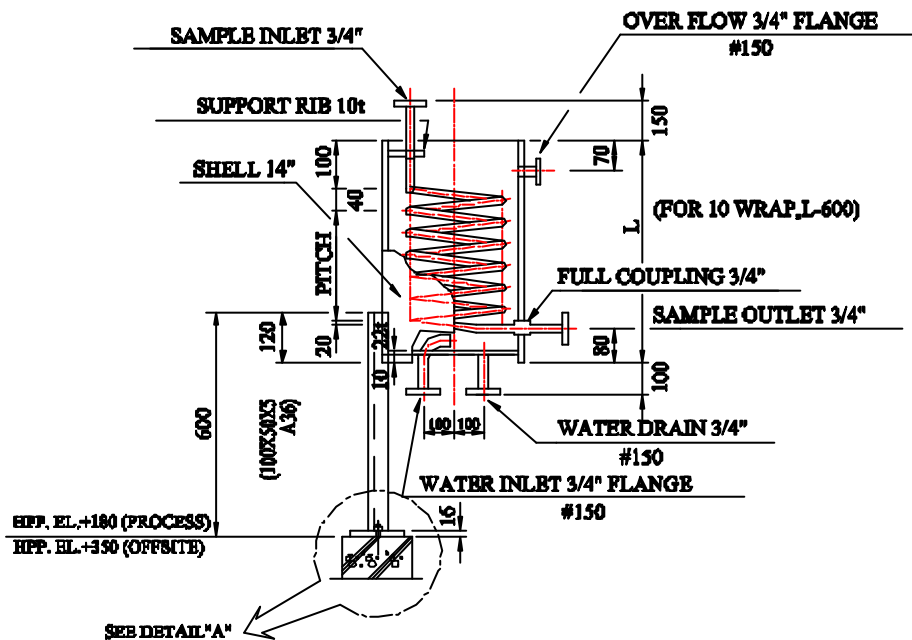
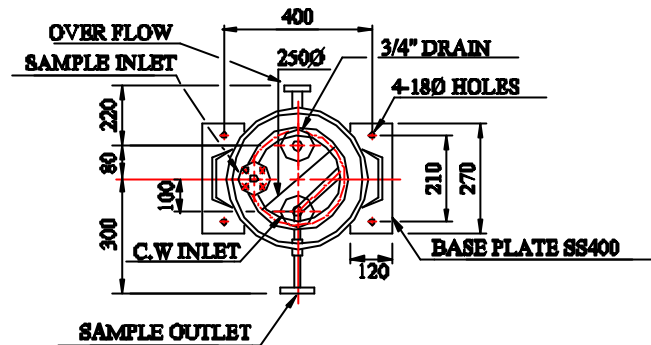
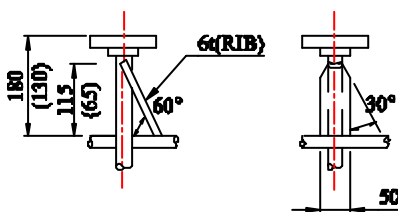
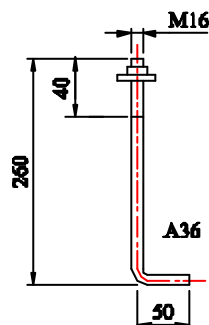
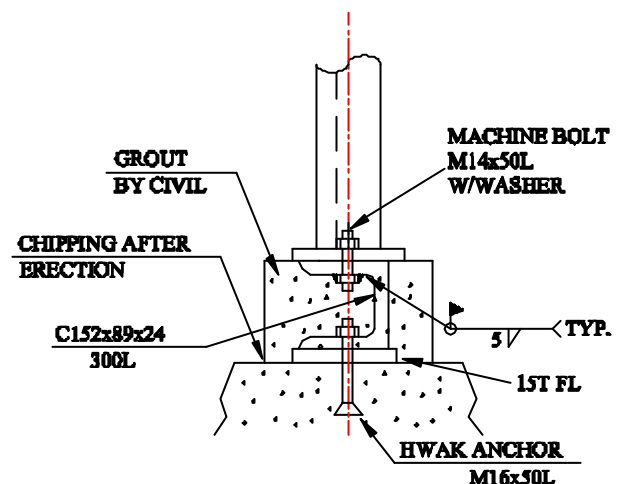
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.10 SPECIAL ITEMS

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 9 OF 24
DATE : DEC. 1995

8. SAMPLE COOLER

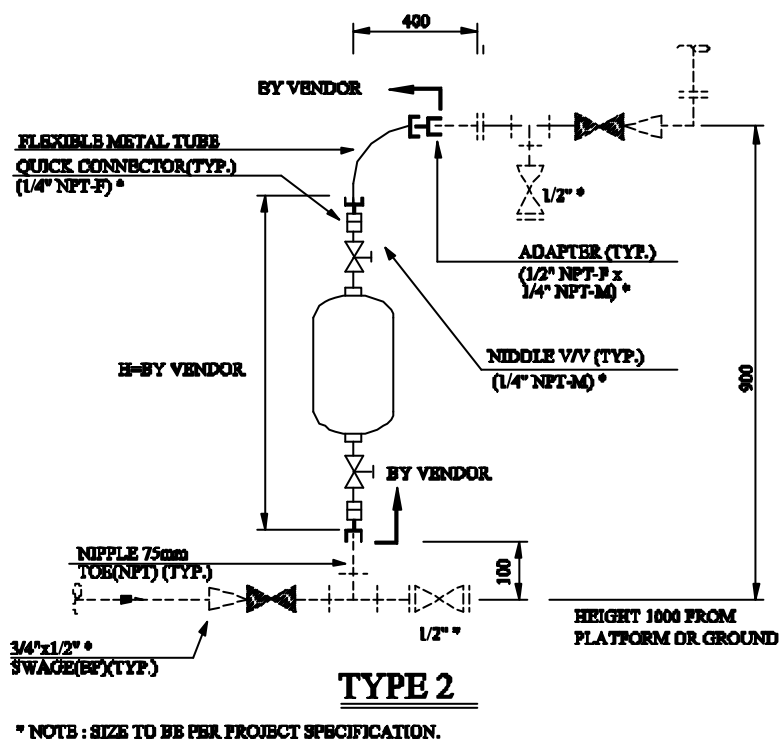
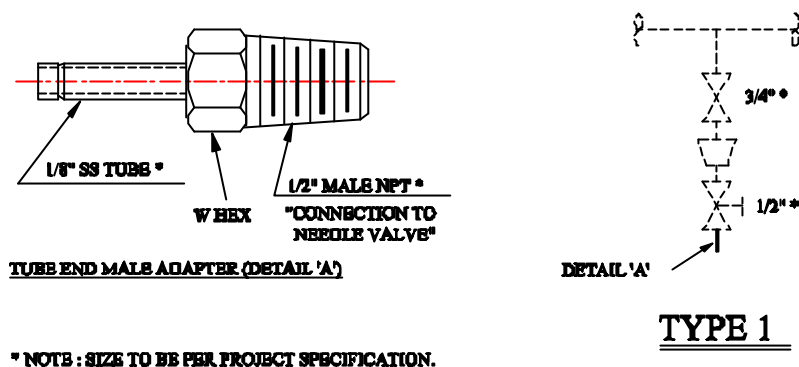
DETAIL OF GROOVEDETAIL OF RIBUNPAVED AREAANCHOR BOLT
DETAIL "A"

NOTES

1. ANCHOR BOLTS SHALL ALSO BE SUPPLIED.
2. COOLING WATER;
DESIGN PRESSURE ____ Bar G

HYDRAULIC TEST;
SHELL SIDE ____ Bar G
COIL ____ Bar G
(SAME PRESS, WITH MAIN PIPE LINE)

9. SAMPLER



NO.	MATERIAL				REMARK
	BOMBE	VALVE	FLEXIBLE TUBE	CONNECTOR	
1	30488	30488	30488	30488	
2	31688	31688	31688	31688	
3	32188	32188	32188	32188	
4	34788	34788	34788	34788	



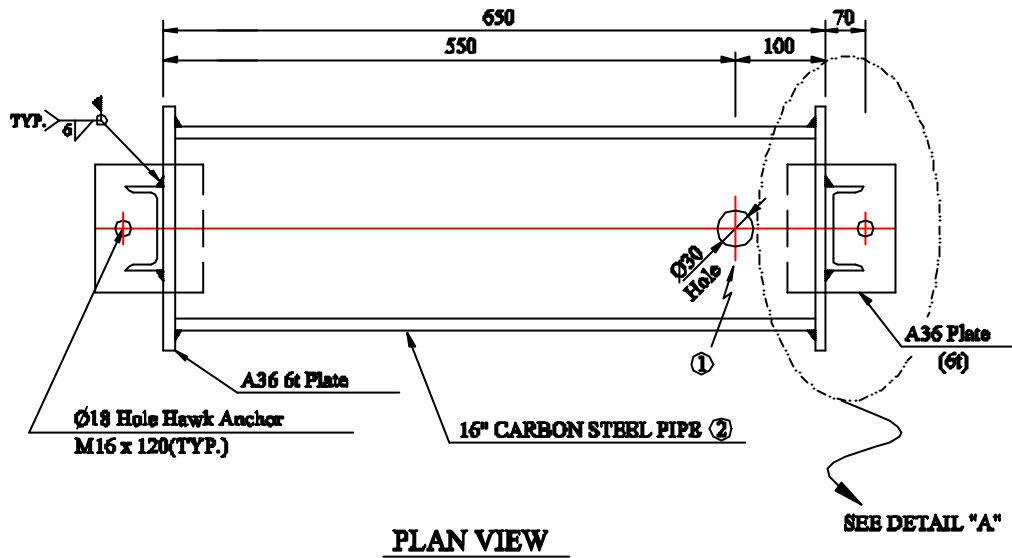
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

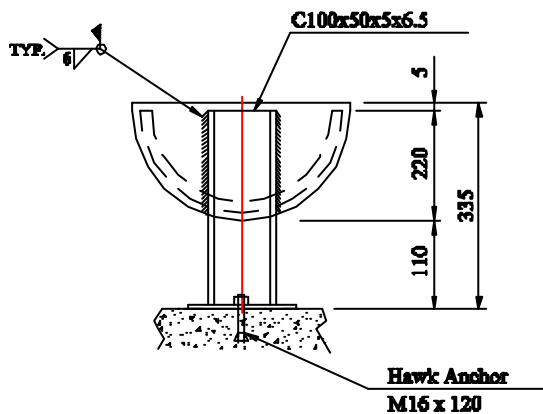
2.10 SPECIAL ITEMS

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 11 OF 24
DATE : DEC. 1995

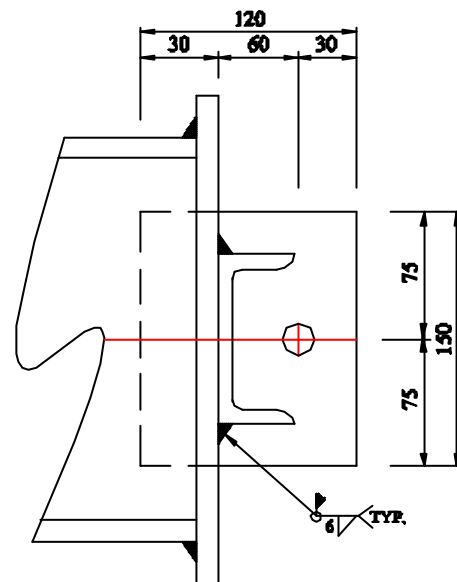
10. DRAIN COLLECTOR FOR SAMPLING



PLAN VIEW



SIDE VIEW

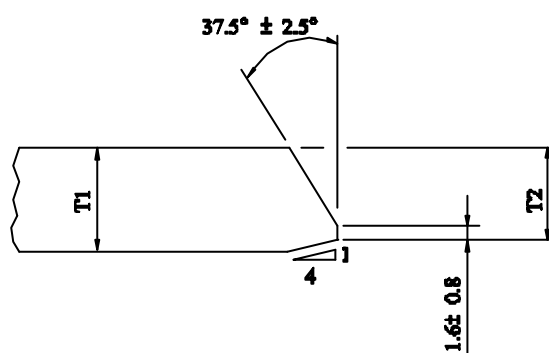
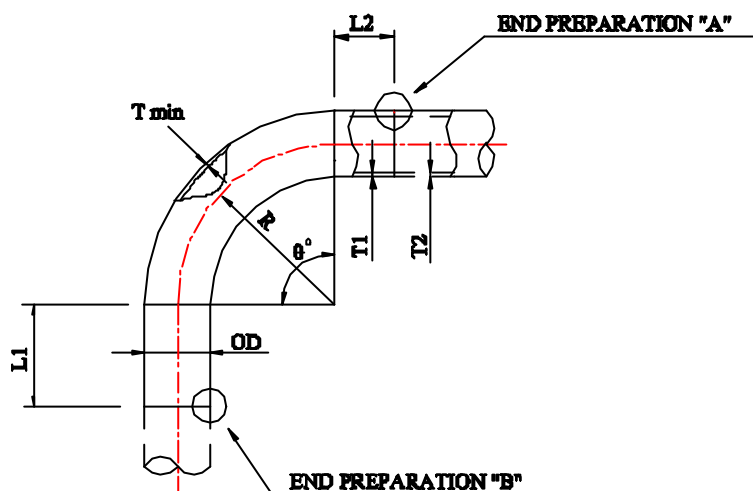


DETAIL "A"

NOTES

- ① NPS 1 INCH DRAIN PIPING SHALL BE ROUTED TO OILY WATER SEWER.
THIS DRAIN PIPINGS ARE NOT REQUIRED THE PRESSURE TEST AND NDE.
COLD BENDING AT CONSTRUCTION SITE SHALL BE USED FOR THE PIPING.
- ② SIZE AND MATERIAL TO BE PER PROJECT SPECIFICATION.

11. SPECIAL BEND

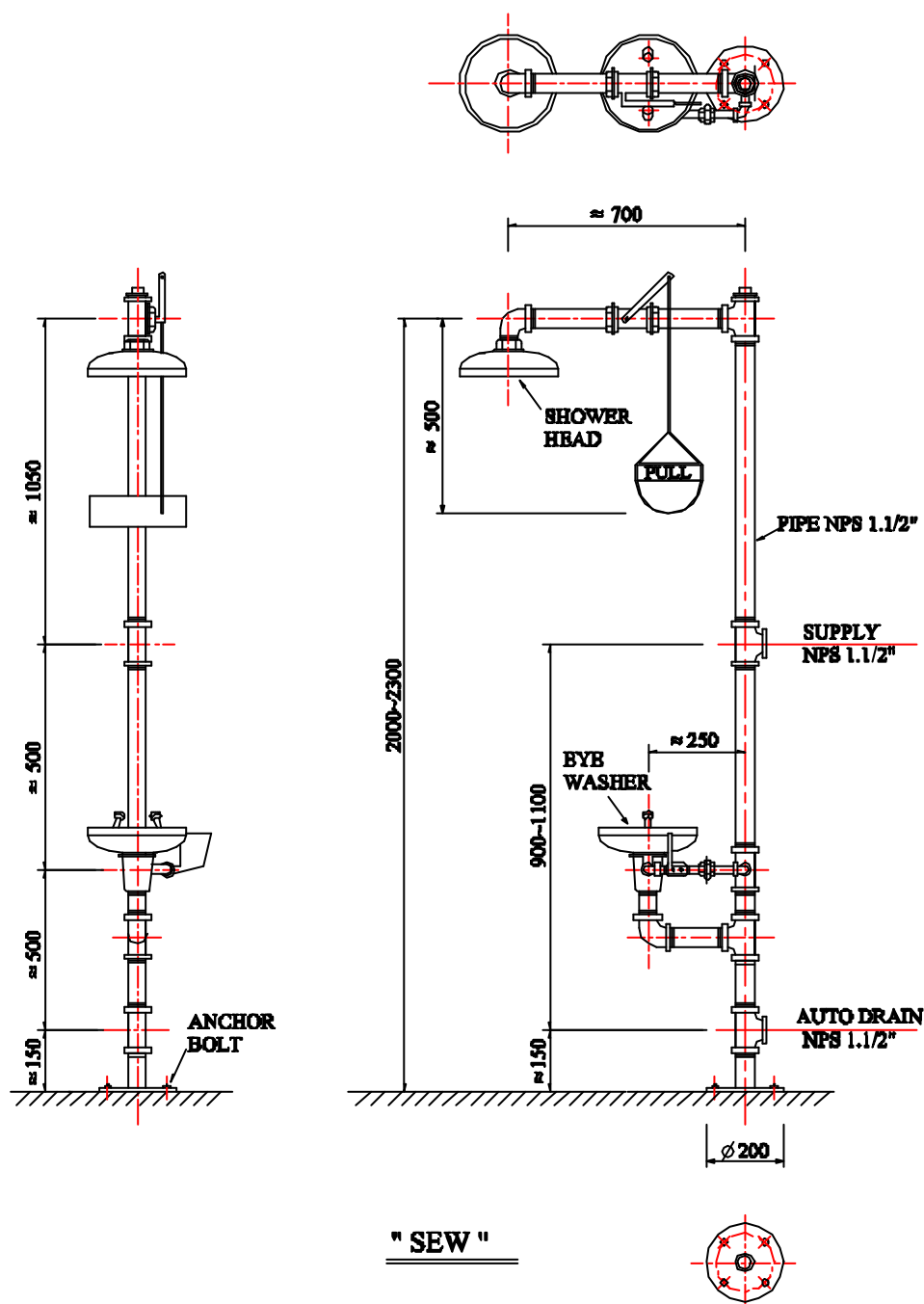


BEVEL END PREPARATION DETAIL

NOTES

1. NAME PLATE SHALL BE TAGGED ON THE BEND.
2. T_{min} = MINIMUM REQUIRED THICKNESS, EXCLUDING MECHANICAL TOLERANCE
PE : PLAIN END BE : BEVELED END

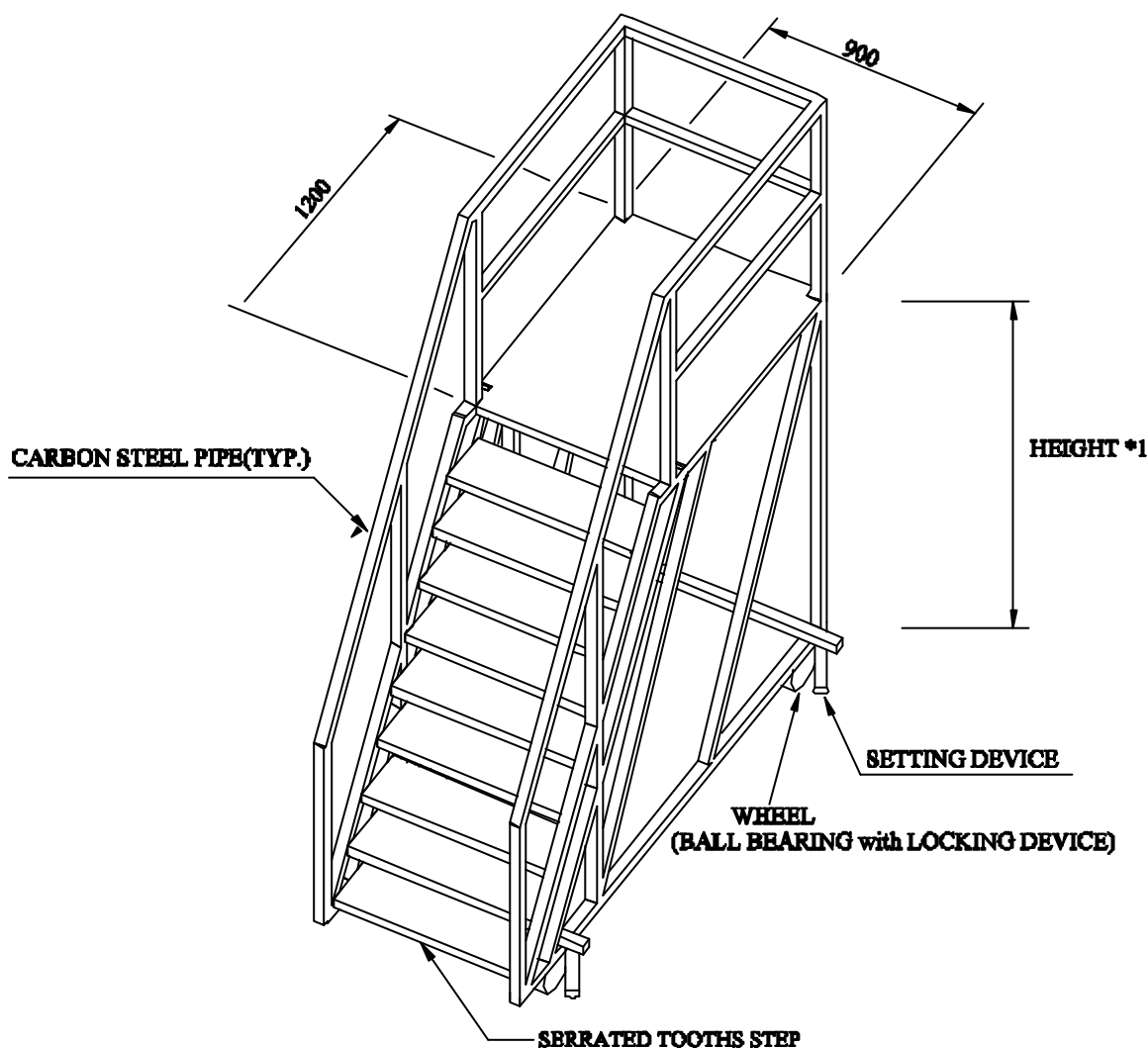
12. EMERGENCY SHOWER&EYE WASHER



NOTES

1. THE GIVEN DIMENSIONS ARE ONLY FOR REFERENCE.
THE MANUFACTURERS STANDARD DIMENSIONS SHALL
NOT BE APPLIED WITHOUT PURCHASER'S APPROVAL

13. MOVABLE PLATFORM



NOTES

1. REFER DATA SHEET FOR MOVABLE PLATFORM.
2. ALL DIMENSIONS ARE IN mm.
3. MATERIALS SHALL BE AS FOLLOWS;
 - SET SCREW : ASTM 304 S.S OR EQUIVALENT
 - WOODEN PILLOW : APITON
 - BRACKET : SAME GRADE MATERIAL AS BODY MATERIAL
4. IN CASE THE BRACKET IS DIRECTLY WELDED TO THE SHELL (NOT THE SKIRT) WHOSE OPERATING TEMPERATURE OF EQUIPMENT IS LOWER THAN -20° C. WOODEN PILLOW SHALL BE INSTALLED BETWEEN THE BRACKET AND THE NAME PLATE.

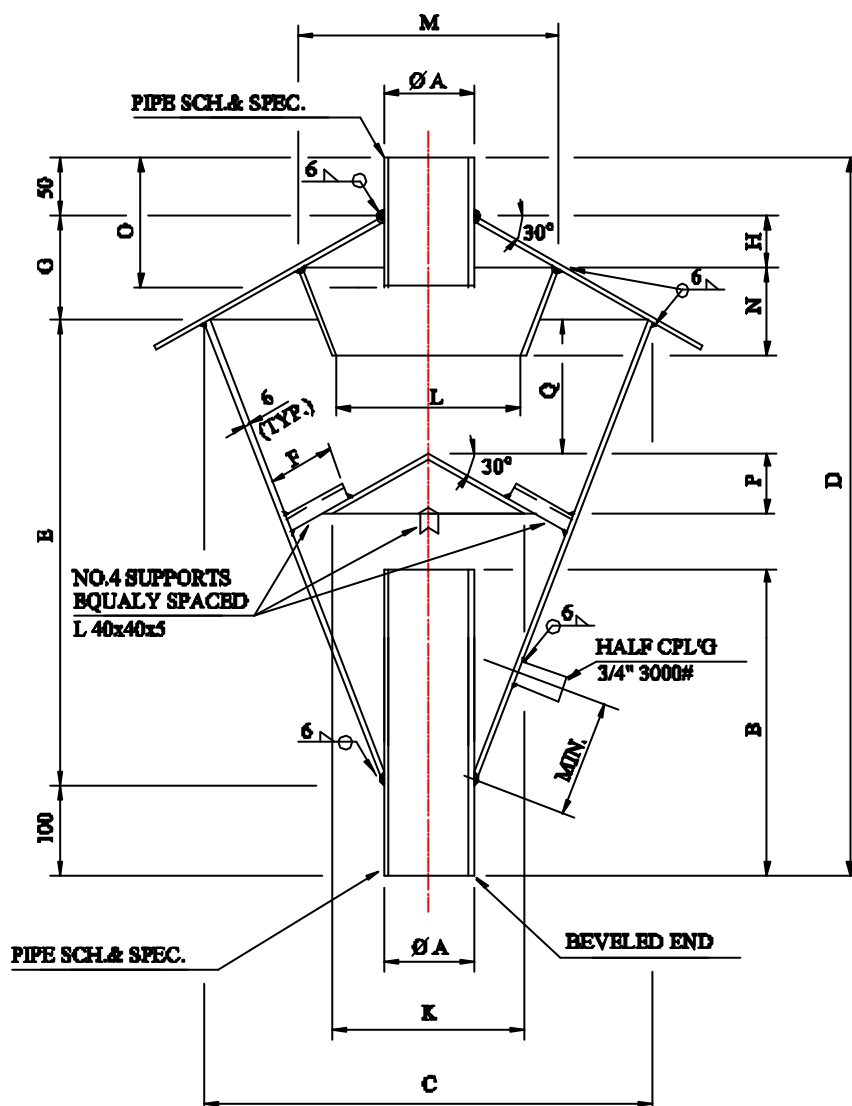


PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.10 SPECIAL ITEMS

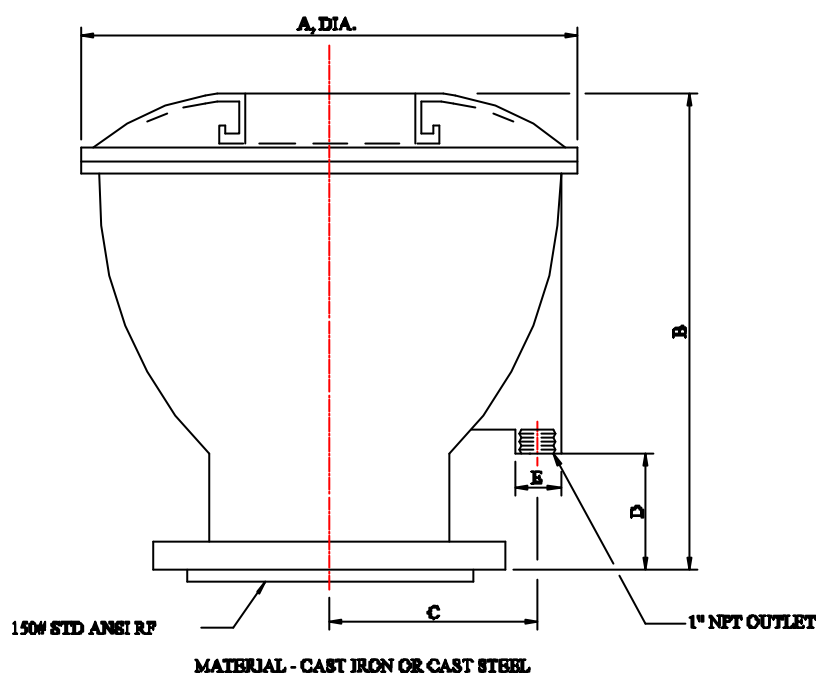
14. EXHAUST HEAD



ØA	B	C	D	E	F	G	H	K	L	M	N	O	P	Q	Kg
2"	220	400	535	285	80	100	53	175	180	245	70	120	55	55	25
3"	240	500	620	350	80	120	61	240	190	300	95	130	70	70	39
4"	300	660	810	505	90	155	80	320	235	390	135	150	95	115	71
6"	380	850	1020	670	90	200	102	440	360	520	145	180	120	150	128
8"	380	850	1020	670	90	200	102	440	360	520	145	180	120	150	135
10"	450	1280	1250	825	120	275	135	530	580	800	180	210	185	200	192
12"	450	1280	1250	825	120	275	135	530	580	800	180	210	185	200	201
14"	500	1500	1400	935	150	315	160	750	710	950	205	250	215	200	263
16"	500	1500	1400	935	150	315	160	750	710	950	205	250	215	200	274

15. SWARTOUT TYPE EXHAUST HEADS(FLANGED)

1" TO 26" - FLANGED



DIMENSIONS AND CAPACITIES

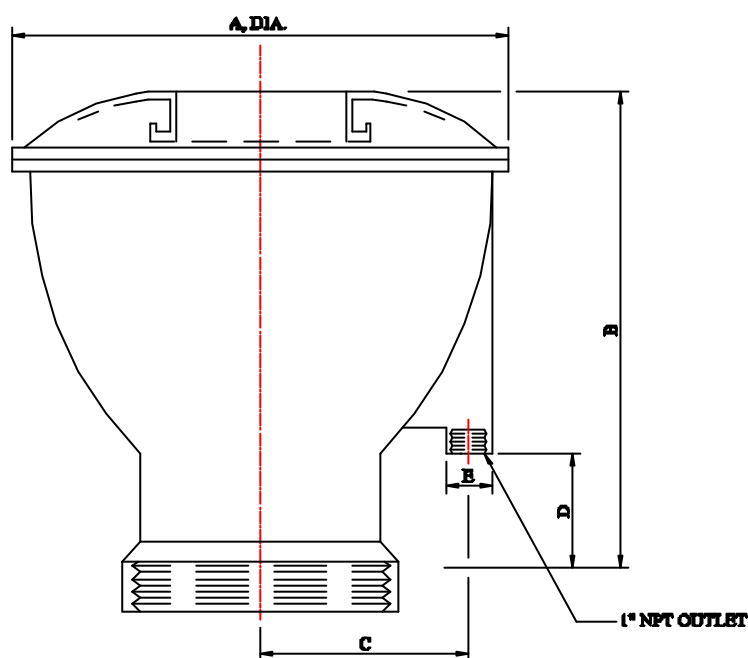
HEAD CONNECTION SIZE (IPS)	CAPACITIES KG OF STEAM PER HR	DIMENSIONS (mm)					NET WEIGHT (N)
		A	B	C	D	E	
1	80	197	216	74	66	13	81
1.1/2	80	197	216	74	66	13	81
2	180	232	267	88	101	20	125
2.1/2	180	232	267	88	101	20	125
3	370	250	274	96	116	20	864
4	590	318	337	126	129	26	1067
6	1050	407	348	167	96	25	356
8	1820	467	461	194	153	25	3430
10	2860	585	550	239	181	51	5893
12	4130	724	629	299	175	64	9780
14	5360	766	677	315	204	64	12192
16	6670	867	797	356	248	77	18084
18	8800	961	861	397	248	77	24638
20	10620	1048	975	426	318	89	28575
24	15430	1436	1169	496	280	102	63500
26	24500	1569	1448	623	388	102	81280

NOTE

BOLT HOLES OF FLANGE ARE DRILLED TO STRADDLE CENTER-LINE OF DRIP OUTLET.
EXHAUST HEAD CAPACITY IS BASED ON 83 FEET PER SECOND VELOCITY AT ATMOSPHERIC PRESSURE.
IN ORDERING SPECIFY QUANTITY, THE MANUFACTURER'S NAME, AND TAG NO.
EXAMPLE : 2 SWARTOUT TAG NO. EXHAUST HEADS.

16. SWARTOUT TYPE ET EXHAUST HEADS(THREADED)

1" TO 4" - THREADED



MATERIAL - CAST IRON OR CAST STEEL

DIMENSIONS AND CAPACITIES

HEAD CONNECTION SIZE (IPS)	CAPACITIES KG OF STEAM PER HR	DIMENSIONS (mm)					NET WEIGHT (N)
		A	B	C	D	E	
1	80	197	216	74	66	13	81
1.1/2	80	197	216	74	66	13	81
2	180	232	267	88	101	20	125
2.1/2	180	232	267	88	101	20	125
3	370	250	274	96	116	20	864
4	590	318	337	126	129	26	1067

NOTE

EXHAUST HEAD CAPACITY IS BASED ON 83 FEET PER SECOND VELOCITY AT ATMOSPHERIC PRESSURE.
 IN ORDERING SPECIFY QUANTITY, THE MANUFACTURER'S NAME, AND TAG NO.
EXAMPLE : 2 SWARTOUT TAG NO. EXHAUST HEADS.

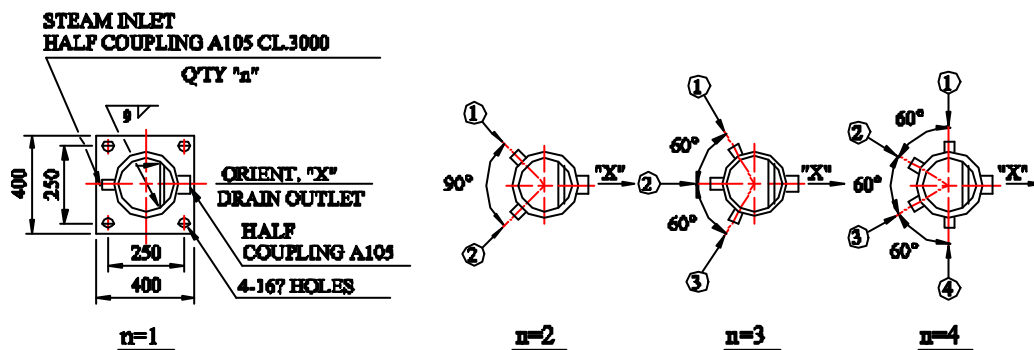
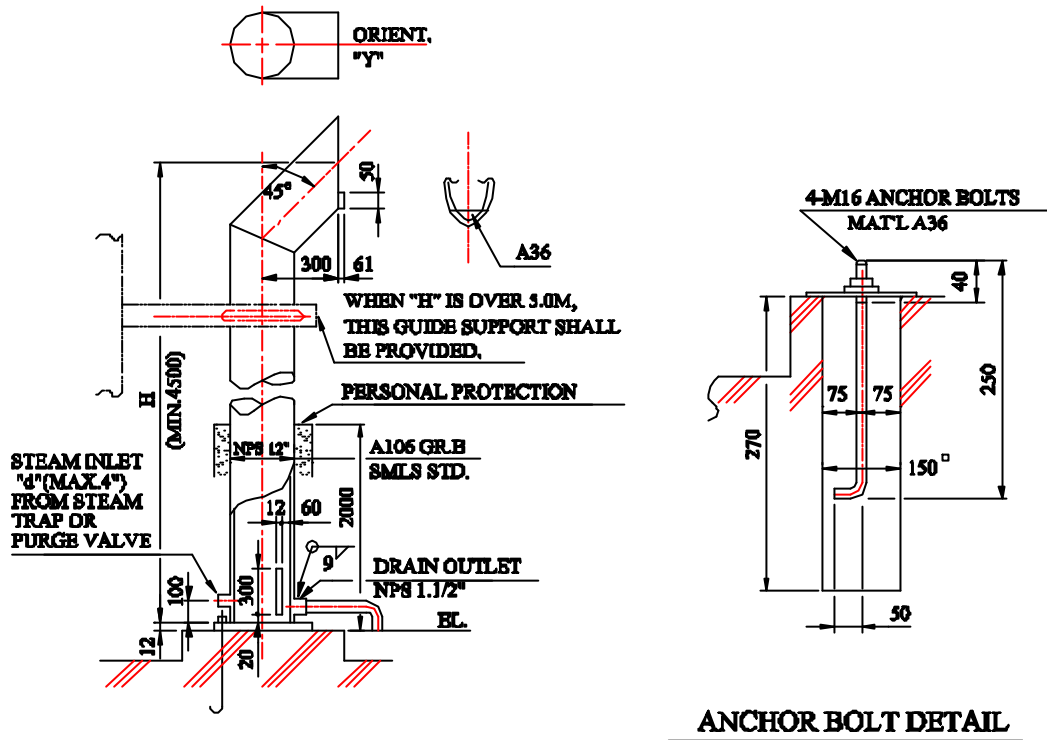


PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.10 SPECIAL ITEMS

17. VENT STACK



ORIENTATION FOR INLET NOZZLE

NOTES

1. THIS TYPE VENT STACK SHALL BE APPLIED TO WARMING-UP PIPINGS OF STEAM TURBINES AND HIGH PRESSURE STEAM CONDENSATE PIPINGS.
2. NO. OF INLET NOZZLE SHALL BE LESS THAN 4.
3. ANCHOR BOLTS SHALL ALSO BE PROVIDED.



18. SPECIAL BOSSES

"FW"(45)/"EW"(50)						"FS"(45)/"ES"(50)					
(SOCKET WELD)						(SCREWED)					
NOMI- NAL SIZE (INCH)	B	C	D	3000#		d	D	6000#		d	REMARKS
				6-30°	6-45°			6-30°	6-45°		
1/2	21.8	9.6	31	85	70	16.1	33	110	95	12.1	
3/4	27.2	12.7	36	95	80	21.1	40	125	109	15.6	
1	33.8	12.7	45	105	90	26.6	50	140	115	20.6	
1.1/2	48.7	12.7	60	125	105	41.1	65	155	130	34.1	

"NW"/"JW" (JACKET LINE)						"NS"/"JS" (JACKET LINE)					
(SOCKET WELD)						(SCREWED)					
NOMI- NAL SIZE (INCH)	B	C	H	3000#		REMARKS	NOMI- NAL SIZE (INCH)	B	C	H	REMARKS
				D	d						
1/2	21.8	9.6	51	31	16.1	33	12.3				
3/4	27.2	12.7	51	36	21.4	40	16.2				
1	33.8	12.7	51	43	27.2	50	21.1				
1.1/2	48.7	12.7	51	60	41.1	65	34.1				
2	61.2	15.8	SEE DATA SHEET	75	52.5	83	42.8				

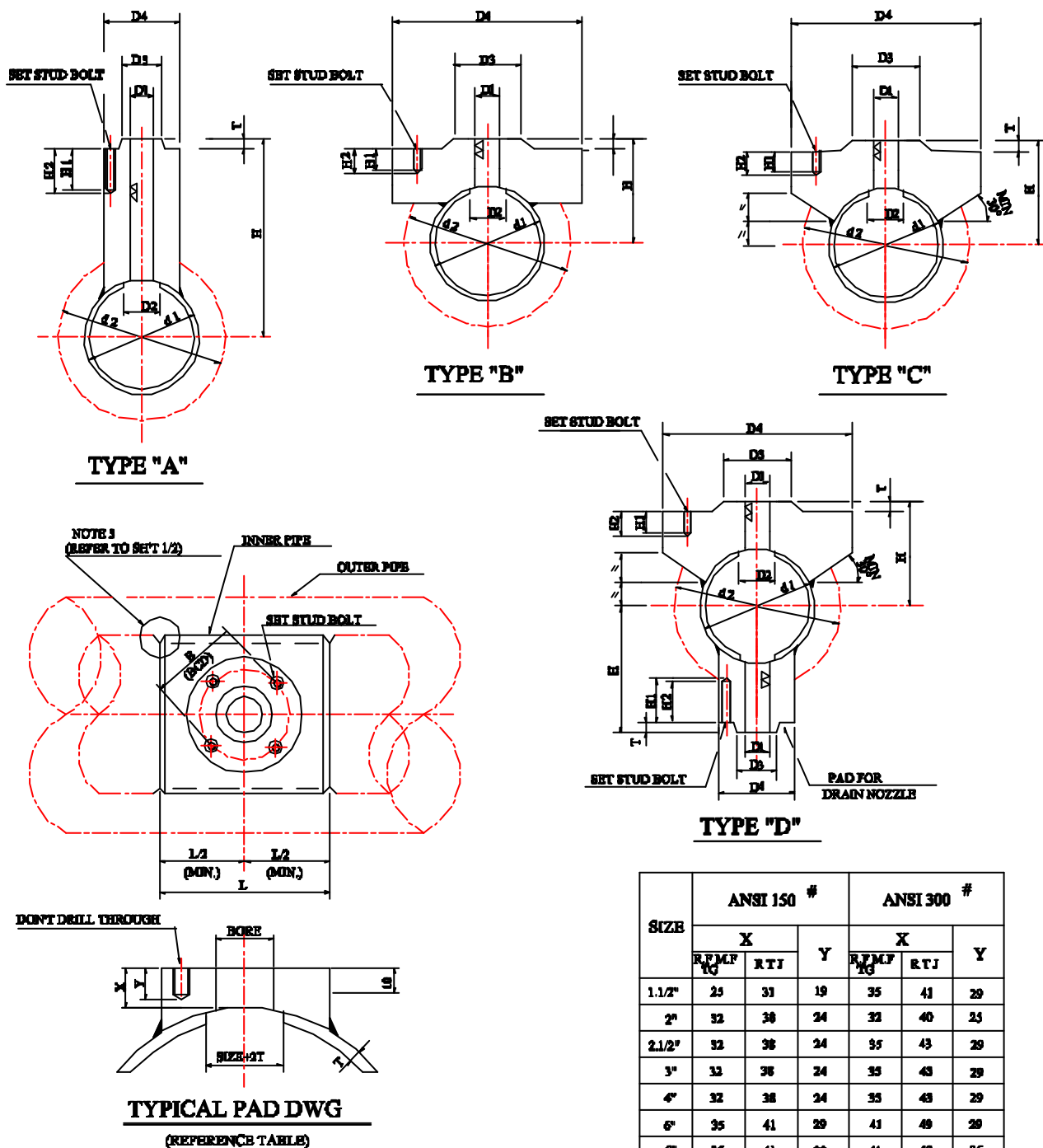
NOTES

1. THREADING TO BE IN ACCORDANCE WITH NPT.
2. TOLERANCES ARE AS FOLLOWS:
 - a) DIMENSION "d" $\pm 0.406\text{mm}$
 - b) DIMENSION "B" $\pm 0.305\text{mm}$
 - c) DIMENSION "H" $\pm 1.571\text{mm}$
 - d) BORE OF BOSSES IS TO BE CONCENTRIC WITH OUTSIDE DIAMETER TO 0.025mm
3. THE LENGTH OF BOSSES WITH JACKETED LINES ARE AS FOLLOWS;

$$\{(O.D \text{ OF OUTER LINE}) - (O.D \text{ OF INNER LINE})\} / 2 + 50\text{mm}$$



19. PAD NOZZLE



SIZE	ANSI 150 #			ANSI 300 #		
	X		Y	X		Y
	R.F.M.F. TO	RTJ		R.F.M.F. TO	RTJ	
1.1/2"	25	31	19	35	41	29
2"	32	38	24	32	40	23
2.1/2"	32	38	24	35	43	29
3"	32	38	24	35	43	29
4"	32	38	24	35	43	29
6"	35	41	29	41	49	29
8"	35	41	29	41	49	35
10"	41	48	33	45	52	38
12"	41	48	33	51	59	45

NOTES

1. TAG NO. SHALL BE FITTED ON THE PAD.
2. ALL DIMENSIONS ARE IN mm.
3. END PREPARATION OF PIPE SHALL BE IN ACCORDANCE WITH ANSI B16.25.
4. EACH DIMENSION OF FLANGE MUST BE PROPER TO STUD BOLT LENGTH AND CAN BE BEARED ON CORRESPONDENT STRENGTH.
5. BOLT/NUT TO BE SUPPLIED BY VENDOR.
6. FLANGE FACE DIMENSIONS (B, D3, D4, T) SHALL BE IN ACCORDANCE WITH ANSI B16.5.



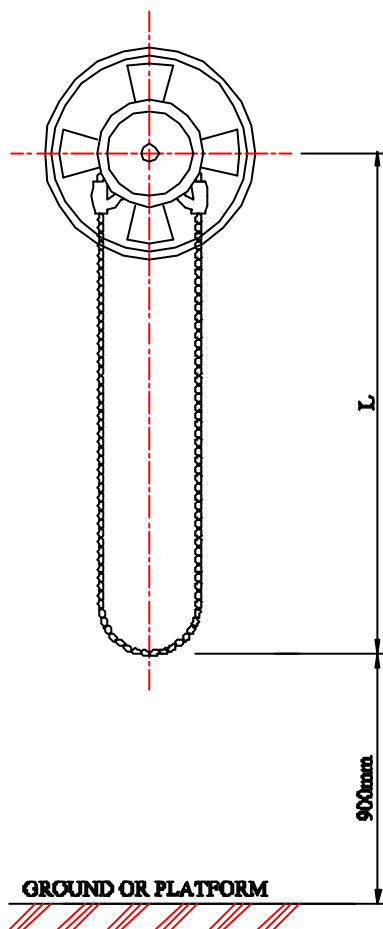
LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK
2. PIPING DESIGN REFERENCES
2.10 SPECIAL ITEMS

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 21 OF 24
DATE : DEC. 1995

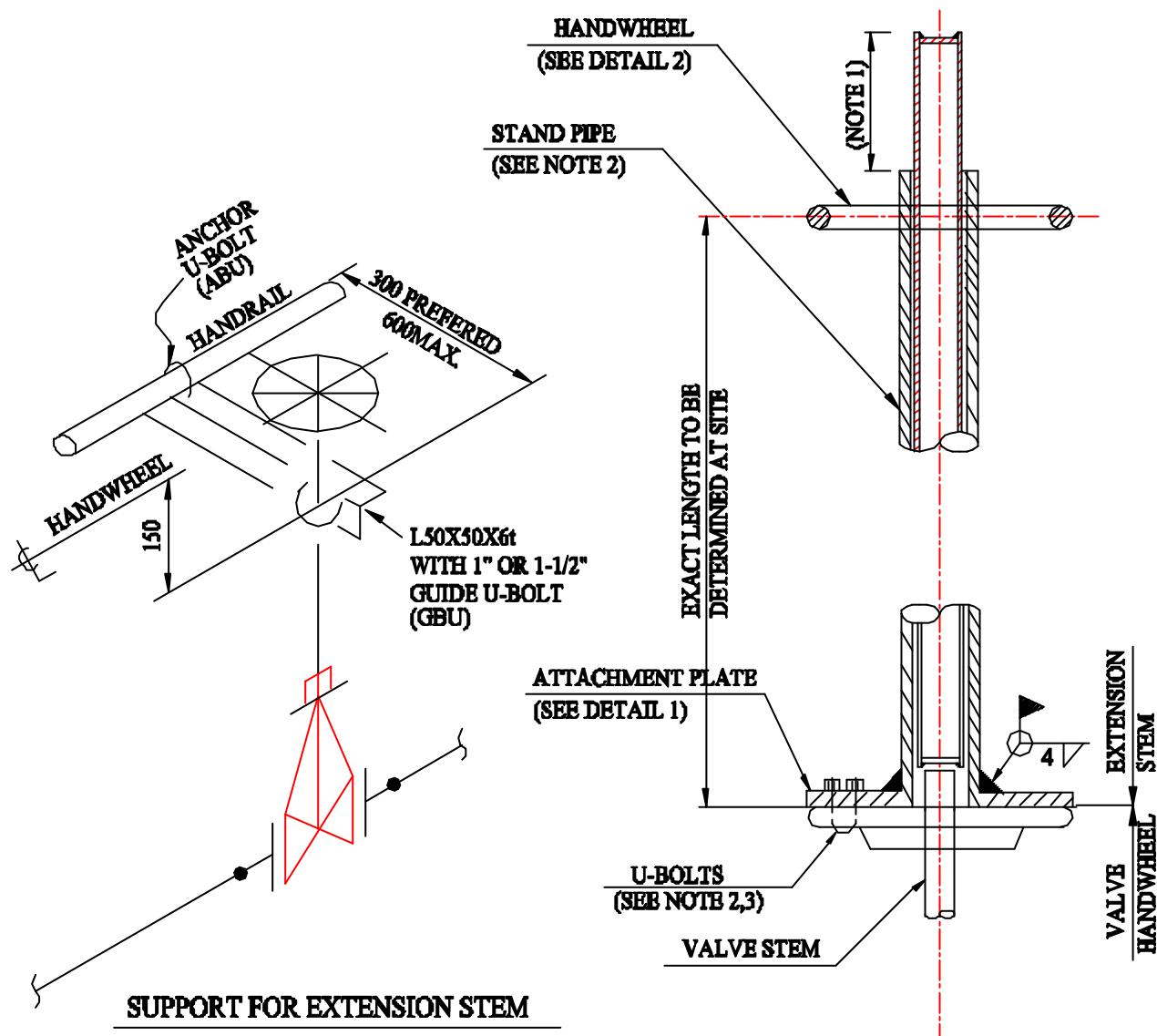
20. CHAIN WHEEL



NOTES

- 1. TAG NO. PLATE SHALL BE FITTED ON THE CHAIN WHEEL.**
- 2. ALL CARBON STEEL CHAIN MATERIALS SHALL BE HOT-DIP GALVANIZED.**

21. VALVE HANDWHEEL EXTENSION SPINDLE (1)



NOTE

1. 20mm AT THE VALVE CLOSED POSITION
2. SIZE OF U-BOLT SHALL BE SELECTED AFTER CHECKING THE VALVE HANDWHEEL.
3. FIELD DRILLING CONFORMING THE VALVE HANDWHEEL
4. MATERIALS, CARBON STEEL, PIPES SUPPLIED BY LGE&C. THE OTHERS BY CONSTRUCTION SUB-CONTRACTOR
5. NDT IS NOT REQUIRED.
6. PAINTING SHALL BE ACCORDING TO THE PAINTING SPECIFICATION.



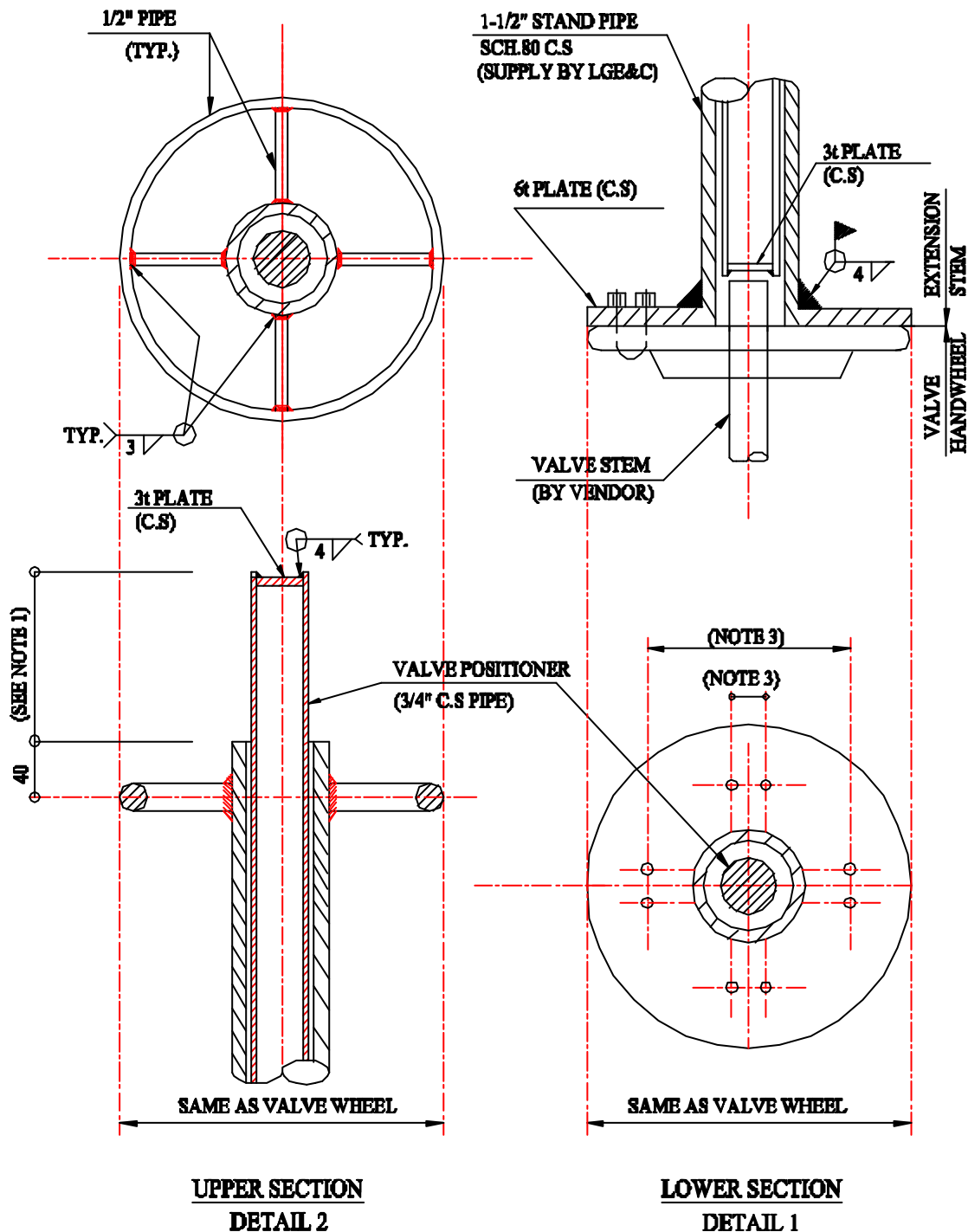
LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK
2. PIPING DESIGN REFERENCES
2.10 SPECIAL ITEMS

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 23 OF 24
DATE : DEC. 1995

22. VALVE HANDWHEEL EXTENSION SPINDLE(2)



VALVE SIZE 4" & OVER



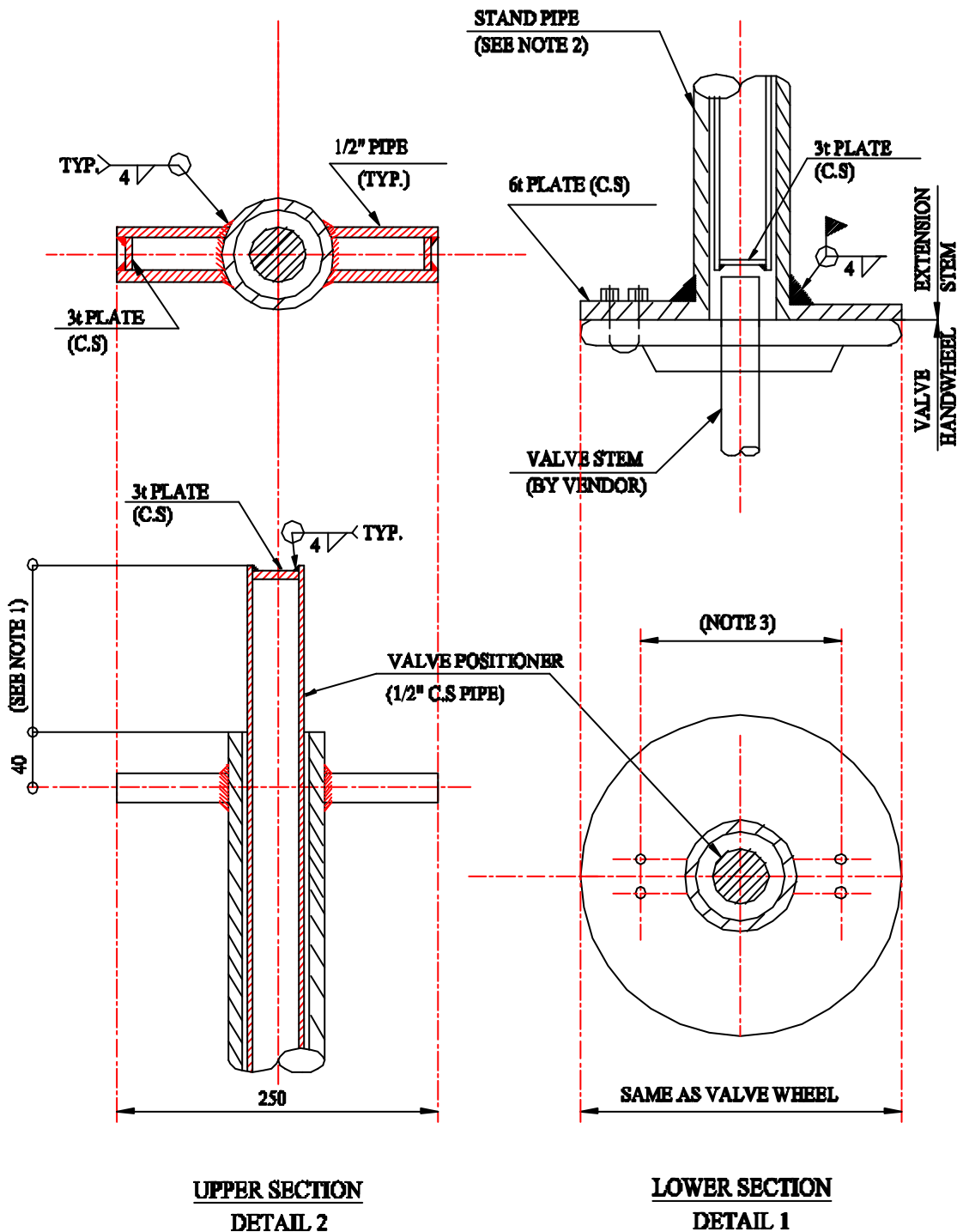
LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK
2. PIPING DESIGN REFERENCES
2.10 SPECIAL ITEMS

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 24 OF 24
DATE : DEC. 1995

23. VALVE HANDWHEEL EXTENSION SPINDLE(3)



VALVE SIZE UP TO 3"

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.11 UTILITY BRANCH SELECTION GUIDE

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 1 OF 2
 DATE : DEC., 1995

1. Relative Carrying Capacities of Standard-Weight² and Outside Diameter Wrought Pipe For Water¹

Actual inside Diameter inches	0.269	0.364	0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	3.548
Nominal size	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2
1/8	1	0.475	0.222	0.122	0.0625	0.0333	0.0167	0.0114	0.0061	0.00392	0.00228	0.00158
1/4	2.1	1	0.475	0.263	0.130	0.0714	0.0657	0.0244	0.0130	0.00833	0.00485	0.00336
3/8	4.5	2.1	1	0.555	0.278	0.151	0.077	0.0526	0.0278	0.0178	0.0103	0.0072
1/2	8.2	3.8	1.8	1	0.500	0.270	0.139	0.091	0.050	0.0322	0.0185	0.0128
3/4	16	7.7	3.6	2	1	0.555	0.278	0.189	0.100	0.0645	0.0370	0.0263
1	30	14	6.6	3.7	1.8	1	0.500	0.344	0.182	0.1180	0.0666	0.0476
1 1/4	60	28	13	7.2	3.6	2	1	0.666	0.357	0.232	0.143	0.0910
1 1/2	88	41	19	11	5.3	2.9	1.5	1	0.526	0.345	0.200	0.139
2	164	77	36	20	10	5.5	2.8	1.9	1	0.625	0.370	0.256
2 1/2	255	120	56	31	15.5	8.5	4.3	2.9	1.6	1	0.588	0.400
3	439	206	97	54	27	15	7	5	2.7	1.7	1	0.715
3 1/2	632	297	139	78	38	21	11	7.2	3.9	2.5	1.4	1
4	867	407	191	107	53	29	15	9.9	5.3	3.4	2	1.4
5	1,525	716	335	188	93	51	26	17	9.3	6	3.5	2.4
6	2,414	1,133	531	297	147	80	41	28	15	9.5	5.5	3.8
8	4,795	2,251	1,054	590	292	160	80	54	29	19	10.9	7.6
10	8,468	3,976	1,862	1,042	516	282	142	97	52	33	19	13.4
12	13,292	6,240	2,923	1,635	809	443	223	152	81	52	30	21
14 in.O.D.	17,028	7,994	3,745	2,094	1,037	567	286	194	104	67	39	27
16 in.O.D.	24,199	11,361	5,322	2,976	1,474	806	406	276	148	95	55	38
18 in.O.D.	31,750	14,906	6,982	3,905	1,933	1,057	533	362	194	124	72	50
20 in.O.D.	41,928	19,685	9,221	5,157	2,553	1,396	703	478	256	164	95	66
24 in.O.D.	67,599	31,737	14,866	8,315	4,116	2,251	1,134	771	413	265	154	107

Actual inside Diameter inches	4.026	5.047	6.065	7.981	10.02	12.00	13.25	15.25	17.00	19.00	23.00
Nominal size	4	5	6	8	10	12	14 in.O.D.	16 in.O.D.	18 in.O.D.	20 in.O.D.	24 in.O.D.
1/3	0.001150	0.000655	0.000415	0.000209	0.000118	0.000075	0.000059	0.000041	0.000032	0.000024	0.000015
1/4	0.00246	0.00139	0.000882	0.000445	0.000252	0.000160	0.000125	0.000088	0.000067	0.000051	0.000032
2/3	0.00523	0.00298	0.00188	0.000948	0.000536	0.000342	0.000267	0.000188	0.000143	0.000108	0.000067
1/2	0.00934	0.00532	0.00336	0.00169	0.000959	0.000611	0.000477	0.000336	0.000256	0.000193	0.000120
3/4	0.0189	0.01075	0.00680	0.00342	0.00194	0.00124	0.000965	0.000678	0.000517	0.000392	0.000243
1	0.0345	0.0196	0.0125	0.00625	0.00355	0.00226	0.00176	0.00124	0.000945	0.000716	0.000444
1 1/2	0.0666	0.0384	0.0244	0.0125	0.00705	0.00449	0.00350	0.00246	0.00188	0.00142	0.000881
1 1/2	0.1010	0.0588	0.0357	0.0185	0.0103	0.00657	0.00515	0.00362	0.00276	0.00209	0.001300
2	0.1887	0.1075	0.0666	0.0345	0.0192	0.0123	0.00961	0.00675	0.00515	0.00390	0.00242
2 1/2	0.294	0.1665	0.1050	0.0526	0.0303	0.0192	0.0149	0.0105	0.00805	0.00610	0.00377
3	0.500	0.296	0.182	0.0917	0.0526	0.0333	0.0256	0.0182	0.0139	0.01050	0.00650
3 1/2	0.715	0.417	0.263	0.1315	0.0746	0.0476	0.0370	0.0263	0.0200	0.01515	0.00935
4	1	0.555	0.357	0.1820	0.1020	0.0666	0.0500	0.0357	0.0270	0.0208	0.0128
5	1.8	1	0.625	0.322	0.1785	0.1150	0.0909	0.0625	0.0476	0.0370	0.0227
6	2.8	1.6	1	0.500	0.286	0.1820	0.1430	0.1000	0.0769	0.0555	0.0357
8	5.5	3.1	2	1	0.555	0.3570	0.278	0.2000	0.1515	0.1150	0.0714
10	9.8	5.6	3.5	1.8	1	0.6250	0.500	0.3450	0.2630	0.2000	0.1250
12	15	8.7	5.5	2.8	1.6	1	0.769	0.555	0.416	0.322	0.196
14 in.O.D.	20	11	7	3.6	2	1.3	1	0.714	0.526	0.400	0.250
16 in.O.D.	28	16	10	5.0	2.9	1.8	1.4	1	0.769	0.588	0.357
18 in.O.D.	37	21	13	6.6	3.8	2.4	1.9	1.3	1	0.769	0.476
20 in.O.D.	48	27	18	8.7	5	3.1	2.5	1.7	1.3	1	0.625
24 in.O.D.	78	44	28	14	8	5.1	4	2.8	2.1	1.6	1

Notes :

- 1) The carrying capacity for water varies as the square root of the fifth power of the actual inside diameter.
- 2) Schedule 40 pipe 10in. and smaller is identical with standard-weight pipe. The relative carrying capacities listed for standard-weight pipe also are approximate for Type K copper water tubes of same nominal size.

Example. A 2-in pipe has a water-carrying capacity equal to ten 3/4-in. pipes, or 0.1887 that of a 4-in. pipe

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.11 UTILITY BRANCH SELECTION GUIDE

 LDP-L901
REV. 1 (OCT., 2002)
PAGE : 2 OF 2
DATE : DEC., 1995

2. Relative Carrying Capacity of Standard-Weight(Schedule 40)¹ Wrought Pipe and Actual Inside Diameter for Air, Steam, and Gas

Dia- meter	1/2	3/4	1	1.1/2	2	2.1/2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Dia- meter
1/2		2.27	4.88	15.8	31.7	52.9	96.9	205	377	620	918	1,292	1,767	2,488	3,014	3,786	4,904	5,927	7,321	8,535	9,717	1/2
3/4	2.60		2.05	6.97	14.0	23.3	42.5	90.4	166	273	405	569	779	1,096	1,328	1,668	2,161	2,615	3,226	3,761	4,282	3/4
1	7.55	2.90		3.45	6.82	11.4	20.9	44.1	18.1	133	198	278	380	536	649	815	1,070	1,263	1,576	1,837	2,092	1
1.1/2	24.2	9.30	3.20		2.00	3.34	6.13	13.0	23.8	39.2	58.1	81.7	112	157	190	239	310	375	463	539	614	1.1/2
2	54.8	21.0	7.25	2.26		1.67	3.06	6.47	11.9	19.6	29.0	40.8	55.8	78.5	95.1	119	155	187	231	269	307	2
2.1/2	102	39.4	13.6	4.23	1.87		1.83	3.87	7.12	11.7	17.4	24.4	33.4	47.0	56.9	71.5	92.6	112	138	161	184	2.1/3
3	170	65.4	22.6	7.03	3.11	1.66		2.12	3.89	6.39	9.48	13.3	20.9	23.7	31.2	39.1	50.6	61.1	75.5	88.0	100	3
4	376	144	49.8	15.5	6.87	3.67	2.21		1.84	3.02	4.48	6.30	8.61	12.1	14.7	18.5	23.9	28.9	35.7	41.6	47.4	4
5	686	263	90.9	28.3	12.5	6.70	4.03	1.83		1.65	2.44	3.43	4.69	6.60	8.00	10.0	13.0	15.7	19.4	22.6	25.8	5
6	1,116	429	148	46.0	20.4	10.9	6.56	2.97	1.63		1.48	2.09	2.85	4.02	4.86	6.11	7.91	9.56	11.8	13.8	15.6	6
7	1,707	656	226	70.5	31.2	16.6	10.0	4.54	2.49	1.51		1.41	1.93	2.71	3.28	4.12	5.34	6.45	7.97	9.31	10.6	7
8	2,435	936	322	101	44.5	23.8	14.3	6.48	3.54	2.18	1.43		1.35	1.93	2.33	2.92	3.79	4.57	5.67	6.60	7.52	8
9	3,335	1,281	440	137	60.8	32.5	19.5	8.85	4.85	2.98	1.95	1.37		1.41	1.71	2.14	2.77	3.35	4.14	4.83	5.50	9
10	4,393	1,688	582	181	80.4	42.9	25.8	11.7	6.40	3.93	2.57	1.80	1.32		1.21	1.52	1.97	2.38	2.94	3.43	3.91	10
11	5,642	2,168	747	233	103	55.1	33.1	15.0	8.22	5.05	3.31	2.32	1.70	1.28		1.26	1.63	1.88	2.43	2.83	3.22	11
12	7,087	2,723	938	293	129	69.2	41.6	18.8	10.3	6.34	4.15	2.91	2.13	1.61	1.26		1.30	1.57	1.93	2.26	2.58	12
13	8,657	3,326	1,146	358	158	84.5	50.7	23.0	12.6	7.75	5.07	3.56	2.60	1.98	1.53	1.22		1.21	1.49	1.74	1.98	13
14	10,600	4,070	1,403	438	193	103	62.2	28.2	15.4	9.48	6.21	4.35	3.18	2.41	1.88	1.50	1.22		1.24	1.44	1.64	14
15	12,824	4,927	1,698	530	234	125	75.3	34.1	18.7	11.5	7.52	5.27	3.85	2.92	2.27	1.81	1.48	1.21		1.17	1.35	15
16	14,978	5,758	1,984	619	274	146	88.0	39.9	21.8	13.4	8.78	6.15	4.51	3.41	2.66	2.12	1.73	1.42	1.18		1.14	16
17	17,537	6,738	2,322	724	320	171	103	46.6	25.6	15.7	10.3	7.20	5.27	3.99	3.11	2.47	2.03	1.66	1.37	1.17		
18	20,327	7,810	2,691	840	371	198	119	54.1	29.6	18.2	11.9	8.35	6.11	4.63	3.60	2.87	2.35	1.92	1.59	1.36	1.16	
20	26,676	10,249	3,532	1,102	487	260	157	70.9	38.9	23.9	15.6	10.9	8.02	6.07	4.73	3.76	3.08	2.52	2.08	1.78	1.52	
24	42,624	16,376	5,644	1,761	778	416	250	113	62.1	38.2	25.0	17.5	12.8	9.70	7.55	6.01	4.92	4.02	3.32	2.84	2.43	
30	75,453	28,990	9,990	3,117	1,378	736	443	201	110	67.6	44.2	31.0	22.7	17.2	13.4	10.7	8.72	7.14	5.88	5.03	4.30	
36	120,100	46,143	15,902	4,961	2,193	1,172	705	319	175	108	70.4	49.3	36.1	27.3	21.3	16.9	13.9	11.3	9.37	8.01	6.85	
42	177,724	68,282	23,531	7,341	3,245	1,734	1,044	473	259	159	104	73.0	53.4	40.5	31.5	25.1	20.5	16.8	13.9	11.9	10.1	
48	249,351	95,818	33,020	10,301	4,554	2,434	1,465	663	363	223	146	102	75.0	56.8	44.2	35.2	28.8	23.5	19.4	16.6	14.2	
Dia- meter	1/2	3/4	1	1.1/2	2	2.1/2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	

Notes :

The upper portion above the diagonal lines of blanks pertains to nominal pipe sizes while the lower portion is for pipe of the actual internal diameter given. Equivalent number of pipes = $(d_1^3/d_2^3) \sqrt{(d_2 + 3.6)/(d_1 + 3.6)}$

Ex.1 – Carrying capacity of 3/4-in. standard-weight pipe is equivalent to 2.27 half-inch standard-weight pipes.

Ex.2 – Carrying capacity of pipe with inside diameter of 13 in. is equivalent to 3.56 pipes with inside diameter of 8 in.

Standard-weight pipe 10 in. and smaller is identical with Schedule 40 pipe.

The data in this table are reproduced by permission from “Steam power plant engineering,” by G.F.Gebhardt, 4th ed., John Wiley & Sons, Inc., New York.

1. 측정 유체

측정유체 유량계	기체	증기	기름	물	특 수 유 체				
					200℃	400℃	점도 200cP 이상	부식	Slurry
전자 유량계 (Magnetic Flow Meter)	×	×	×	○	△	×	○	○	○
초음파 유량계 (Ultra Sonic Flow Meter)	○	○	○	○	○	△	○	○	△
와류 유량계 (Vortex Flow Meter)	○	○	○	○	○	△	×	△	△
용적 유량계 (P/D Flow Meter)	○	×	○	○	○	△	○	△	×
Turbine 유량계 (Turbine Flow Meter)	○	×	○	○	○	△	×	○	×
차압 유량계 (Orifice Plate)	○	○	○	○	○	○	△	○	△
면적 유량계 (Rotameter)	○	○	○	○	○	△	○	△	△
Coriolis 힘 질량유량계 (Mass Flow Meter)	△	△	○	○	○	△	○	○	○

○ : 이 유량계와 유체와의 조합은 적당함 쉽게 유량계의 성능을 발휘
 △ : 유량계와 유체와의 조합을 추천할 수는 없으나 측정은 가능하다.
 단, 만족할 만한 결과를 얻지 못할 때가 있으므로 주의할 필요가 있다.

2. FLOWMETER 특성

FLOWMETER TYPE	CON'N TYPE	METER RUN		설치조건	ACCESSORIES	REMARKS
		UP-STREAM	DOWN-STREAM			
MAGNETIC	WAFER FLANGE	5D (2)	2D (2)	수평/수직가능 (1)		
TURBINE	삽입형 FLANGE WAFER	20D (2)	5D (2)	수평/수직가능 (1)	STRAINER 정류기 기체분리기 (5)	
VORTEX	WAFER FLANGE	15D (2)	5D (2)	수평/수직가능 (1)		
TARGET		15D (4)	5D (4)			
P/D METER	FLANGE	불필요	불필요	수평/수직가능 (1)	STRAINER(5)	
ROTAMETER	FLANGE	불필요	5D		STRAINER(5)	
ULTRASONIC		10 D (2)	5D (2)			
MASS	FLANGE	불필요	불필요	수평/수직가능 (1)		
THERMAL MASS FLOW		10D	5D			
THERMAL (INSERTION TYPE)		10D	5D			
ORIFICE PLATE or INTEGRAL CELL		20D (2)	5D (2)	수평		
PITOT TUBE		30D	5D			
VENTURI TUBE		15D	5D			
FLOW NOZZLES		20D	5D			
V-CONE	FLANGE WELD	2D	5D	수평/수직가능		
SEGMENTAL		15D	5D			

Notes :

- 1) 유량계의 배관설계 및 설치기준에 따른다.
- 2) 유량계의 직관부 도표에 따른다.
- 3) 정류기를 설치하지 않을 경우, 상류측 배관 형태에 따른다.
- 4) METER RUN 이 MFR 에 따라 다소 달라질 수 있다. 확정된 METER RUN 은 VENDOR INFORMATION 자료에 따른다.
- 5) ACCESSORIES 는 PROCESS & 배관의 조건에 따라 선택될 수 있다.

3. FLOWMETER STRAIGHT - RUN

3.1 MAGNETIC FLOWMETER (전자유량계)

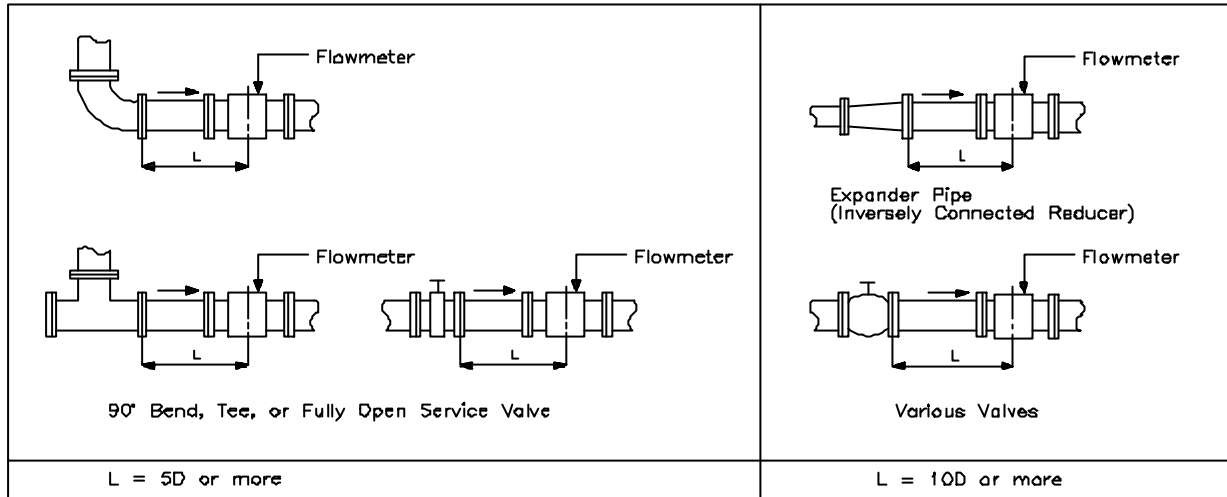


도표 1-1

Notes : 1) L : Minimum length of straight pipe-run

2) Down stream side 의 straight pipe-run 은 필요하지 않으나, valve 및 fitting 을 사용할 경우는 2D ~ 3D 의 직관부가 필요하다.

3.2 TURBINE FLOWMETER (API Standard 2534)

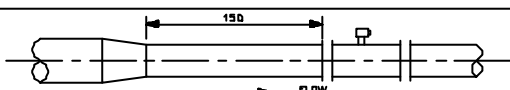
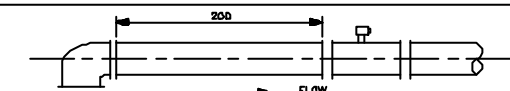
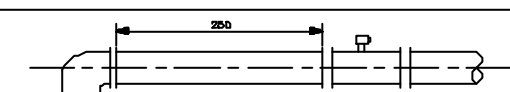
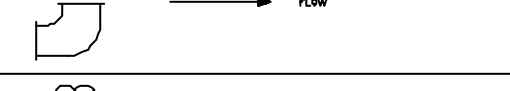
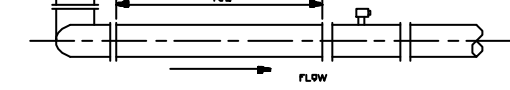
	Piping condition	Pipe length	Description
Reducer		15D min.	A concentric reducer upstream of meter
Elbow		20D min.	An elbow upstream of meter
		25D min.	Two elbows in horiz. plane upstream of meter
		40D min.	Two elbows in vert. plane upstream of meter
Sluice valve		50D min.	A partially open sluice valve upstream of meter

도표 2-1

*The minimum length required for downstream pipe is 5D.

3.3 VORTEX FLOWMETER (와류 유량계)

(ISO - 5167 Standard)

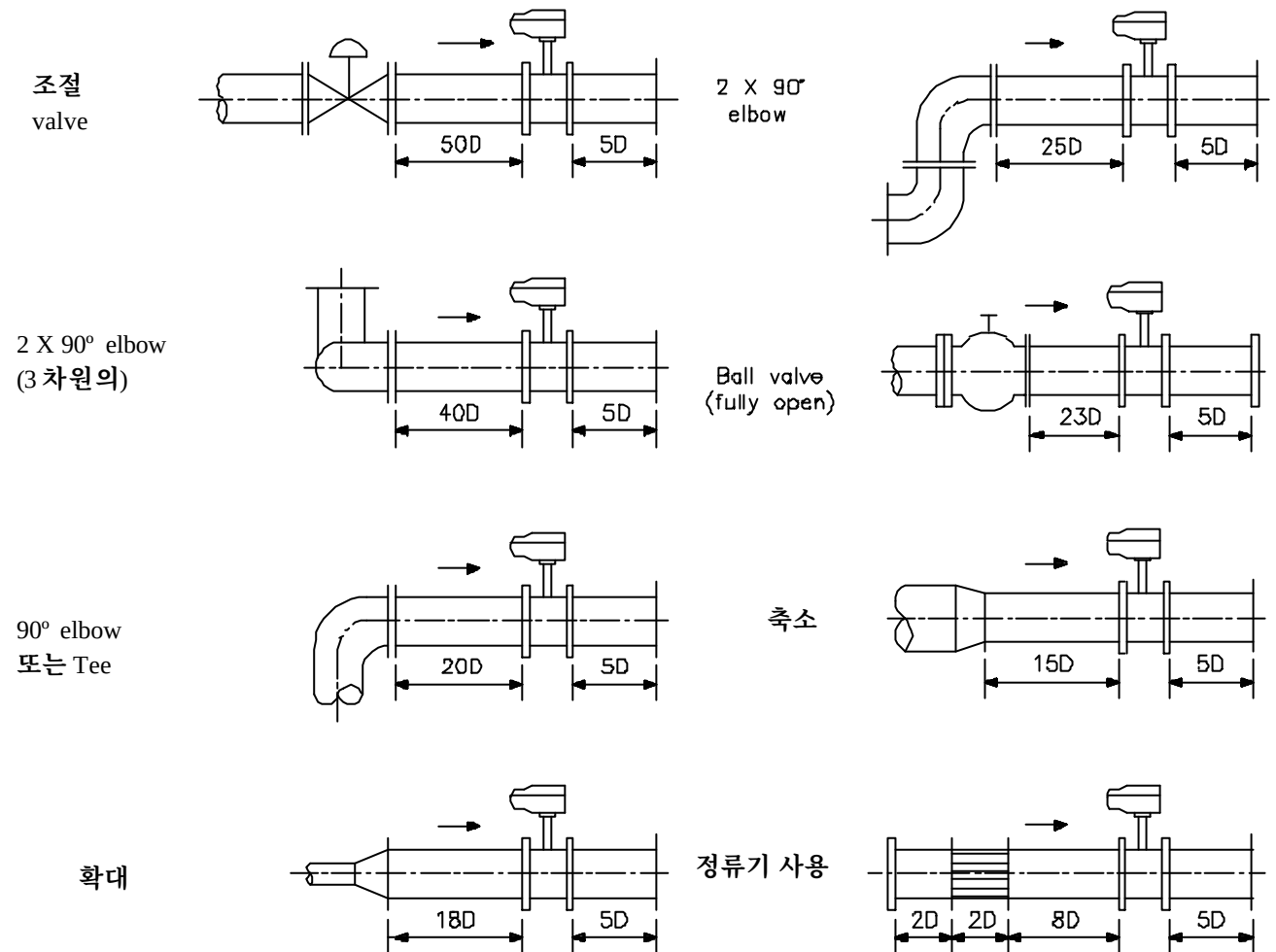


도표 3-1

3.4 ULTRASONIC FLOWMETER (초음파 유량계)

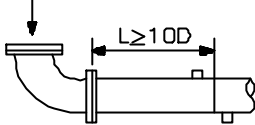
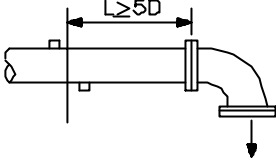
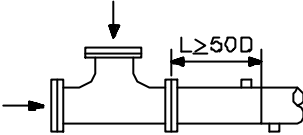
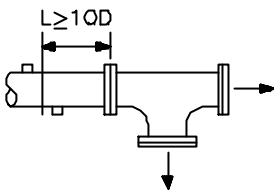
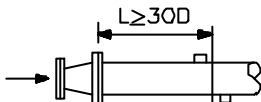
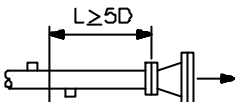
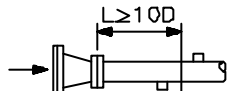
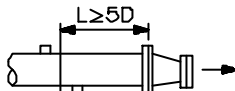
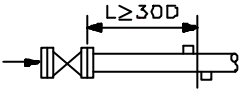
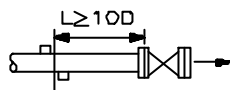
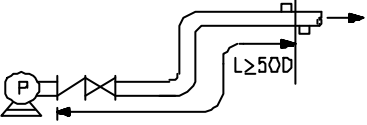
구분	상류측	하류측
90 ° bend		
Tee		
확대관		
축소관		
각종 Valve		
각종 Valve		

도표 4-1

주의) 위 직관부는 transit-time method (전파 시간차법) 일 때의 직관길이 이다.

Doppler 법 초음파 유량계 일 때는 전파 시간차법의 직관길이에 약 1.5 배 정도가 더 필요하다.

3.5 PITOT TUBE (ANNUBAR)

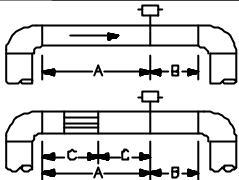
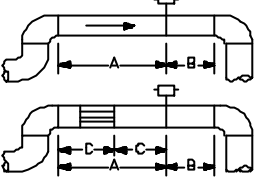
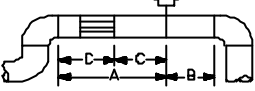
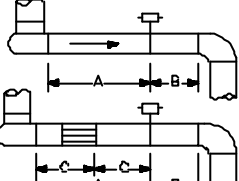
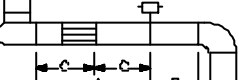
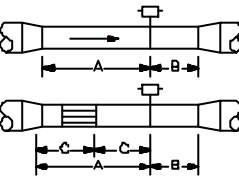
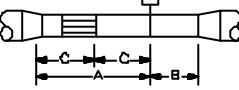
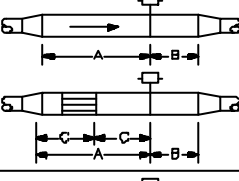
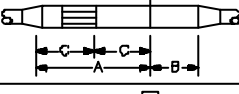
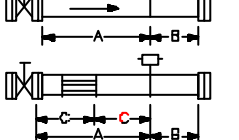
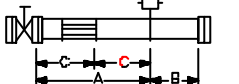
Minimum diameters of straight pipe	Upstream dimension					Downstream dimension	
	Without vanes		With vanes				
	In plane A	Out of plane A	A'	C	C'		
Fig 1		7	9				3
				6	3	3	
Fig 2		9	14				3
				8	4	4	
Fig 3		19	24				4
				9	4	5	
Fig. 4		8	8				3
				8	4	4	
Fig 5		8	8				3
				8	4	4	
Fig. 6		24	24				4
				9	4	5	

도표 5-1

Annubar recommended approach and depart values

Selecting correct mounting locations for Annubar in lengths the pipeline is important because disturbance in flow downstream produced by pipe layout may affect the accuracy of made measurement. Chart a describes the minimum number of pipe diameters upstream and downstream of the Annubar. Longer lengths are always preferred (if available) for accurate flow measurement.

Straight run requirements

Use of recommended straight pipe of uniform diameter upstream and ensures that flow measurements will be flow with fully developed characteristics.

PIPING HANDBOOK

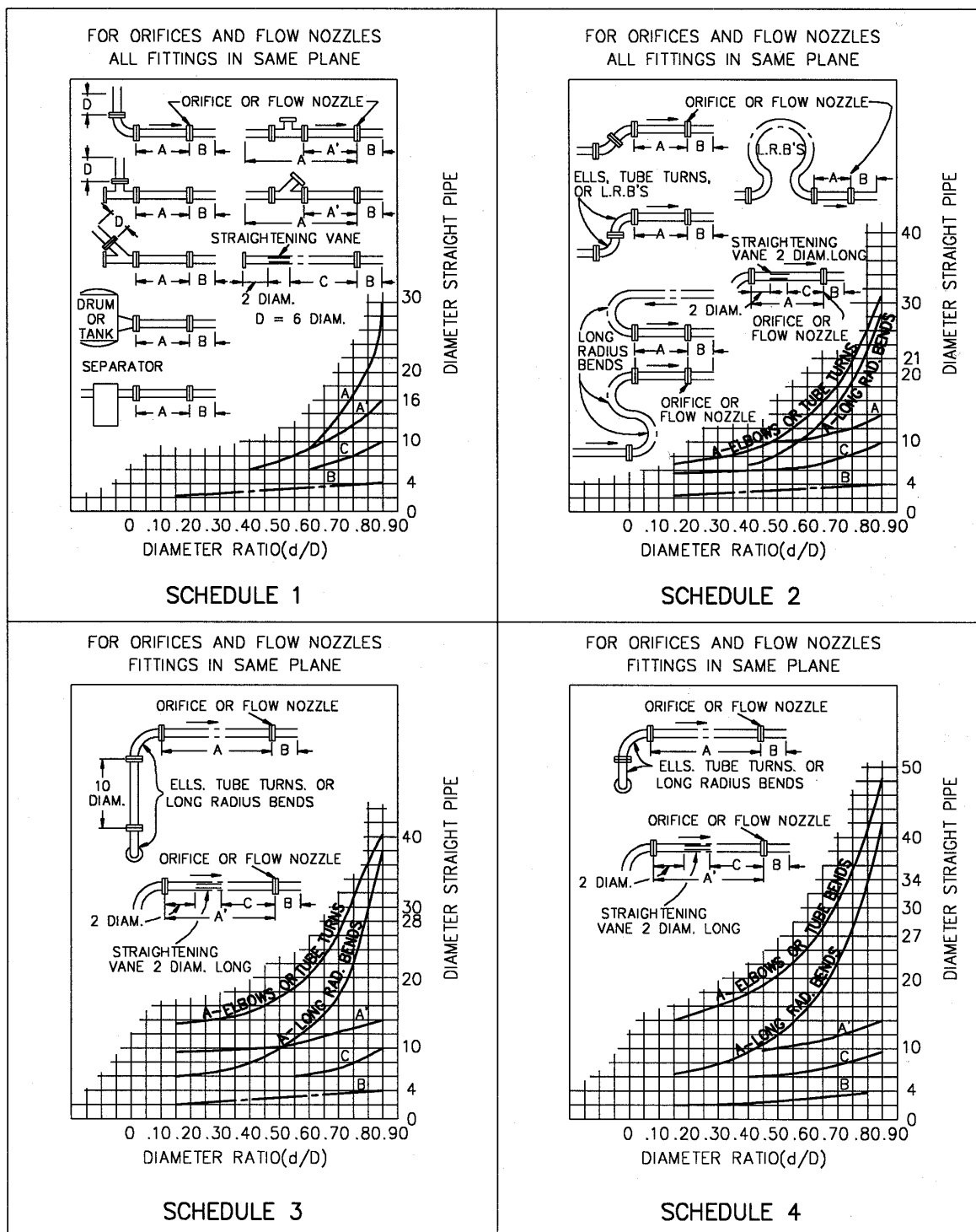
2. PIPING DESIGN REFERENCES

2.12 FLOW INSTRUMENT

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 7 OF 11
 DATE : DEC., 1995

3.6 ORIFICE / FLOW NOZZLE / VENTURI

3.6.1 ORIFICE / FLOW NOZZLE / VENTURI (ASME PART - II)

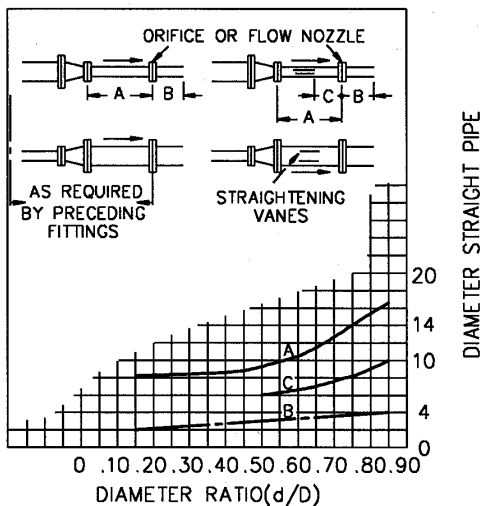


PIPING HANDBOOK

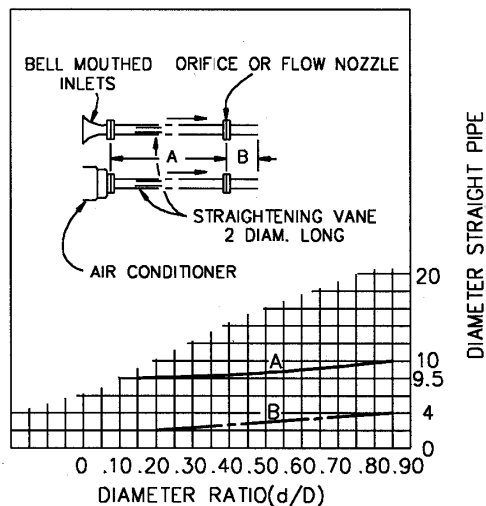
2. PIPING DESIGN REFERENCES

2.12 FLOW INSTRUMENT

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 8 OF 11
 DATE : DEC., 1995

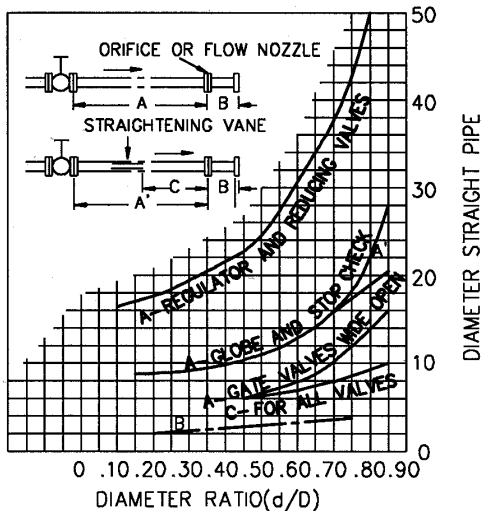
 FOR ORIFICES AND FLOW NOZZLES
WITH REDUCERS AND EXPANDERS


SCHEDULE 5

 FOR ORIFICES AND FLOW NOZZLES
IN ATMOSPHERIC INTAKE


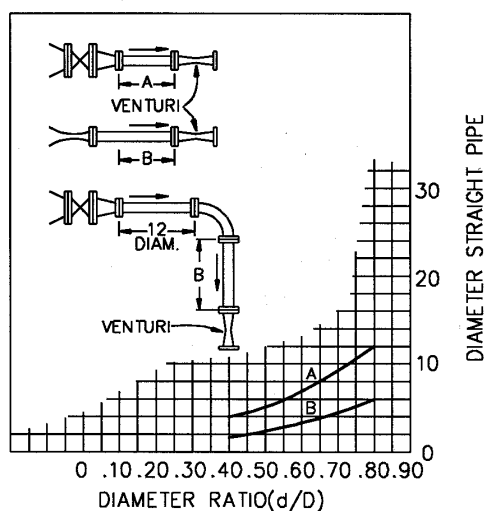
SCHEDULE 6

VALVES



SCHEDULE 7

FOR VENTURI TUBES



SCHEDULE 8

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.12 FLOW INSTRUMENT

PIPING REQUIREMENTS FOR ORIFICES, FLOW NOZZLES AND VENTURI TUBES (APPLICABLE ON SCHEDULE 1 THRU 8)

	0.0 - 0.50 RATIO	0.50 - 0.60 RATIO	0.60 - 0.70 RATIO	0.70 - 0.80 RATIO
FITTINGS ALLOWED ON OUTLET SIDE IN PLACE OF STRAIGHT PIPE	1. TEES 2. 45 ° ELBOWS 3. GATE VALVES 4. SEPARATOR 5. Y - FITTINGS 6. EXPANSION JOINTS	1. TEES 2. EXPANSION JOINTS 3. GATE VALVES 4. T - FITTINGS 5. SEPARATOR (IN INLET NECK IS ONE DIAM. L' G)	1. GATE VALVES 2. Y - FITTINGS 3. SEPARATOR (IF INLET NECK IS ONE DIAMETER LONG.)	1. GATE VALVES 2. LONG RADIUS BEND

Notes :

1. For schedules 1 thru 8 the absolute minimum downstream run shall be 6 diameters if a control valve, regulator, partially closed gate valve or check valve is the first downstream fitting.
2. d : ORIFICE I.D
3. D : ACTUAL PIPE I.D

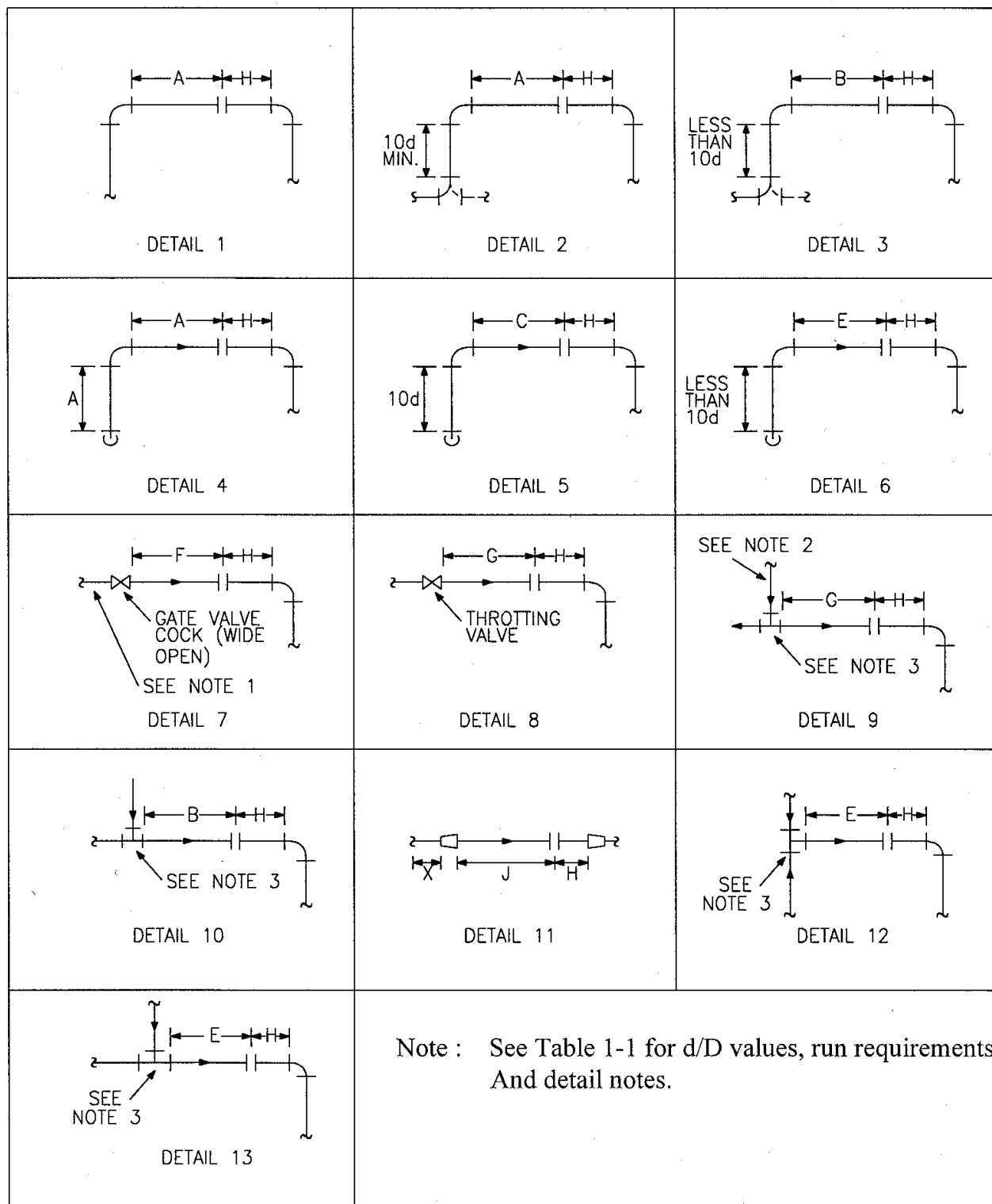
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.12 FLOW INSTRUMENT

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 10 OF 11
 DATE : DEC., 1995

3.6.2 ORIFICE (API RP 550-PART 1)



PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.12 FLOW INSTRUMENT

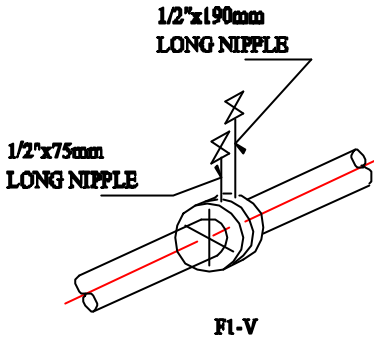
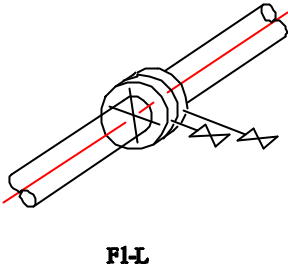
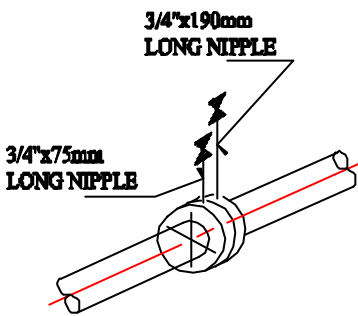
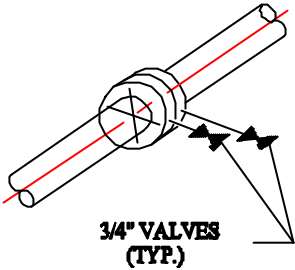
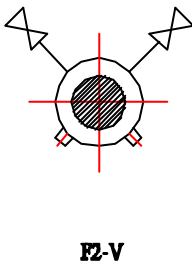
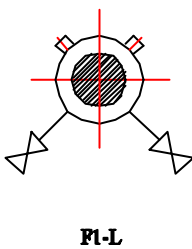
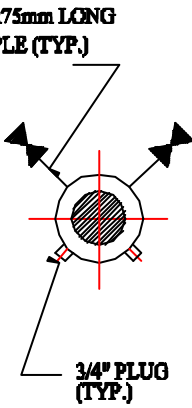
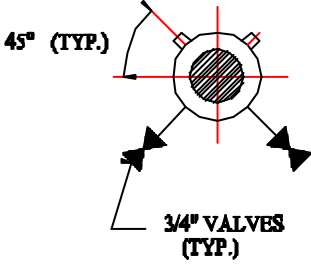
Table 1-1 d/D Ratio vs. Straight Run Requirements (API RP 550 PART - I)

Straight Run Requirement (In Nominal Pipe Diameters) 도표 5-1								
d/D Ratio	A	B	C	E	F	G	H	J
0.80	20	25	33	40	14	50	5	15
0.75	17	21	27	35	11	44	5	14
0.70	14	19	23	31	9	39	5	13
0.65	12	15	21	28	8	34	5	11
0.60	10	14	19	25	8	31	5	10
0.55	9	12	18	22	7	28	5	9
0.50	8	10	17	21	7	25	5	8
0.45	7	9	16	20	5	24	5	7
0.40	7	9	15	18	5	22	5	7
0.35	6	9	14	17	5	21	5	6
0.30	6	9	14	16	5	20	5	6
0.25	6	9	14	16	5	19	5	6

Notes :

1. When the valve is preceded by fittings, the straight run must be sufficient to cover their requirements.
2. If this line contains fittings in another plane, use dimension C or E as required by detail 5 or 6 in Figure 5-1.
3. Double entry fittings may be considered as single bends when the line is normally blocked off, such as at spare pumps.
4. In Figure 5-1 detail 11. X 3 must be equal to the number of diameters required by previous Fittings.

1. ORIFICE FLANGE TAP PIPING

FABRICATION AND INSTALLATION PACKAGES		FLANGE RATING	VAPOR&STEAM	LIQUID
	PREFERRED	600# & BELOW USE PACKAGE	 1/2"x190mm LONG NIPPLE 1/2"x75mm LONG NIPPLE F1-V	 F1-L
		900# & ABOVE DETAIL ON ISOMETRIC	 3/4"x190mm LONG NIPPLE 3/4"x75mm LONG NIPPLE F2-V	 3/4" VALVES (TYP.)
	ALTERNATE	600# & BELOW USE PACKAGE	 F2-V	 F1-L
		900# & ABOVE DETAIL ON ISOMETRIC	 3/4"x75mm LONG NIPPLE (TYP.) 3/4" PLUG (TYP.)	 45° (TYP.) 3/4" VALVES (TYP.)

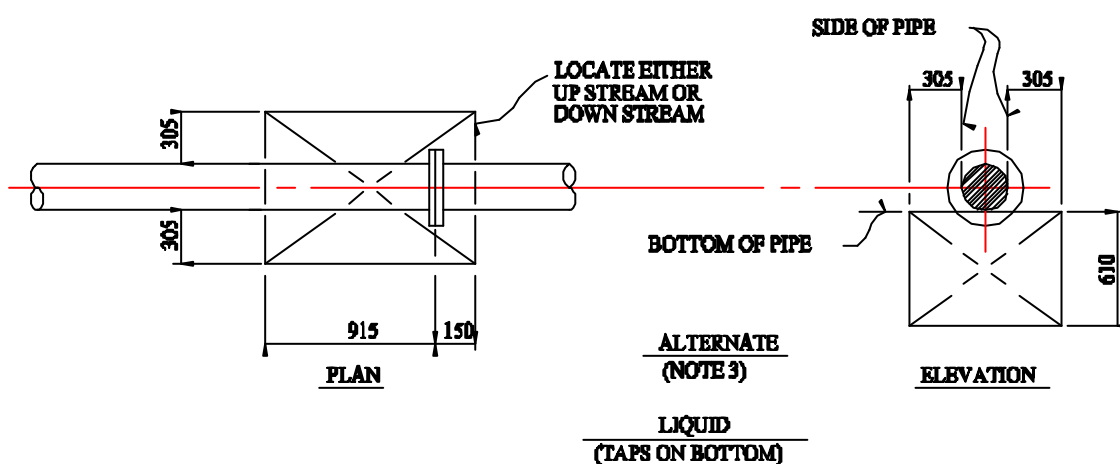
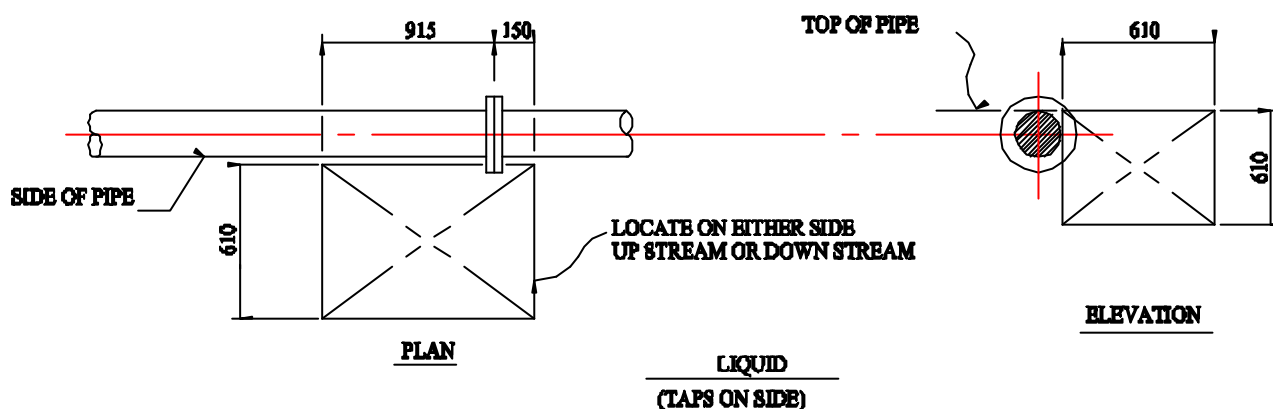
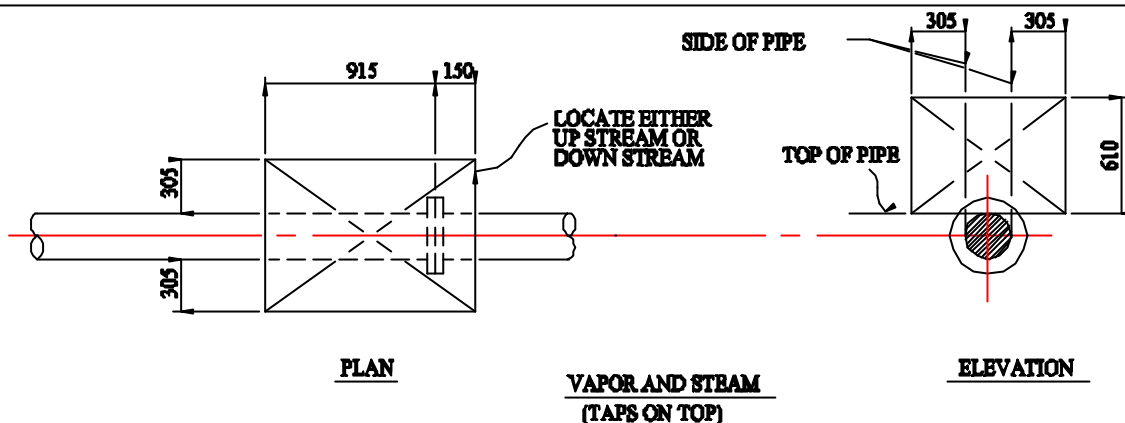
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.13 ORIFICE FLANGE TAP PIPING

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 2 OF 2
DATE : DEC. 1995

CLEARANCE FOR LINE MOUNTED FLOW TRANSMITTER



NOTES

1.0 THIS GUIDE SHALL BE USED FOR SELECTION, APPLICATION AND CLEARANCE ALLOTMENT FOR ORIFICE FLANGE TAP PIPING.

2.0 ORIFICE TAP BLOCK VALVES SHALL BE 1/2" FOR 600# FLANGE RATINGS AND BELOW AND 3/4" FOR 900# FLANGE RATINGS AND ABOVE.

3.0 CLEARANCE FOR LINE MOUNTED FLOW TRANSMITTER SHALL BE SHOWN ON PIPING PLAN.

4.0 PACKAGES SHALL NOT BE USED FOR 900# AND ABOVE RATINGS. A.S.M.E., CAT. "M" ALLOY AND HEAT TREATED PIPING.

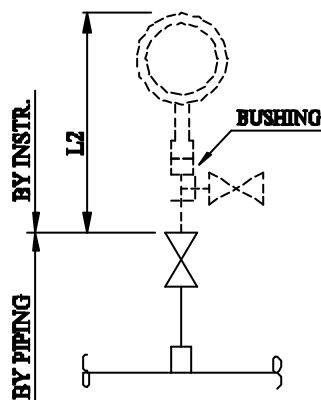
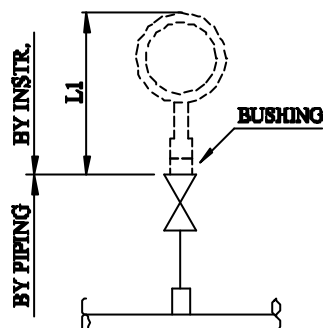
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

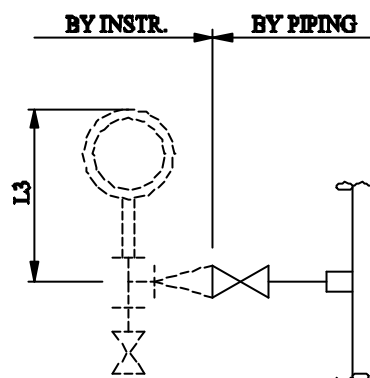
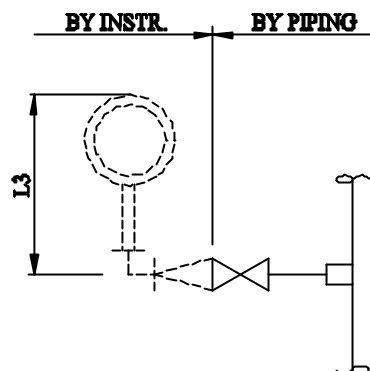
2.14 PRESSURE GAGE

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995

1. OUTLINE DIMENSION OF PRESURE GAGE



HORIZONTAL



VERTICAL

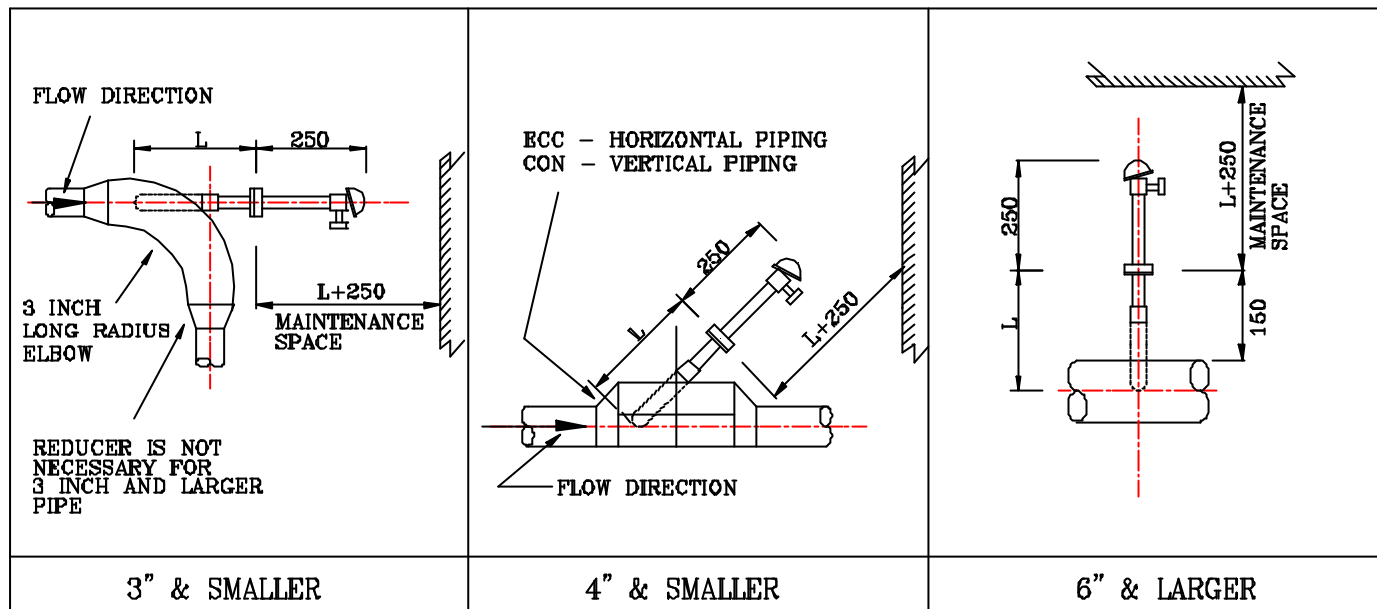
NOTES

PRESSURE GAGE	L1	L2	L3	REMARK
GAGE W/O ACCESSORIES	170	250	190	
GAGE WITH SIPHON	470	550	490	
GAGE WITH DIAPHRAM	230	310	250	
GAGE WITH DAMPENER	230	310	250	

1. THESE DIMENSIONS SHALL BE USED FOR REFERENCE ONLY.
2. SIZE OF BLOCK VALVE SHALL BE 3/4" OR AS OTHERWISE NOTED ON JOB INSTRUCTION.
3. ADDITIONAL CLEARANCE SHALL BE A LOCATED FOR MAINTENANCE AND ACCESSIBILITY.

PRESSURE GAGE	SERVICES
GAGE WITH SIPHON 	SYPHONS ARE INTENDED TO PROTECT THE PRESSURE GAGE FROM THE EFFECT OF HOT PRESSURE MEDIA SUCH AS STEAM AND ALSO REDUCE THE EFFECT OF RAPID PRESSURE SERGES.
GAGE WITH DIAPHRAM 	DIAPHRAM IS SUITABLE FOR CORROSIVE ENVIRONMENTS AND ALSO FOR VISCOUS AND CONTAMINATED MEDIA.
GAGE WITH DAMPENER 	DAMPENER ARE INTENDED TO SUPPRESS THE EFFECT OF PRESSURE PULSES AND PRESURE PEAKS.

1. Installation of Temperature Instrument

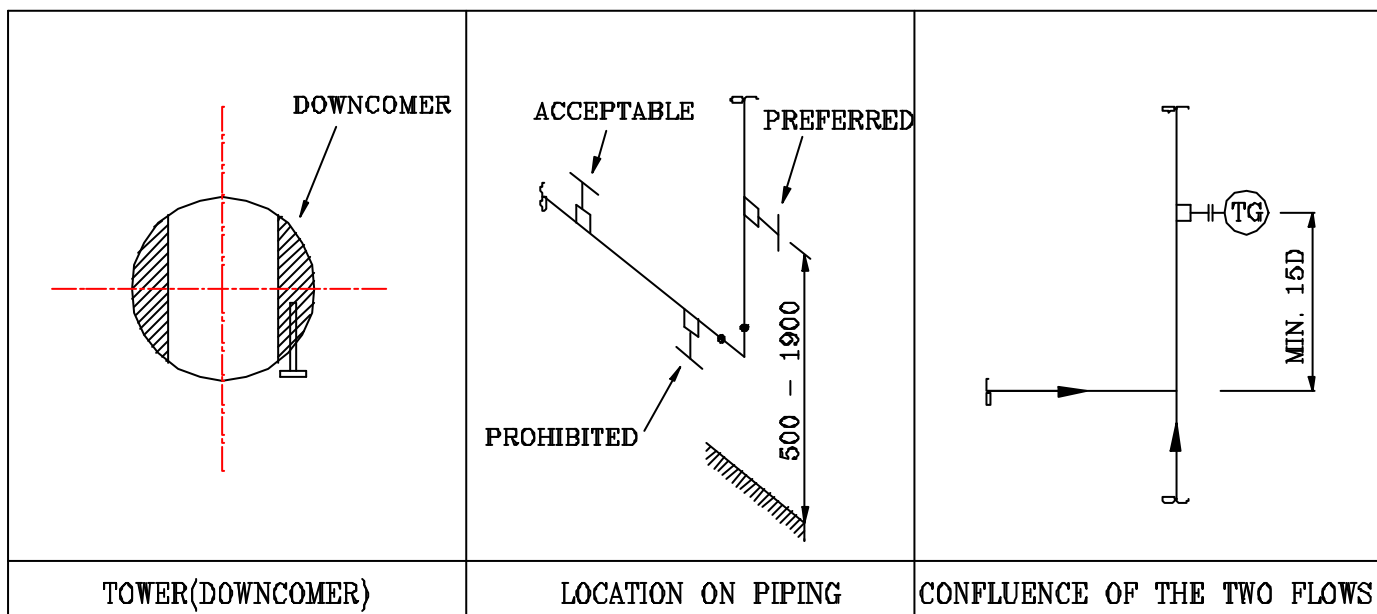


PIPING OR EQUIP.	PIPING				EQUIPMENT	
	4" & SMALLER	6" - 8"	10" - 18"	20" & LARGER	VESSEL	STORAGE TANK
L-LENGTH(mm)	200	250	300	350	400	500

Notes :

1. All dimensions shall be used for reference only.
2. All dimensions shown on above drawing are base on flanged connection.

2. Location of Temperature Instrument



PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

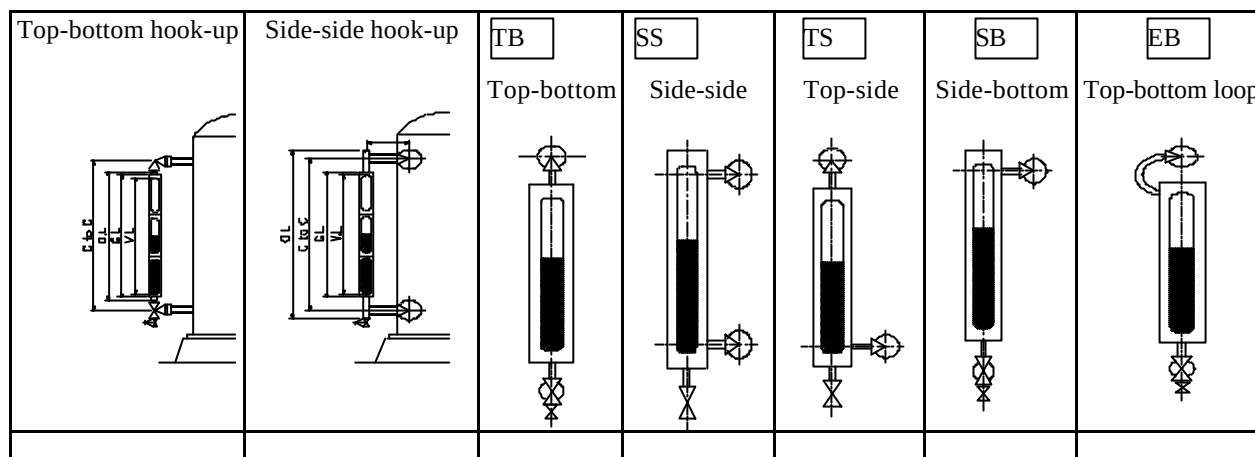
2.16 LEVEL GAGE

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 1 OF 2
 DATE : DEC., 1995

LEVEL GAUGE.

 Dimensions of SAM II direct reading gages are determined according to the following items

Center-to-center dimension (C to C) . Visible length (V.L) . Gage length (G.L) . Overall length (O.L)



DIMENSIONS

GLASS SIZE and No of SEC	V.L	G.L	STANDARD O.L		STANDARD Cto C		WEIGHT WITHOUT VALVES
			TB	SS	TB	SS	
#1 x 1	90	130	145	200	320	140	4 Kgs
#2 x 1	115	155	170	225	345	165	4.5
#3 x 1	140	180	195	250	370	190	5
#4 x 1	165	205	220	275	395	215	5.5
#S4 x 1	175	215	230	285	405	225	6.5
#5 x 1	195	235	250	305	425	245	7
#6 x 1	225	265	280	335	455	275	7.5
#7 x 1	255	295	310	365	485	305	8
#S7 x 1	275	315	330	385	505	325	8.5
#8 x 1	295	335	350	405	525	345	9
#9 x 1	315	355	380	425	545	365	9.5
#10 x 1	375	415	430	485	605	425	10.5
#S4 x 2	390	430	445	500	620	440	12.5
#5 x 2	430	470	485	540	660	480	13.5
#6 x 2	490	530	545	600	720	540	15
#7 x 2	550	590	605	660	780	600	16
#S7 x 2	590	630	645	700	820	640	17
#8 x 2	630	670	685	740	860	680	18
#9 x 2	670	710	725	780	900	720	19
#10 x 2	790	830	845	900	1020	840	22
#6 x 3	755	795	810	865	985	805	22.5
#7 x 3	845	885	900	955	1075	895	23.5
#S7 x 3	905	945	960	1015	1135	955	25.5
#8 x 3	965	1005	1020	1075	1195	1015	27
#9 x 3	1025	1065	1080	1135	1255	1075	28.5
#10 x 3	1205	1245	1260	1315	1435	1255	31.5
#7 x 4	1140	1180	1195	1250	1370	1190	32

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

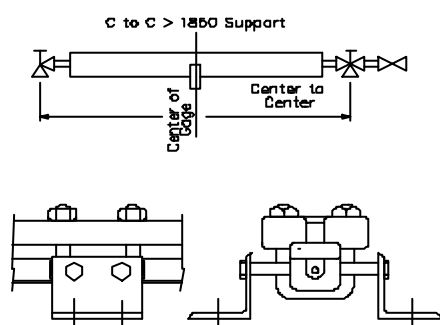
2.16 LEVEL GAGE

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 2 OF 2
 DATE : DEC., 1995

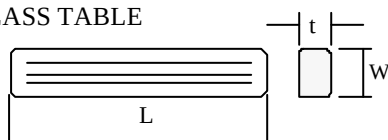
GLASS SIZE and No of SEC	V.L	G.L	STANDARD O.L		STANDARD Cto C		WEIGHT WITHOUT VALVES
			TB	SS	TB	SS	
#S7 x 4	1220	1260	1275	1330	1450	1270	34
#8 x 4	1300	1340	1355	1410	1530	1350	36
#9 x 4	1380	1420	1435	1490	1610	1430	38 Kgs
#10 x 4	1620	1660	1675	1730	1850	1670	42
#7 x 5	1435	1475	1490	1545	1665	1485	39
#S7 x 5	1535	1575	1590	1645	1765	1585	42.5
#8 x 5	1635	1675	1690	1745	1865	1685	45
※ #9 x 5	1735	1775	1790	1845	1965	1785	47.5
※ #10 x 5	2035	2075	2090	2145	2265	2085	52.5
※ #7 x 6	1730	1770	1785	1840	1960	1780	47
※ #8 x 6	1970	2010	2025	2080	2200	2020	54
※ #9 x 6	2090	2130	2140	2200	2320	2140	57
※ #7 x 7	2025	2065	2080	2135	2255	2075	55
※ #8 x 7	2305	2345	2360	2415	2535	2355	63
※ #9 x 7	2445	2483	2500	2555	2675	2495	67
※ #7 x 8	2320	2360	2375	2430	2550	2370	63
※ #8 x 8	2640	2680	2695	2750	2870	2690	72
※ #9 x 8	2800	2840	2855	2910	3030	2850	76

SUPPORTER FITTING

The Supporter fittings shown below are available please give us instructions by referring to the attached illustration.
 We recommend this Supporter fitting for gages over 2 meters long.



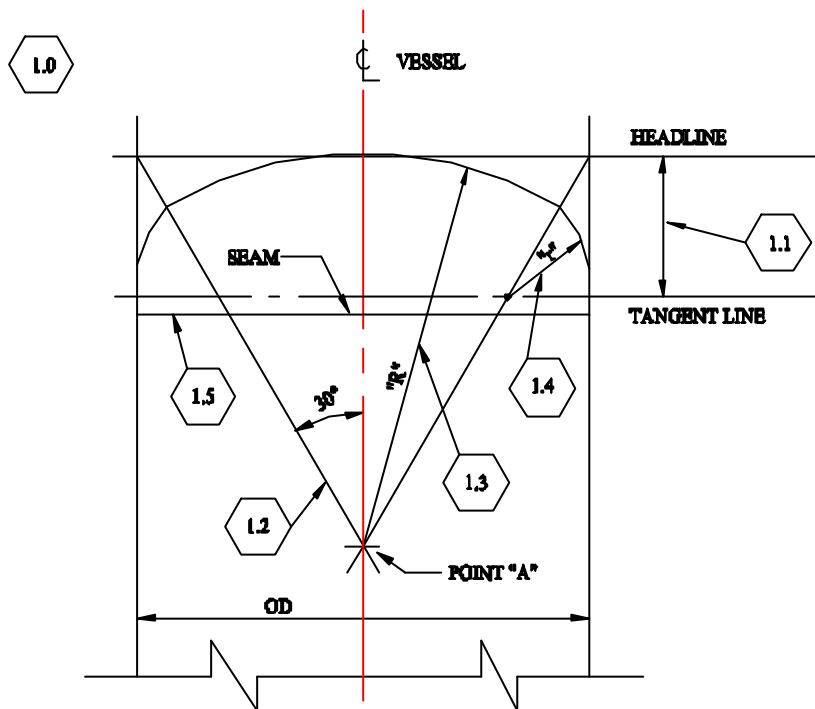
GLASS TABLE



GLASS SIZE

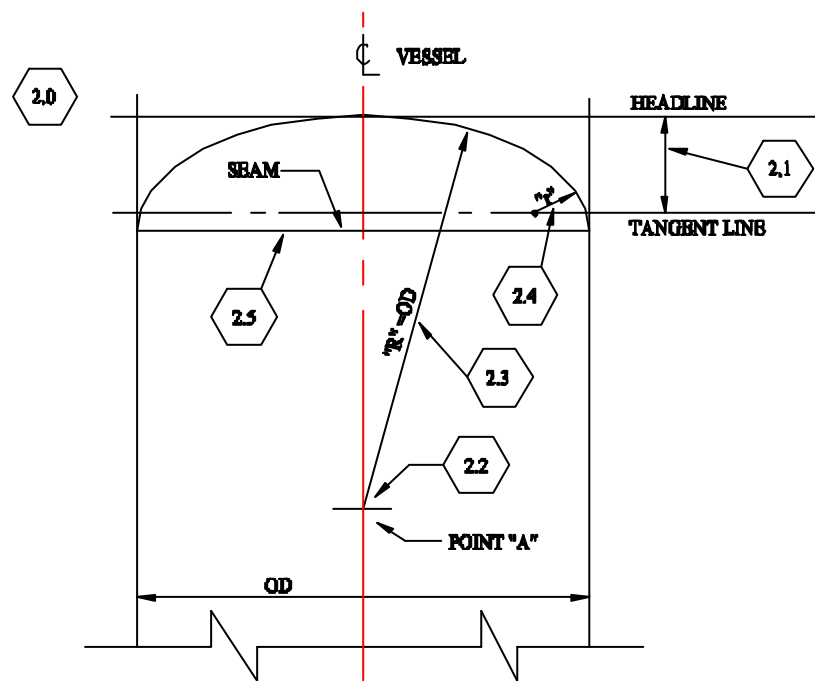
* SPECIAL TYPE

NO	L	W	T	REMARK	NO	L	W	T	REMARK
1	115	34	17		6	250	34	17	
2	140	"	"		7	280	"	"	*
3	165	"	"		S7	300	"	"	
4	190	"	"		8	320	"	"	*
S4	200	"	"		9	340	"	"	*
5	220	"	"	*	10	400	"	"	



1.0 ELLIPTICAL HEAD

- 1.1 DRAW HEADLINE, WHICH IS OD/4 FROM TANGENT LINE.
- 1.2 DRAW 30° LINE FROM INTERSECTION OF VESSEL AND HEADLINE. TOWARDS CENTERLINE OF VESSEL. THIS IS POINT "A"
- 1.3 FROM POINT "A" DRAW "R" R = DISTANCE FROM POINT A TO HEADLINE,
- 1.4 FROM TANGENT LINE USE CIRCLE TEMPLATE AND DRAW "r".
- 1.5 DRAW VESSEL SEAM 50mm ± FROM TANGENT LINE.



2.0 DISHED HEAD

- 2.1 DRAW HEADLINE, WHICH IS 0.18 X OD FROM TANGENT LINE.
- 2.2 FROM HEADLINE MEASURE BACK OD OF VESSEL, ON VESSEL CENTERLINE. THIS IS POINT "A".
- 2.3 FROM POINT "A" DRAW "R" (R = OD).
- 2.4 FROM TANGENT LINE USE CIRCLE TEMPLATE AND DRAW "r".
- 2.5 DRAW VESSEL SEAM 50mm ± FROM TANGENT LINE.



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.18 PIPE DAVIT

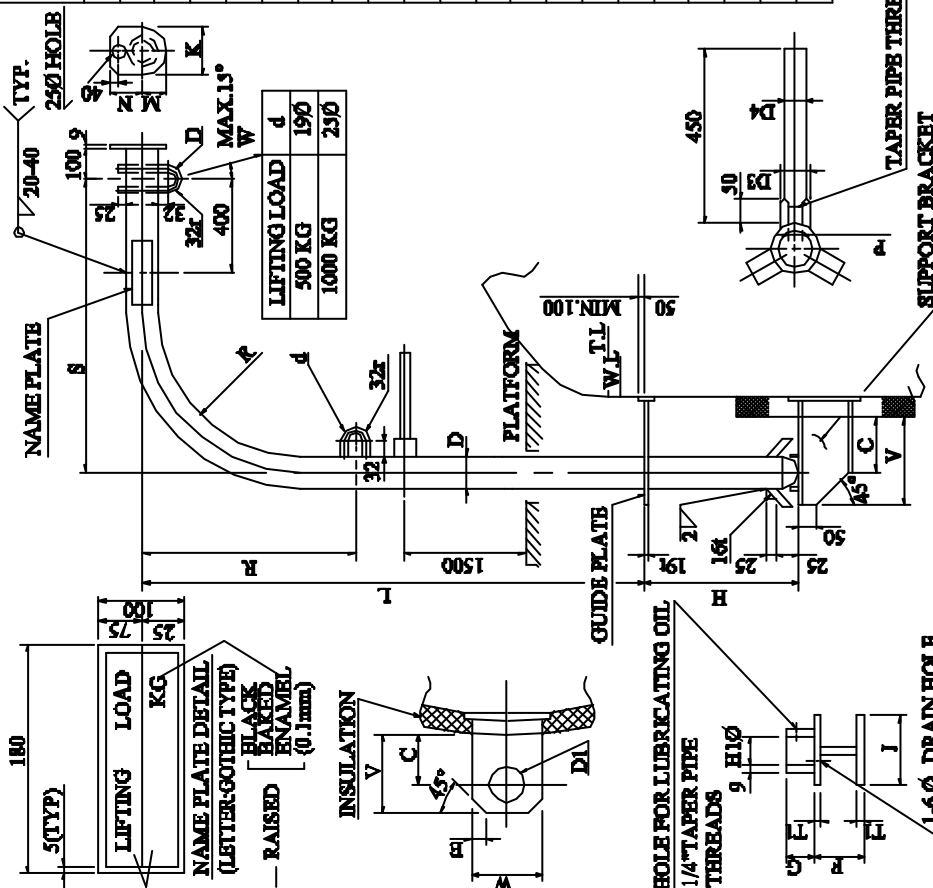
LDP-L901

REV. 1 (OCT, 2002)

PAGE : 1 OF 1

DATE : DEC. 1995

S	LIFTING LOAD 500 KG					LIFTING LOAD 1000 KG					L (MAX.)	H
	TYPE NO.	D		R	TYPE NO.	D	R					
		MM	IN					MM	IN	MM		
600	1	100	4	80	500	—	—	—	—	2300	750	
700	2	100	4	80	500	—	—	—	—	2300	750	
800	3	150	6	40	750	103	150	6	80	750	750	
900	4	↑	↑	↑	↑	104	150	6	80	750	750	
1000	5					105	150	6	80	750	900	
1100	6					106	200	8	40	1000	900	
1200	7					107	200	8	40	↑	900	
1300	8			↓		108	↑	↑	↑	2500	900	
1400	9			40		109		↓		2800	1100	
1500	10			80		110		40		2800	1100	
1600	11			↑		111		80		3000	1250	
1700	12					112		↑		↑	↑	
1800	13					113						
1900	14					114				↑	↑	
2000	15	↓	↓	↓	↓	115	↓	↓	↓	3000	1250	
2100	16	150	6	80	750	116	200	8	80	1000	1400	
2200	17	200	8	40	1000	—	—	—	—	↑	1400	
2300	18	↑	↑	↑	↑	—	—	—	—	—	1550	
2400	19					—	—	—	—	—	↑	
2500	20	↑	↑	↑	↑	—	—	—	—	—	↑	
2600	21	200	8	40	1000	—	—	—	—	3300	1550	



NOTES

1. ALL DIMENSIONS ARE IN mm.
2. FOR TYPE NO. AND MATERIALS OF PADS SEE ENG G DWG.
3. MATERIALS EXCEPT PADS TO BE AS FOLLOWS IS STPG 370, ASTM A36, SS 400.
4. FILLET WELDS TO BE ALL AROUND AND SIZE OF WELDS TO BE 6MM AND OVER.
5. WHEN "S" AND/OR "L" IS OVER THAN THIS STANDARD, THE STRENGTH CALCULATION OF THE DAVIT SHALL BE CARRIED OUT BY VENDOR.

D	W		V	C	D1	E	F	G	H1	J	T1	T2	K	M	N	Q	D3	P (NPT)	D4	
	MM	IN																	MM	IN
100	4	250	305	175	120	65	180	100	120	150	16	9	140	70	140	180	55	1"	25	1
150	6	300	350	200	172	75	200	100	175	200	16	9	190	95	160	230	70	1.1/2"	40	1.1/2
200	8	400	425	225	222	100	250	100	225	230	19	12	240	120	185	280	70	1.1/2"	40	1.1/2

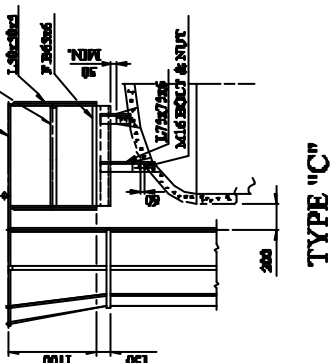
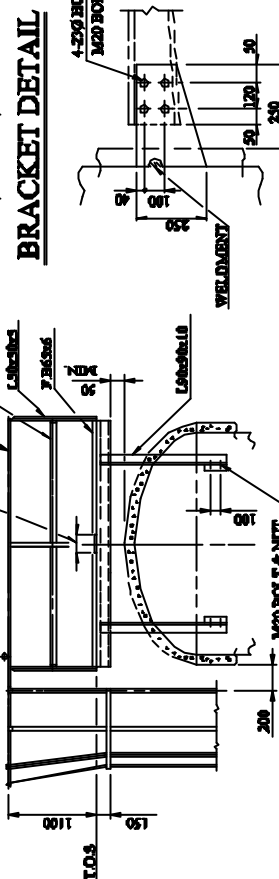
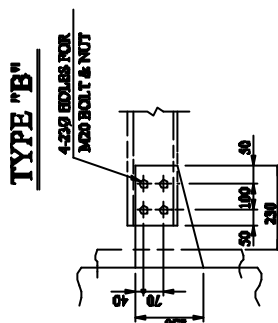
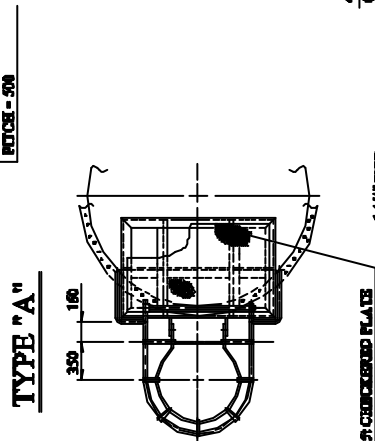
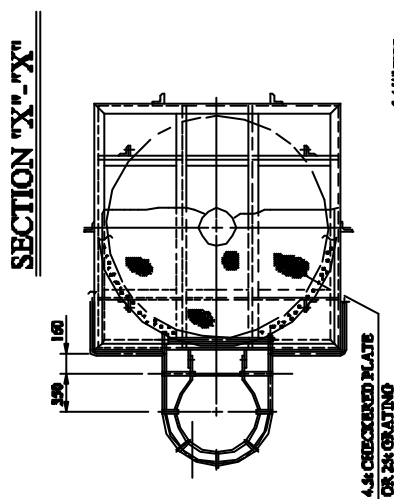
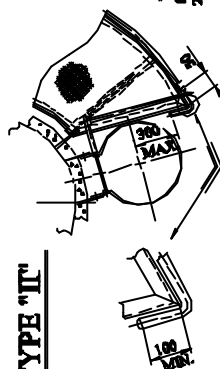
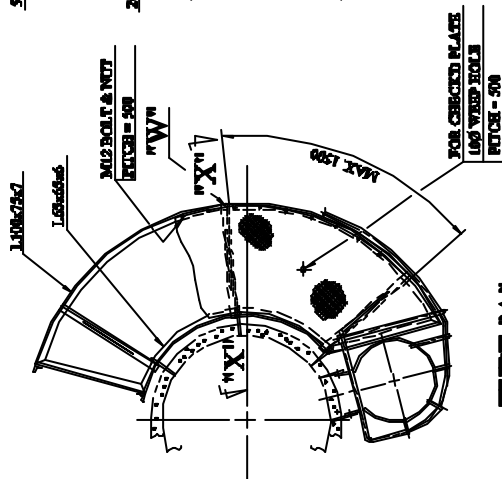
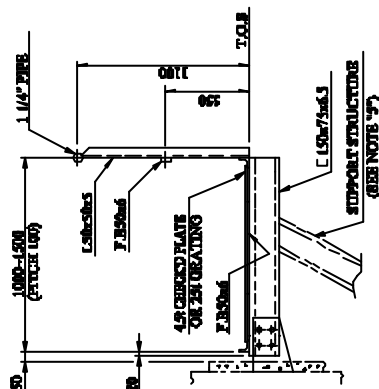
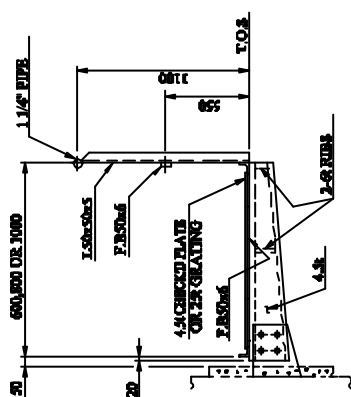
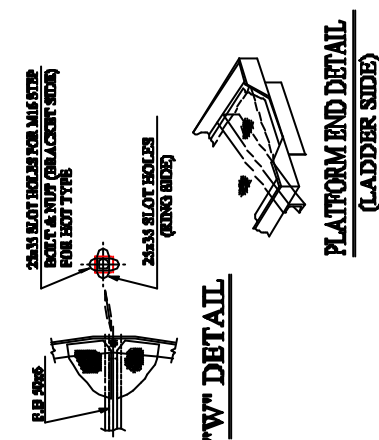


PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.19 PLATFORM

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995



NOTES

1. ALL DIMENSIONS ARE IN MM.
 2. MATERIALS USED FOR PLATEWORK & TUBING TO BE AS FOLLOWS:
 • 304.7 & NOT-17# C & OVER SS400 A387 G-B
 • 20" ~100" CA302 L74.194 G-A OR B
 B3604, A358 LF
 • 10" C & LOWER SIZE/A358 LF
 • WOOD WHITE OAK OR ASTON.
 • STRUCTURAL STEEL: S601, S62, A36
 3. FOR MATERIALS DIRECTLY WELDED TO THE SHELL SEE ENG'D DWG.
 4. SUPPORTS USED FOR TYPE C & D PLATFORM TO BE OF CHANNEL TYPE.
 5. A. PLOOR TYPE: SEE ENG'D DWG.
 6. IN CASE OF FLOOR WHITE-100 AND NONE CIRCULAR FLOOR TYPE, RUSTING PREVENTIVE TO BE PREPARED BY CALCULATION
 7. TYPE: TOP OF STRUCTURES, THIS IS THE SPECIFIED LEVEL ON ENG'D DWG UNLESS OTHERWISE NOTED.
 8. PLOOR FIXING METHOD:
 • CHECKED FLATS / PARTIAL WELDING
 • CRATING / CLAMPING

TYPE "B"

4-239 BOLLERS FOR

BRACKET DETAIL

BRACKET DETAIL

TYPE "D"

TYPE "C"



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

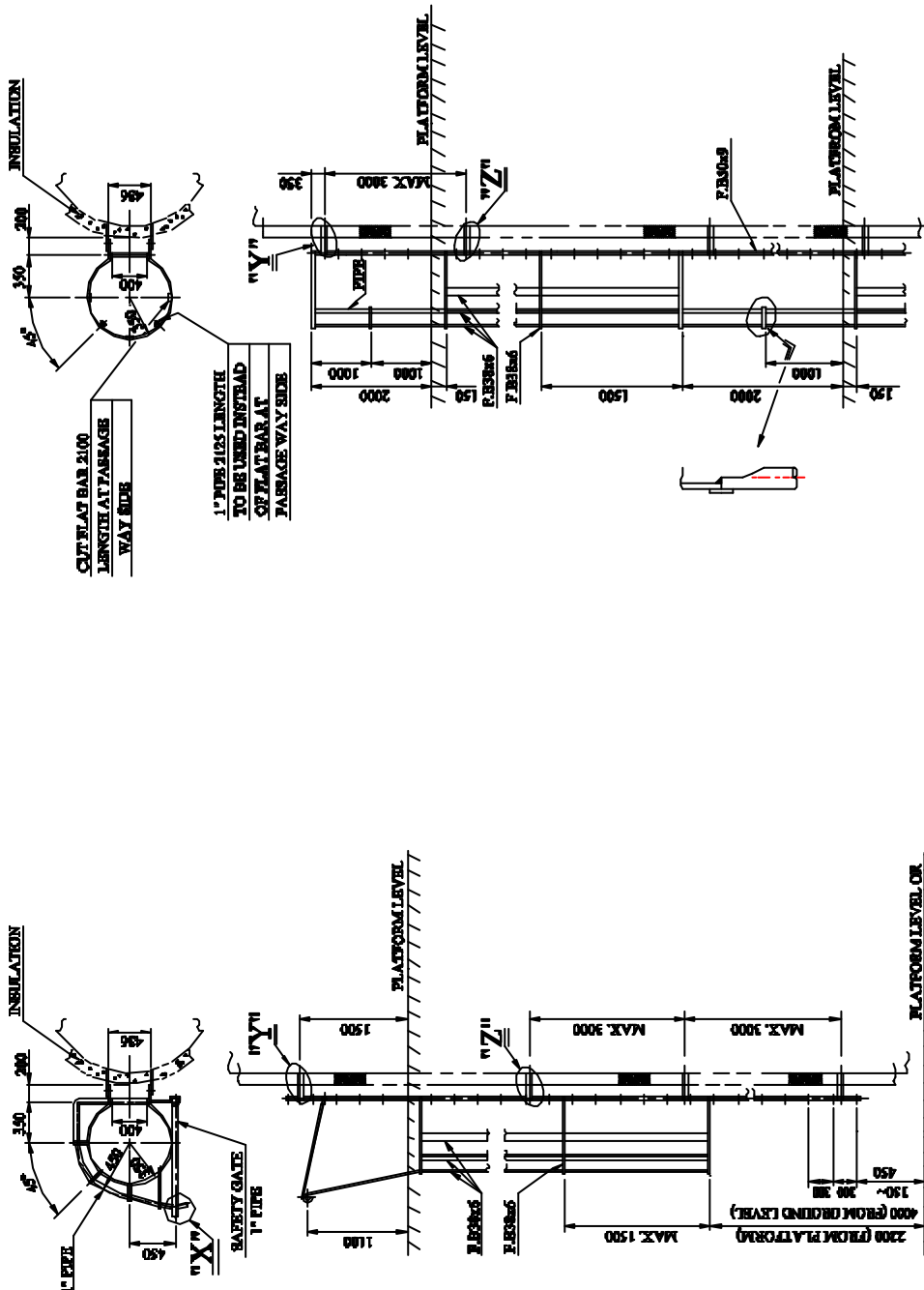
2. PIPING DESIGN REFERENCES

2.20 LADDER

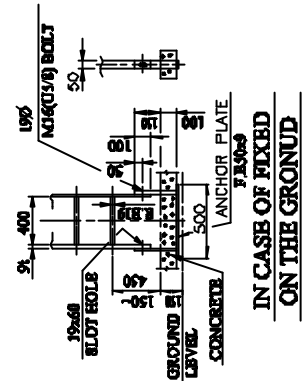
LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995

NOTES

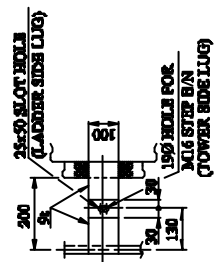
1. ALL DIMENSIONS ARE IN mm.
2. MATERIALS USED FOR PLATFORMS & LADDERS TO BE AS FOLLOWS:
 - BOLT & NUT - 16" C & OVER SS400, A387 Q-3
 - GALVANIZED FOR CS AND LOW ALLOY - 30" C
 - 10" C A325 L7 + A194 G4 OR SS304A325 L8
 - 161" C AND LOWER SS304A325 L8
 - WOOD WHITE OAK OR APTON
 - STRUCTURAL STEEL, SS400, S235
 - FOR MATERIALS DIRECTLY WELDED TO THE SHELL SEE ENCO DWG.



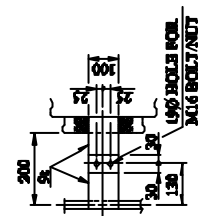
TYPE "B"



DETAIL "Z"



TYPE "A"



DETAIL "Y"



PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

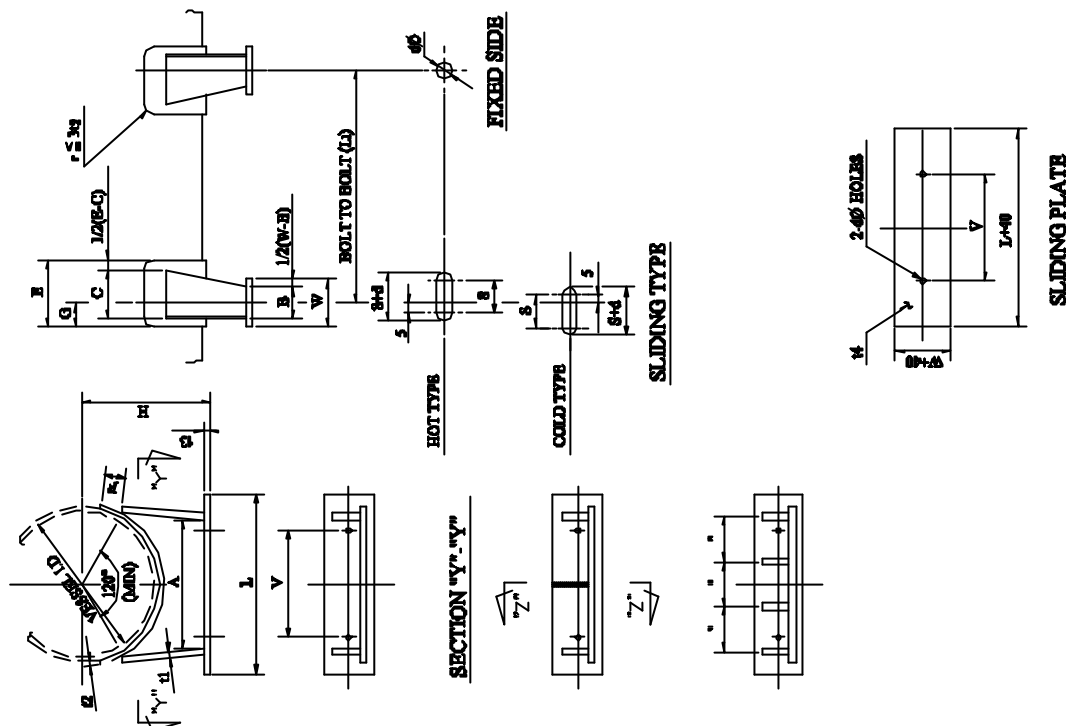
2.21 STEEL SADDLES(LIGHT DUTY)

LDP-L901
REV. 1 (OCT, 2002)
PAGE: 1 OF 4
DATE: DEC. 1995

DIMENSION "S"

SADDLE SPAN (L1)	MAX. TEMP. DIFFER. TEMP. DIFFER. = OPER. TEMP. -25° C						
	50° C	100° C	150° C	200° C	250° C	300° C	325° C
2000	10		20	30			
3000							
4000							
5000							
6000							
7000			30	45	60		
8000							
9000							
10000							
12000							
15000	20		45	75	95		

MAX. OPER. LOAD (10 ³ kg f)	MAX. OPER. LOAD (10 KN)	
	H=STD. (10 ³ kg f)	H= $\frac{LD}{2}$ -STD.
9	9	5
9	9	5
32	32	16
32	32	16
32	32	16
43	43	22
43	43	22
43	43	22
43	43	22
43	43	22
99	99	53
100	100	53
100	100	53
100	100	53
100	100	53
126	126	67
126	126	67
126	126	67
247	247	132
289	289	156
289	289	156
289	289	156
289	289	156
289	289	156
349	349	188
349	349	188
563	563	308
567	567	310
569	569	310
569	569	310
569	569	310



NOTES

1. ALL DIMENSIONS ARE IN mm.
2. FLEET WELDS OF SADDLES TO BE ALL AROUND EXCEPT THAT CIRCUMFERENTIAL WELDS OF PAIRS MAY BE INTERMITTENT UNLESS OTHERWISE NOTED.
3. FOR MATERIALS SEE ENGG DWG.
4. THESE LIGHT DUTY SADDLES SHALL BE APPLIED FOR VEHICLES UNLESS OTHERWISE SPECIFIED.
5. ONE TAIL TAILS SHALL BE PROVIDED AT THE LOWEST POINT OF PAD.
6. BECAUSE S'VALUING ON THE TAILS ARE BASE ON THE VESSEL BY CARBON AND LOW ALLOY STEEL, THE S'VALUING OF THE VESSEL BY HIGH ALLOY AND NON FERROUS SHALL BE MULTIPLIED AS THE RATIO OF THERMAL EXPANSION COEFF.
7. SINKING PLATE TO BE PROVIDED EXCEPT THAT EQUIPMENT MAY BE INSTALLED IN STEEL FOUNDATION UNLESS OTHERWISE NOTED.



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK **2. PIPING DESIGN REFERENCES** **2.21 STEEL SADDLES(LIGHT DUTY)**

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 2 OF 4
DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. FILLET WELDS OF SADDLES TO BE ALL AROUND EXCEPT THAT CIRCUMFERENTIAL WELDS OF PADS MAY BE INTERMITTENT UNLESS OTHERWISE NOTED.
3. FOR MATERIALS SEE ENGTG DWG.
4. THESE LIGHT DUTY SADDLES SHALL BE APPLIED FOR VESSELS UNLESS OTHERWISE SPECIFIED.
5. ONE TELL TAIL BOLT SHALL BE PROVIDED AT THE LOWEST POINT OF PAD.
6. BECAUSE 'S' VALUES ON THE TABLE ARE BASED ON THE VESSEL BY CARBON AND LOW ALLOY STEEL THE 'S' VALUES OF THE VESSEL BY HIGH ALLOY AND NON FERROUS SHALL BE MULTIPLIED AS THE RATIO OF THERMAL EXPANSION COEFF.
7. SLIDING PLATE TO BE PROVIDED EXCEPT THAT EQUIPMENT MAY BE INSTALLED IN STEEL FOUNDATION UNLESS OTHERWISE NOTED.

VESSEL		SADDLE					SADDLE PAD					BASE PLATE & SLIDING PLATE					BOLT					NO. RIB
ID		A	B	C	H	t1	D	t2	E	F	G	L	W	t3	t4	V	X	NO. BOLT	d	U (mm)	M (mm)	
1000		870	140	270	750	6	134	6	310	30	90	910	170	12	9	720	-	2	22	3/4	20	1
1100		950	140	270	800	6	134	6	318	30	90	990	170	12	9	750	-	2	22	3/4	20	1
1200		1040	140	270	850	9	131	9	334	50	100	1080	170	16	9	870	-	2	29	1	24	1
1300		1130	160	310	900	9	151	9	370	50	110	1180	190	16	9	940	-	2	29	1	24	1
1400		1210	160	310	950	9	151	9	370	50	110	1260	190	16	9	1040	-	2	29	1	24	1
1500		1300	180	340	1000	9	171	9	400	50	120	1350	210	16	9	1080	-	2	29	1	24	2
1600		1390	180	340	1050	9	171	9	400	50	120	1440	210	16	9	1160	-	2	29	1	24	2
1700		1470	180	340	1100	9	171	9	400	50	120	1520	210	16	9	1220	-	2	29	1	24	2
1800		1560	180	340	1150	9	171	9	400	50	120	1610	210	16	9	1300	-	2	29	1	24	2
1900		1650	180	370	1200	9	171	9	430	50	120	1700	210	16	9	1370	-	2	29	1	24	2
2000		1750	180	370	1250	12	168	12	450	50	130	1800	220	19	9	1440	-	2	37	1.1/4	30	2
2200		1910	180	370	1350	12	168	12	450	50	130	1980	220	19	9	1590	-	2	37	1.1/4	30	2
2400		2090	280	420	1450	12	188	12	500	50	140	2150	240	19	9	1750	-	2	37	1.1/4	30	2
2600		2250	280	420	1550	12	188	12	500	50	140	2320	240	19	9	1870	-	2	37	1.1/4	30	2
2800		2430	220	460	1650	12	208	12	540	50	150	2500	260	19	9	2020	-	2	37	1.1/4	30	2
3000		2600	220	480	1750	12	208	12	560	50	150	2670	260	19	12	2170	870	4	37	1.1/4	30	3
3200		2770	220	480	1850	12	208	12	560	50	150	2840	260	19	12	2310	920	4	37	1.1/4	30	3
3400		2950	220	500	1950	12	208	12	580	50	150	3020	260	19	12	2460	980	4	37	1.1/4	30	3
3600		3120	220	500	2050	16	204	16	600	50	160	3200	270	22	12	2650	1040	4	43	1.1/2	36	3
3800		3290	250	530	2150	16	234	16	630	50	175	3370	300	22	12	2740	1100	4	43	1.1/2	36	3
4000		3460	250	600	2250	16	234	16	700	50	175	3540	300	22	12	2880	1150	4	43	1.1/2	36	3
4200		3640	250	600	2350	16	234	16	700	50	175	3720	300	22	12	3030	1210	4	43	1.1/2	36	3
4400		3810	280	650	2450	16	264	16	750	50	190	3890	330	22	12	3170	1270	4	43	1.1/2	36	3
4600		3980	280	650	2550	16	264	16	750	50	190	4060	330	22	12	3320	1330	4	43	1.1/2	36	3
4800		4160	280	650	2650	16	264	16	750	50	190	4240	330	22	12	3610	1940	4	51	1.3/4	42	4
5000		4330	280	650	2750	16	264	16	750	50	190	4410	330	22	16	3750	2020	4	51	1.3/4	42	4
5200		4500	300	700	2850	19	281	19	800	70	200	4600	350	25	16	3900	2100	4	57	2	48	4
5400		4680	300	700	2950	19	281	19	800	70	200	4780	350	25	16	4060	2180	4	57	2	48	4
5600		4850	330	750	3050	19	311	19	850	70	215	4950	380	25	16	4250	2260	4	57	2	48	4
5800		5020	330	750	3150	19	311	19	850	70	215	5120	380	25	16	4350	2340	4	57	2	48	4
6000		5200	330	800	3250	19	311	19	900	70	215	5300	380	25	16	4510	2450	4	57	2	48	4



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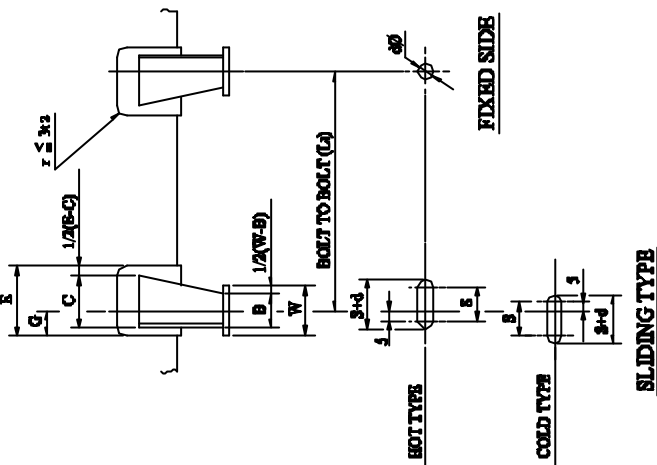
PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

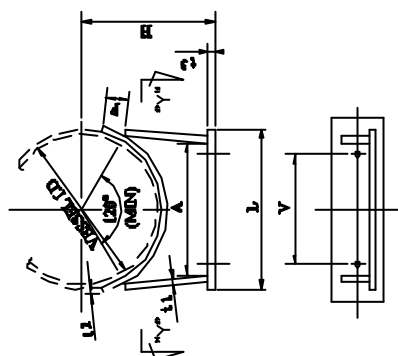
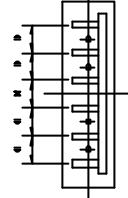
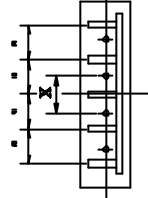
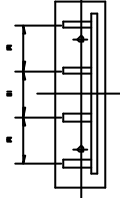
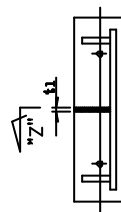
2. PIPING DESIGN REFERENCES

2.21 STEEL SADDLES(HEAVY DUTY)

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 3 OF 4
DATE : DEC. 1995



SECTION "Z-Z'"



SLIDING PLATE

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. FILLET WELDS OF SADDLES TO BE ALL AROUND EXCEPT THAT CIRCUMFERENTIAL WELDS OF PADES MAY BE INTERMITTENT UNLESS OTHERWISE NOTED.
3. FOR MATERIALS SEE ENGG DWG.
4. THESE HEAVY DUTY SADDLES SHALL BE APPLIED FOR HEAT EXCHANGERS UNLESS OTHERWISE SPECIFIED.
5. ONE TELL TALE HOLE SHALL BE PROVIDED AT THE LOWEST POINT OF PAD.
6. BECAUSE 'F' VALUES ON THE TABLE ARE BASE ON THE VESSEL BY CARBON AND LOW ALLOY STEEL THE 'F' VALUES ON THE VESSEL BY HIGH ALLOY AND NON FERROUS SHALL BE MULTIPLIED AS THE RATIO OF THERMAL EXPANSION COEFF.
7. SLIDING PLATE TO BE PROVIDED EXCEPT THAT EQUIPMENT MAY BE INSTALLED IN STEEL FOUNDATION UNLESS OTHERWISE NOTED.

DIMENSION "S" (NOTE 6)

SADDLE SPAN (L)	MAX. TEMP. DIFFER.				
	TEMP. DIFFER. = (OPER. TEMP. - 25° C)				
	50° C	100° C	150° C	200° C	250° C
2000					
3000					
4000					
5000					
6000					
7000					
8000					
9000					
10000					
12000					
15000					

MAX. OPER. LOAD (10 kg f)	H=STD.	H=LD +STD.
5	3	2
6	3	3
6	3	3
6	3	3
6	3	3
11	6	6
13	6	6
11	6	6
18	8	8
16	8	8
18	8	8
16	8	8
27	13	13
25	13	13
28	13	13
31	16	16
32	16	16
45	24	24
59	31	31
59	31	31
94	51	51
95	51	51
96	51	51
97	52	52
98	52	52
130	68	68
132	70	70
162	85	85
164	87	87
231	124	124
281	151	151
284	153	153
288	154	154
313	178	178
420	227	227
424	229	229
428	231	231
525	286	286
597	324	324
697	382	382
703	386	386
796	438	438
802	441	441
1053	525	525
1061	538	538
1089	592	592



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.21 STEEL SADDLES(HEAVY DUTY)

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 4 OF 4

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. FILLET WELDS OF SADDLES TO BE ALL AROUND EXCEPT THAT CIRCUMFERENTIAL WELDS OF PADS MAY BE INTERMITTENT UNLESS OTHERWISE NOTED.
3. FOR MATERIALS SEE ENGG DWG.
4. THESE HEAVY DUTY SADDLES SHALL BE APPLIED FOR HEAT EXCHANGERS UNLESS OTHERWISE SPECIFIED.
5. ONE TELL TAILS SHALL BE PROVIDED AT THE LOWEST POINT OF PAD.
6. BECAUSE 'F' VALUES ON THE TABLE ARE BASED ON THE VESSEL BY CARBON AND LOW ALLOY STEEL, THE 'F' VALUES OF THE VESSEL BY HIGH ALLOY AND NON FERROUS SHALL BE MULTIPLIED AS THE RATIO OF THERMAL EXPANSION COEFF.
7. SLIDING PLATE TO BE PROVIDED EXCEPT THAT EQUIPMENT MAY BE INSTALLED IN STEEL FOUNDATION UNLESS OTHERWISE NOTED.

VESSEL		SADDLE						SADDLE PAD						BASE PLATE & SLIDING PLATE						BOLT					NO. RIB
ID	A	B	C	H	t1	D	t2	E	F	G	L	W	t3	t4	V	X	NO. (REQD)	d	U (inch)	M (mm)					
8"	180	90	160	350	6	-	6	200	30	65	210	110	12	6	180	-	2	22	3/4	20	-				
	270	90	160	400	6	-	6	200	30	65	300	110	12	6	190	-	2	22	3/4	20	-				
350	300	90	160	400	6	-	6	200	30	65	330	110	12	6	220	-	2	22	3/4	20	-				
400	350	90	160	450	6	-	6	200	30	65	380	110	12	6	270	-	2	22	3/4	20	-				
450	390	90	160	450	6	-	6	200	30	65	420	110	12	6	310	-	2	22	3/4	20	-				
500	480	100	190	500	9	-	9	250	50	80	470	130	12	6	340	-	2	22	3/4	20	-				
550	480	100	190	500	9	-	9	250	30	80	520	130	12	6	390	-	2	22	3/4	20	-				
600	520	100	190	550	9	-	9	250	30	80	560	130	12	6	430	-	2	22	3/4	20	-				
650	560	120	220	550	9	-	9	280	30	90	600	150	12	6	470	-	2	22	3/4	20	-				
700	610	120	220	600	9	-	9	280	50	90	650	150	12	6	510	-	2	22	3/4	20	-				
750	650	120	220	600	9	-	9	280	30	90	690	150	12	6	540	-	2	22	3/4	20	-				
800	690	120	220	650	9	-	9	280	30	90	730	150	12	6	570	-	2	22	3/4	20	-				
850	740	120	220	650	9	111	9	280	30	90	780	150	12	6	620	-	2	22	3/4	20	1				
900	780	120	240	700	9	111	9	300	30	90	820	150	12	6	650	-	2	22	3/4	20	1				
950	820	120	240	700	9	111	9	300	50	90	860	150	12	6	680	-	2	22	3/4	20	1				
1000	870	140	270	750	9	131	9	330	30	100	910	170	12	9	720	-	2	22	3/4	20	1				
1100	950	140	270	800	9	131	9	330	30	100	990	170	12	9	790	-	2	22	3/4	20	1				
1200	1040	140	270	850	12	128	12	350	50	110	1080	170	16	9	870	-	2	29	1	24	1				
1300	1130	160	310	900	12	148	12	390	50	120	1180	190	16	9	940	-	2	29	1	24	1				
1400	1210	160	310	950	12	148	12	390	50	120	1260	190	16	9	1010	-	2	29	1	24	1				
1500	1300	180	340	1000	12	168	12	420	50	130	1350	210	16	9	1080	-	2	37	1.1/4	30	2				
1600	1390	180	340	1050	12	168	12	420	50	130	1440	210	16	9	1160	-	2	37	1.1/4	30	2				
1700	1470	180	340	1100	12	168	12	420	50	130	1520	210	16	9	1220	-	2	37	1.1/4	30	2				
1800	1560	180	340	1150	12	168	12	420	50	130	1610	210	16	9	1300	-	2	37	1.1/4	30	2				
1900	1650	180	370	1200	12	168	12	450	50	130	1700	210	16	9	1370	-	2	37	1.1/4	30	2				
2000	1750	180	370	1250	16	164	16	470	50	140	1800	220	19	9	1440	-	2	43	1.1/2	36	2				
2200	1910	180	370	1350	16	164	16	470	50	140	1980	220	19	9	1590	-	2	43	1.1/2	36	2				
2400	2080	200	420	1450	16	184	16	520	50	150	2150	240	19	9	1750	-	2	43	1.1/2	36	2				
2600	2250	200	420	1550	16	184	16	520	50	150	2320	240	19	9	1870	-	2	43	1.1/2	36	2				
2800	2480	220	460	1650	19	201	19	560	70	160	2500	260	22	9	2020	-	2	51	1.3/4	42	2				
3000	2600	220	480	1750	19	201	19	580	70	160	2670	260	22	12	2170	870	4	43	1.1/2	36	3				
3200	2770	220	480	1850	19	201	19	580	70	160	2840	260	22	12	2310	920	4	43	1.1/2	36	3				
3400	2850	220	500	1950	19	201	19	600	70	160	3020	260	22	12	2460	960	4	43	1.1/2	36	3				
3600	3120	220	500	2050	22	198	22	600	70	160	3200	270	25	12	2600	1040	4	43	1.1/2	36	3				
3800	3290	250	550	2150	22	228	22	650	70	175	3370	300	25	12	2740	1100	4	51	1.3/4	42	3				
4000	3460	250	600	2250	22	228	22	700	70	175	3540	300	25	12	2880	1150	4	51	1.3/4	42	3				
4200	3640	250	600	2350	22	228	22	700	70	175	3720	300	25	12	3030	1210	4	51	1.3/4	42	3				
4400	3810	280	650	2450	22	238	22	750	70	190	3890	330	25	12	3170	1270	4	57	2	48	3				
4600	3980	280	650	2550	25	235	25	750	90	190	4060	330	28	12	3320	1350	4	57	2	48	3				
4800	4160	280	650	2650	25	235	25	750	90	190	4240	330	28	12	3470	1400	4	64	2.1/4	56	4				
5000	4330	280	650	2750	25	235	25	750	90	190	4410	330	28	16	3750	2020	4	64	2.1/4	56	4				
5200	4500	300	700	2850	25	275	25	800	90	200	4600	350	28	16	3900	2100	4	64	2.1/4	56	4				
5400	4680	300	700	2950	25	275	25	800	90	200	4780	350	28	16	4060	2180	4	64	2.1/4	56	4				
5600	4850	330	750	3050	28	302	28	850	90	215	4950	380	32	16	4200	2260	4	71	2.1/2	64	4				
5800	5020	330	750	3150	28	302	28	850	90	215	5120	380	32	16	4350	2340	4	71	2.1/2	64	4				
6000	5200	330	800	3250	28	302	28	900	90	215	5300	380	32	16	4510	2430	4	71	2.1/2	64	4				



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES 2.22 SUPPORT LUG FOR VERTICAL VESSEL (LIGHT DUTY)

LDP-L901

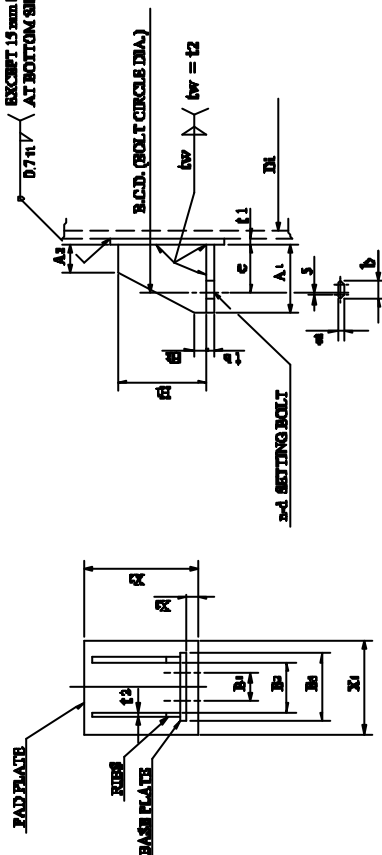
REV. 1 (OCT, 2002)

PAGE : 1 OF 2

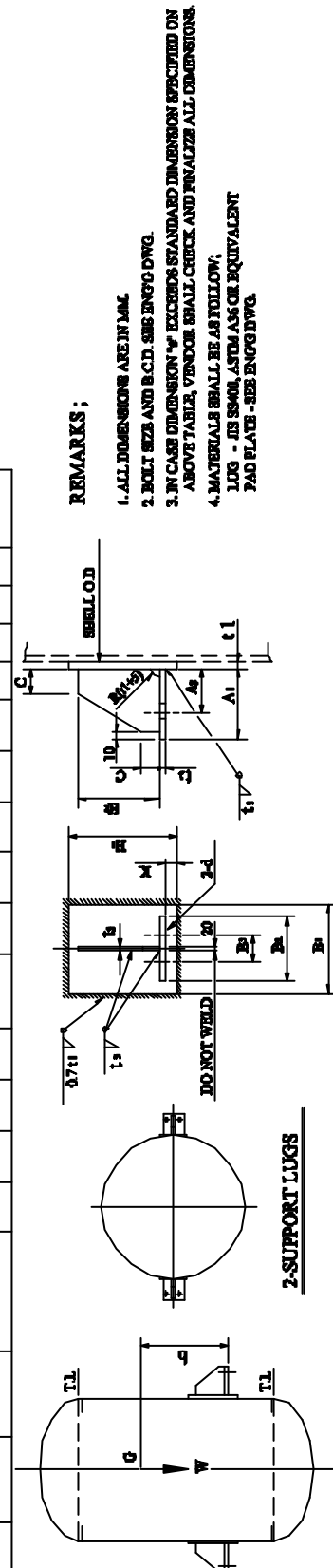
DATE : DEC. 1995

VESSEL ID DI	NO. OF LUG	d _s	o	a	b	e	A ₁	A ₂	t ₁	t ₂	B ₁	B ₂	B ₃	H ₁	H ₂	X ₁	X ₂	X ₃	MAXIMUM ALLOWABLE OPERATION WEIGHT (KGF)	MAXIMUM ALLOWABLE MOMENT ARMS DUE TO EARTHQUAKE	MAXIMUM LENGTH OF VESSEL
550 ~ 790	4	M16	1	19	35	150 ~ 350		50	12	6	6	160	200	270	50	250	340	30	4450	2500	5500
800 ~ 1040	4	M20	1	23	46	150 ~ 350		50	12	6	9	180	230	300	50	280	370	30	10300	2500	7500
1050 ~ 1340	4	M24	1	27	54	170 ~ 370	ø50	70	12	6	9	200	250	350	70	300	420	30	22130	2500	9000
1350 ~ 2040	4	M24	2	27	54	200 ~ 400		70	16	9	12	250	310	400	70	360	470	30	72930	2500	12500
2050 ~ 2540	4	M30	2	35	70	220 ~ 420		100	16	9	12	340	400	500	100	480	600	40	118800	2500	16000
2550 ~ 3080	4	M36	2	41	82	250 ~ 450		100	19	9	12	420	480	600	100	560	700	40	176700	2500	19000

EXCEPT 15 mm LENGTH
AT BOTTOM SIDE



	ALLOWABLE LOAD W (Kgf)	MAX. SHELL O.D D _s	MAX. CENTER OF GRAVITY HEIGHT h	BOLT POSITION A ₃	LUG SUPPORT										SET BOLT				MIN. SHELL THICK
					H ₁	H ₂	B ₁	B ₂	A ₁	t ₁	t ₂	C	K	B ₃	BOLT SIZE		d		
															M	UNC		M	
1	1030	UP TO 250	3000	110 ~ 160	270	220	170	140	A3+40	12	9	30	20	80	20	3/4	23	22	3.0
2	2410	260 ~ 540	3000	120 ~ 170	320	260	240	200	A3+50	16	12	50	20	120	20	3/4	23	22	3.0



REMARKS;

1. ALL DIMENSIONS ARE IN MM.
2. BOLT SIZE AND B.C.D. SEE ENGG DWG.
3. IN CASE DIMENSION "W" EXCEEDS STANDARD DIMENSION SPECIFIED ON ABOVE TABLE, VENDOR SHALL CHECK AND FINALIZE ALL DIMENSIONS.
4. MATERIALS SHALL BE AS FOLLOW:
LUGS - IS 2063, ASTM A307 OR EQUIVALENT
PAD PLATE - SEE ENGG DWG.

2-SUPPORT LUGS



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES 2.22 SUPPORT LUG FOR VERTICAL VESSEL (HEAVY DUTY)

LDP-L901

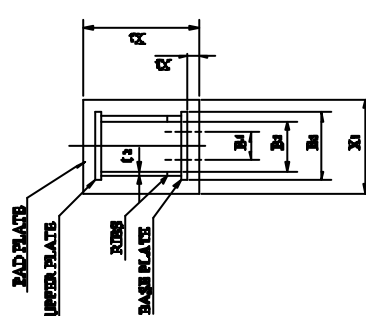
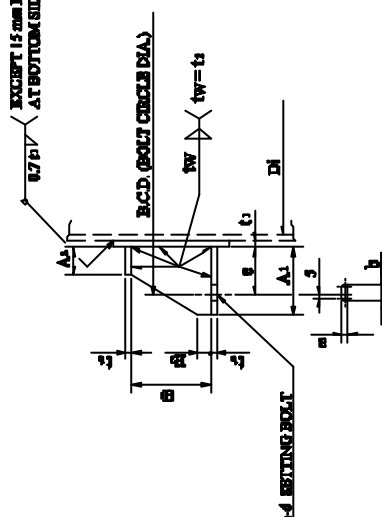
REV. 1 (OCT, 2002)

PAGE : 2 OF 2

DATE : DEC. 1995

VESSEL ID DI	NO. OF LUG	d ₁	a	b	e	A ₁	A ₂	t ₁	t ₂	B ₁	B ₂	H ₁	H ₂	X ₁	X ₂	MAXIMUM ALLOWABLE OPERATION WEIGHT (KG)	MAXIMUM ALLOWABLE MOMENT ARMS DUE TO EARTHQUAKE	MAXIMUM LENGTH OF VESSEL	
550 ~ 790	4	M16	2	19	38	150 ~ 350	50	12	6	80	160	200	270	50	250	350	25	8950	8000
800 ~ 1040	4	M20	2	23	46	150 ~ 350	50	12	6	90	180	230	300	50	280	360	25	20650	11000
1050 ~ 1540	4	M24	2	27	54	170 ~ 370	70	12	6	90	200	250	350	70	300	430	25	44300	13000
1550 ~ 2040	4	M30	2	35	70	200 ~ 400	70	16	12	150	260	320	400	70	370	490	25	109400	16000
2050 ~ 2540	4	M36	2	41	82	220 ~ 420	100	16	12	200	340	400	500	100	480	620	40	178200	19000
2550 ~ 3000	4	M36	2	41	82	250 ~ 450	100	19	12	260	420	480	600	100	560	720	40	214000	19000

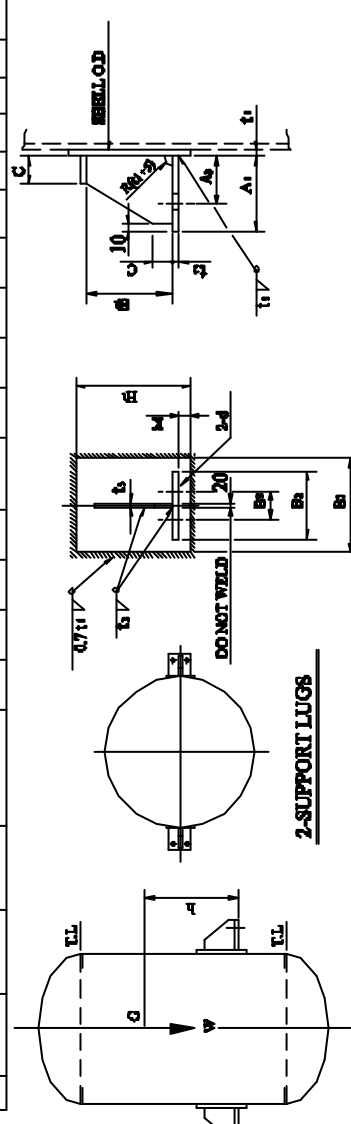
EXCEPT IS ONE LENGTH
AT BOTTOM SIDE



	ALLOWABLE LOAD W (Kgf)	MAX. SHELL O.D D _o	MAX. CENTER OF GRAVITY HEIGHT h _g	BOLT POSITION A ₁	LUG SUPPORT								SET BOLT				MIN. SHELL THICK		
					H ₁	H ₂	B ₁	B ₂	A ₁	t ₁	t ₂	C	K	B ₃	BOLT SIZE			d	
															M	UNC			M
1	1020	UP TO 250	3000	110 ~ 160	270	220	170	140	A3+40	12	9	30	20	80	20	3/4	23	22	3.0
2	2410	260 ~ 540	3000	120 ~ 170	320	260	240	200	A3+50	16	12	50	20	120	20	3/4	23	22	3.0

REMARKS ;

1. ALL DIMENSIONS ARE IN MM.
2. BOLT SIZE AND B.C.D. SEE ENDO DWG.
3. IN CASE DIMENSION "W" EXCEEDS STANDARD DIMENSION SPECIFIED ON ABOVE TABLE, VENDOR SHALL CHECK AND FINALIZE ALL DIMENSIONS.
4. MATERIALS SHALL BE AS FOLLOW;
LUG - JIS 5540, A574 A56 OR EQUIVALENT
PAD PLATE - SEE ENDO DWG.





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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK **2. PIPING DESIGN REFERENCES**

2.23 SUPPORT LEG FOR VERTICAL VESSEL

LDP-L901

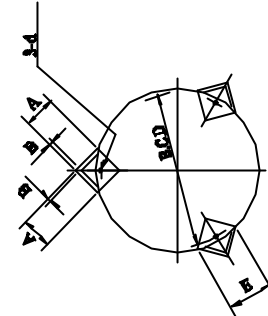
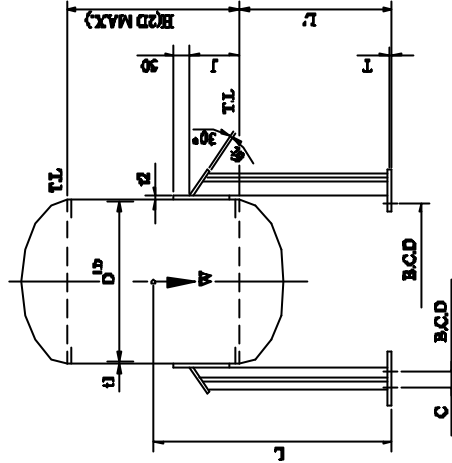
REV. 1 (OCT, 2002)

PAGE : 1 OF 2

DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN MM
2. THE VALUES OF λ ARE SPECIFIED AS MINIMUM REQUIRED THICKNESS OF VESSEL SHELL PLATE DUE TO THE LOAD.
3. FOR MATERIALS AND BOLT UNIT SEE ENGS DWG.
4. IN CASE THAT LOAD (W), LENGTH (L) AND HEIGHT EXCEEDS TO THE VALUE OF THIS TABLE, THE STANDARD DIMENSIONS SHALL BE CHECKED BY CALCULATION.
5. VESSEL $D > 900$ MAY BE USED 2 SADDLES WITH RING TYPE BASE PLATE



"A" TYPE

TYPE	D	W Kg (MAX.)	λ (MAX.)	L (MAX.)	LEG NO.	LEG SIZE	BASE PLATE	
							A x B x T	B
A	500	400	1000	1500	3	L50 x 50 x 6	100 x 100 x 9	-
	600	600	1000	2000		L50 x 50 x 6	120 x 120 x 12	15
	700	900	1000	1700		L65 x 65 x 8	120 x 120 x 12	15
	800	1200	1000	1800		L65 x 65 x 8	120 x 120 x 12	15
B	900	1700	1000	2300	4	L75 x 75 x 9	150 x 150 x 16	20
	1000	2200	1000	2400		L90 x 90 x 7	180 x 180 x 19	25
	1100	2800	1000	2100		L90 x 90 x 10	180 x 180 x 19	25
	1200	3600	1000	2600		L90 x 90 x 13	200 x 200 x 23	30
	1300	4700	1000	2700		L100 x 100 x 13	220 x 220 x 25	35
	1400	5600	1000	2800		L100 x 100 x 13	220 x 220 x 25	35
	1500	7200	1000	2900		L130 x 130 x 9	220 x 220 x 25	35
	1600	8500	1000	2400		L130 x 130 x 12	220 x 220 x 25	35
	1700	11000	1000	2500		L130 x 130 x 15	220 x 220 x 25	35
	1800	13000	1000	2600		L150 x 150 x 15	260 x 260 x 25	190
	1900	15000	1200	2800		H150 x 150 x 7 x 10	300 x 300 x 25	190
	2000	18000	1200	2900		H175 x 175 x 7.5 x 11	340 x 340 x 25	170
C	2100	20000	1200	3000	4	H200 x 200 x 8 x 12	380 x 380 x 25	190
	2200	23000	1200	3100		H250 x 250 x 9 x 14	420 x 420 x 25	210
	2300	26000	1200	3200		H300 x 300 x 10 x 15	480 x 480 x 25	340
	2400	29000	1200	3300		H350 x 350 x 12 x 19	480 x 480 x 25	340
	2500	33000	1200	3400		H350 x 350 x 12 x 19	480 x 480 x 25	340
	2600	36000	1200	3500		H350 x 350 x 12 x 19	480 x 480 x 25	340
	2700	41000	1200	3600		H350 x 350 x 12 x 19	480 x 480 x 25	340
	2800	45000	1200	3700		H350 x 350 x 12 x 19	480 x 480 x 25	340
	2900	50000	1200	3800		H350 x 350 x 12 x 19	480 x 480 x 25	340
	3000	57000	1200	3900		H350 x 350 x 12 x 19	480 x 480 x 25	340
			1200	4000		H350 x 350 x 12 x 19	480 x 480 x 25	340
			1200	4100		H350 x 350 x 12 x 19	480 x 480 x 25	340



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.23 SUPPORT LEG FOR VERTICAL VESSEL

LDP-L901

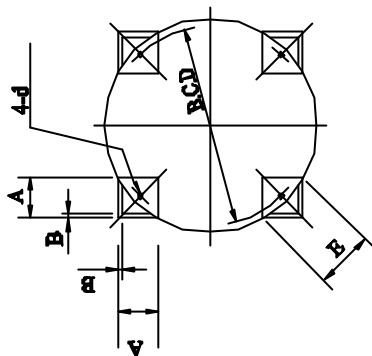
REV. 1 (OCT, 2002)

PAGE : 2 OF 2

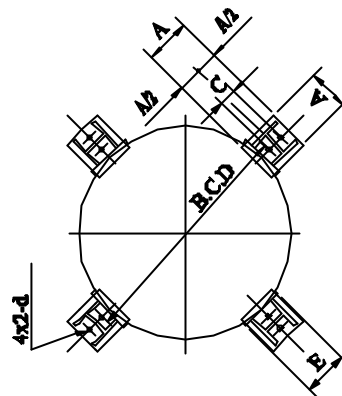
DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. THE VALUES OF d_1 ARE SPECIFIED AS MINIMUM REQUIRED THICKNESS OF VESSEL SHELL PLATE DUE TO THE LOAD.
3. FOR MATERIALS AND BOLT UNIT SEE ENGB DWG.
4. IN CASE THAT LOAD(W), LENGTH(L) AND HEIGHT(H) EXCEED TO THE VALUE OF THIS TABLE, THE STANDARD DIMENSIONS SHALL BE CHECKED BY CALCULATION.
5. VESSEL D<800 MAY BE USED 2 HANDLES WITH RING TYPE BASE PLATE.



"B" TYPE



"C" TYPE

BOLT HOLE	BOLT SIZE M(mm)	U(inch)	U (NOTE 2)	REIN. PAD		J	B.C.D	W.L(MAX.) (mm - m)
				t2	E			
18	M16	U 1/2	1.3	4.5	150	200	480	0.6
			1.6					0.8
			1.5					0.96
			1.8		200	250	560	1.26
22	M16	U 5/8	1.9	4.5			660	1.53
			2.3					1.98
			2.1		220	300	760	2.16
			2.6					2.76
22	M16	U 5/8	2.4	4.5			850	3.23
			2.8		250	350	950	4.08
			2.5					4.4
			3.0					5.5
26	M20	U 3/4	2.7	4.5			1040	5.88
			3.2		300	400	1150	7.28
			2.8					7.92
			3.3					9.7
30	M24	U 1	3.0	6			1280	10.8
			3.5			450		13.2
			3.2		350		1380	13.9
			3.8				1390	16.8
22	M16	U 5/8	3.5	9		500	1490	18.0
			4.1				1520	21.6
			3.8		6	500		24.0
			4.4					29.0
26	M20	U 3/4	4.5	9		550		32.0
			4.8		400			39.5
			4.5					39.0
			5.2					47.0
30	M24	U 1	4.6	9		600		46.5
			5.4		450			55.5
			4.8					57.5
			5.6					68.5
36	M30	U 1 1/4	5.1	12		650		66.0
			5.9		500			78.0
			5.1			700		78.0
			6.1					92.0
42	M36	U 1 1/2	5.4	12				91.0
			6.4					107.0
			5.4		550	750		104.0
			6.6					121.0
30	M24	U 1	5.9	9				122.0
			6.9					142.0
			5.9			800		158.0
			6.9		600			160.0
26	M20	U 3/4	6.2	6				185.0
			7.1			850		180.0
			6.4					207.0
			7.3					200.0
22	M16	U 5/8	6.6	4.5				235.0
			7.7			900		240.0
			7.2					274.0
			8.4					

PIPING HANDBOOK

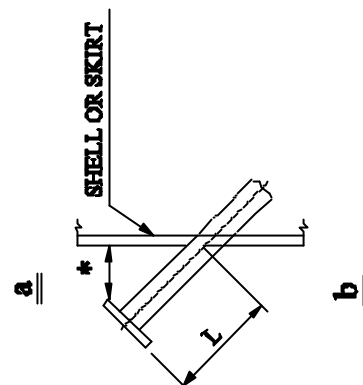
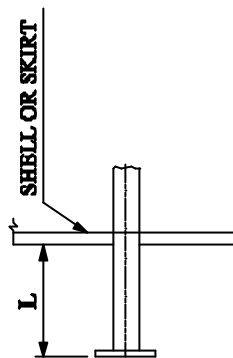
2. PIPING DESIGN REFERENCES

2.24 NOZZLE LENGTH

LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 2
DATE : DEC. 1995

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. FOR NOZZLE LENGTHS NOT DETAIL (a)(b)(c) & (d).
3. FOR NOZZLE SIZE OVER 60".
4. NOZZLE LENGTH TO BE AS FOLLOWS :
1. - FLANGE THICK + NOT THICK + INSULATION
(ON FIRE PROOFING) THICK + 15mm.
5. STEPPED TO BE REQUIRED FOR NOZZLE WITH
SIZE 2" OR SMALLER AND WITH LENGTH 900mm
AND OVER.
6. FOR TANGENTIAL NOZZLES CLEARANCE BETWEEN
FLANGE AND INSULATION COVER (*) TO BE
25mm AND OVER.
7. WHEN TANGENTIAL CONNECTION IS TO BE PROVIDED
ON NOZZLE NECK, NOZZLE LENGTH SHALL BE
EXTENDED ACCORDINGLY.
8. INSULATION OR FIREPROOFING THICKNESS.
9. IF THE NOZZLE LENGTH SHOWN ON ENGINEERING
DRAWING IS SMALLER THAN THIS GIVEN TABLE,
THE MANUFACTURER SHALL IMMEDIATELY NOTIFY
LDC AND REQUEST A RESOLUTION.



RATING	ASME 150# 300# API 150# 300# , JIS 10K 20K 30K									
	0	76	101	126	151	176	201	226	251	276
NOZZLE SIZE (inch)	75	100	125	150	175	200	225	250	275	300
1/2	150	150	200	200	250	250	300	300	350	350
3/4	150	150	200	200	250	250	300	300	350	350
1	150	150	200	200	250	250	300	300	350	350
1.1/4	150	150	200	200	250	250	300	300	350	350
1.1/2	150	150	200	200	250	250	300	300	350	350
2	150	150	200	200	250	250	300	300	350	350
2.1/2	150	150	200	200	250	250	300	300	350	350
3	150	150	200	200	250	250	300	300	350	350
3.1/2	150	150	200	200	250	250	300	300	350	350
4	150	150	200	200	250	250	300	300	350	350
5	150	150	200	200	250	250	300	300	350	350
6	150	150	200	200	250	250	300	300	350	350
8	150	150	200	200	250	250	300	300	350	350
10	150	150	200	200	250	250	300	300	350	350
12	150	150	200	200	250	250	300	300	350	350
14	150	150	200	200	250	250	300	300	350	350
16	150	150	200	200	250	250	300	300	350	350
18	150	150	200	200	250	250	300	300	350	350
20	150	150	200	200	250	250	300	300	350	350
24	150	150	200	200	250	250	300	300	350	350
26	150	150	200	200	250	250	300	300	350	350
28	150	150	200	200	250	250	300	300	350	350
30	150	150	200	200	250	250	300	300	350	350
32	150	150	200	200	250	250	300	300	350	350
34	150	150	200	200	250	250	300	300	350	350
36	150	150	200	200	250	250	300	300	350	350
42	150	150	200	200	250	250	300	300	350	350
48	150	150	200	200	250	250	300	300	350	350
54	150	150	200	200	250	250	300	300	350	350
60	150	150	200	200	250	250	300	300	350	350



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PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.25 SHELL NOZZLE

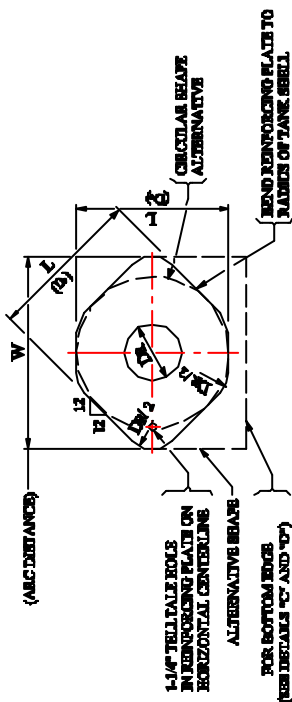
LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995

PIPE, PLATE AND WELDING SCHEDULES

t AND T	D _n	B	NOZZLE/PLATE THICKNESS	3" - 24" NOZZLES
3	16 ± 0.03	5	6	A
6.5	4	6.5	1	A
8		8		
9.5		9.5		
11		11		
13		13		
14	16 ± 0.03	14	6	A
16	19 ± 0.03	16	8	
17.5	19 ± 0.03	17.5	8	
19	19 ± 0.03	19	8	
21	24 ± 0.03	21	9.5	
22	24 ± 0.03	22	9.5	
24	24 ± 0.03	24	9.5	
25	27 ± 0.03	25	11	
27	27 ± 0.03	27	11	
28.5	27 ± 0.03	28.5	11	
30	33 ± 0.03	30	13	
32	33 ± 0.03	32	13	
33	33 ± 0.03	33	13	
35	33 ± 0.03	35	14	
36.5	33 ± 0.03	36.5	14	
38	33 ± 0.03	38	14	

SHELL NOZZLE DIMENSIONS

NOZZLE SIZE (INCH)	NOZZLE O.D.	D _n	L (IN)	W (IN)	J (IN)	H (IN)	C (IN)	REMARK
FLANGED FITTING								
24	609.5	613	1257	1304	305	700	640	
25	559.8	562	1156	1203	280	670	590	
20	508	511	1054	1093	250	620	540	
16	457.3	460	953	993	225	570	490	
15	426.4	430	891	931	215	530	440	
14	381.5	385	789	829	195	470	390	
12	311.5	315	655	695	165	400	320	
10	267.4	271	564	604	140	340	260	
8	216.3	220	463	503	115	280	210	
6	165.3	170	362	402	90	220	160	
4	114.3	118	261	301	65	160	110	
3	89.1	93	209	249	50	120	80	
2	63.5	67	157	197	35	90	60	
1.5/2	48.6	51	115	155	25	60	40	
THREADED FITTING								
3	101.6	105	206	246	30	240	180	COUPLING
2	76	80	154	194	20	180	120	COUPLING
1.5/2	50.8	55	102	142	15	120	80	COUPLING
1	40	45	81	121	10	100	60	COUPLING
3/4	33.4	37	66	106	8	80	50	COUPLING





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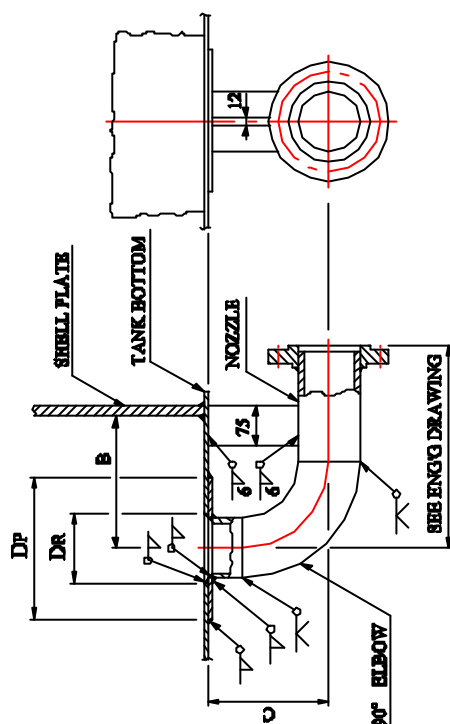
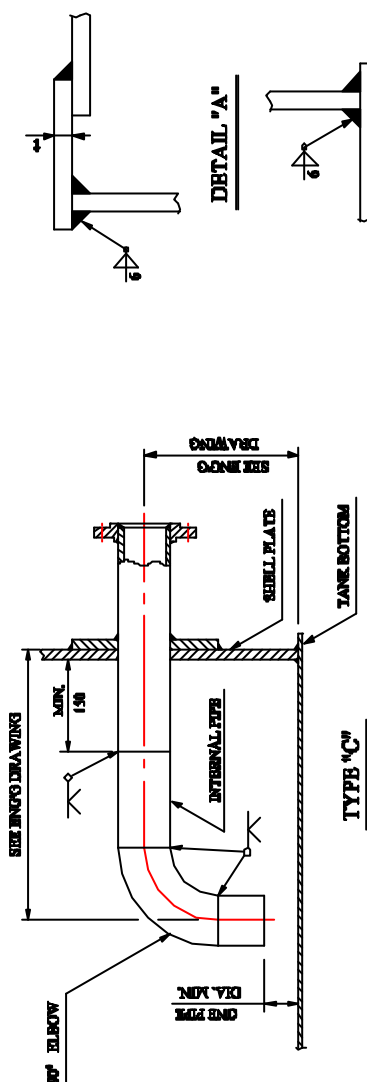
**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.26 DRAIN NOZZLE

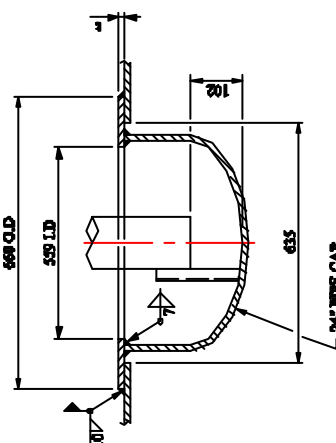
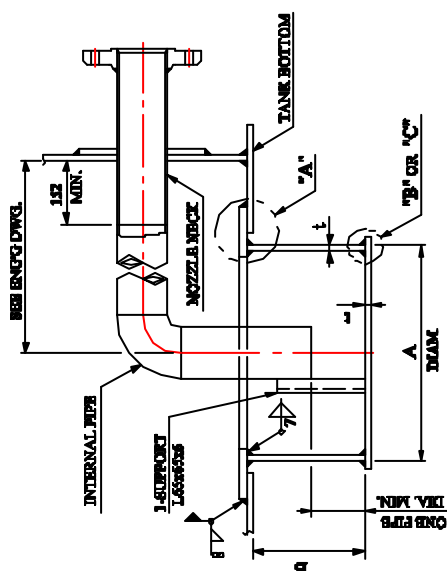
LDP-L901
REV. 1 (OCT, 2002)
PAGE : 1 OF 1
DATE : DEC. 1995



NOTE
1. ALL DIMENSIONS ARE IN MM.

DIMENSION FOR TYPE "D"

NOZZLE SIZE	B	C	DR	DP
2	100	150	60	140
3	215	175	110	200
4	240	210	135	250
6	310	280	185	325



DIMENSION FOR TYPE "A"

NOZZLE SIZE	A	B	t
2	610	305	8
3	915	467	10
4	1220	618	10
6	1525	915	11



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**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

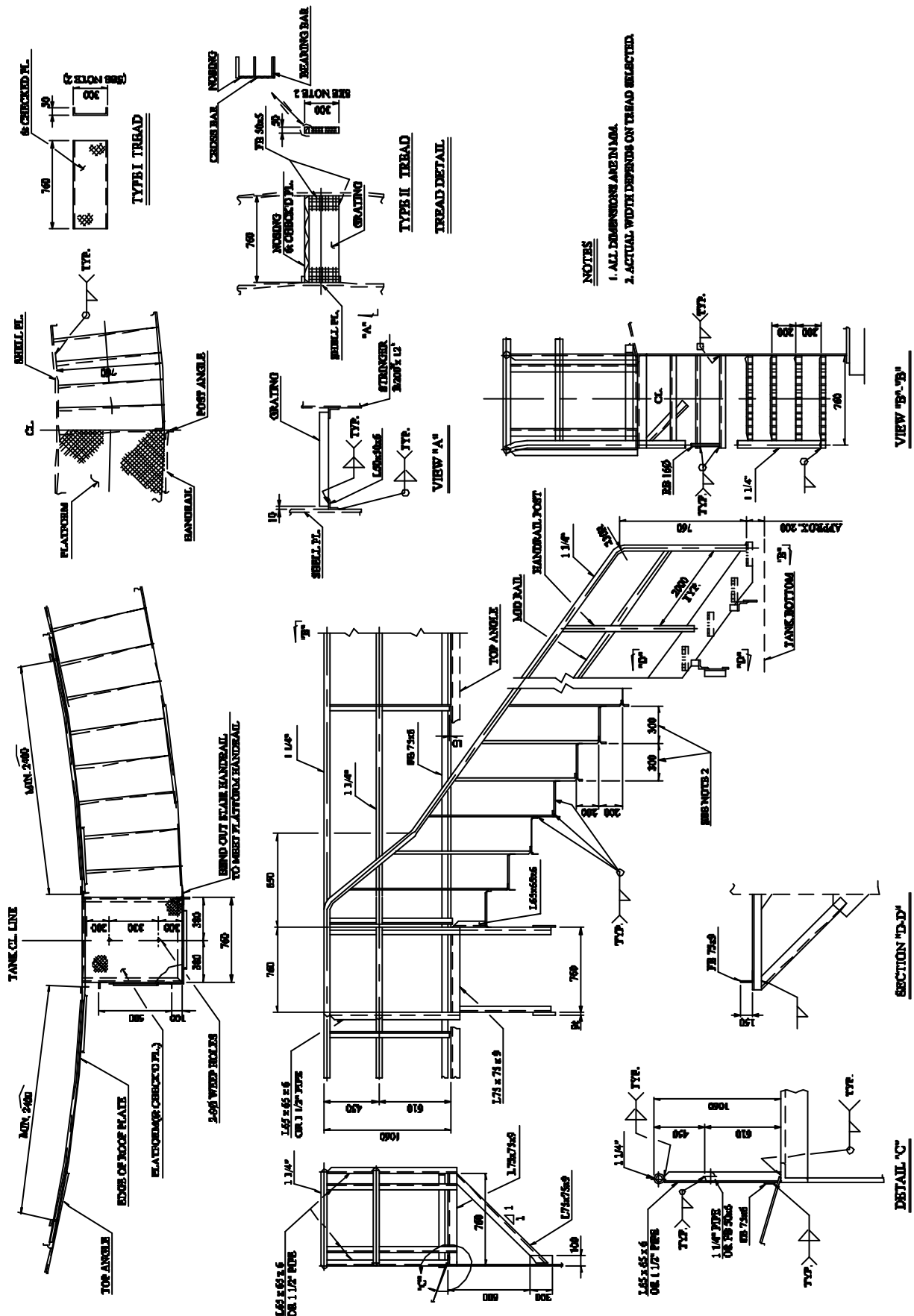
2.27 CIRCUMFERENTIAL STAIRWAY & PLATFORM FOR C.R.T(NON-INSULATION)

LDP-L901

REV. 1 (OCT, 2002)

PAGE : 1 OF 2

DATE : DEC. 1995





LG E&C

PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

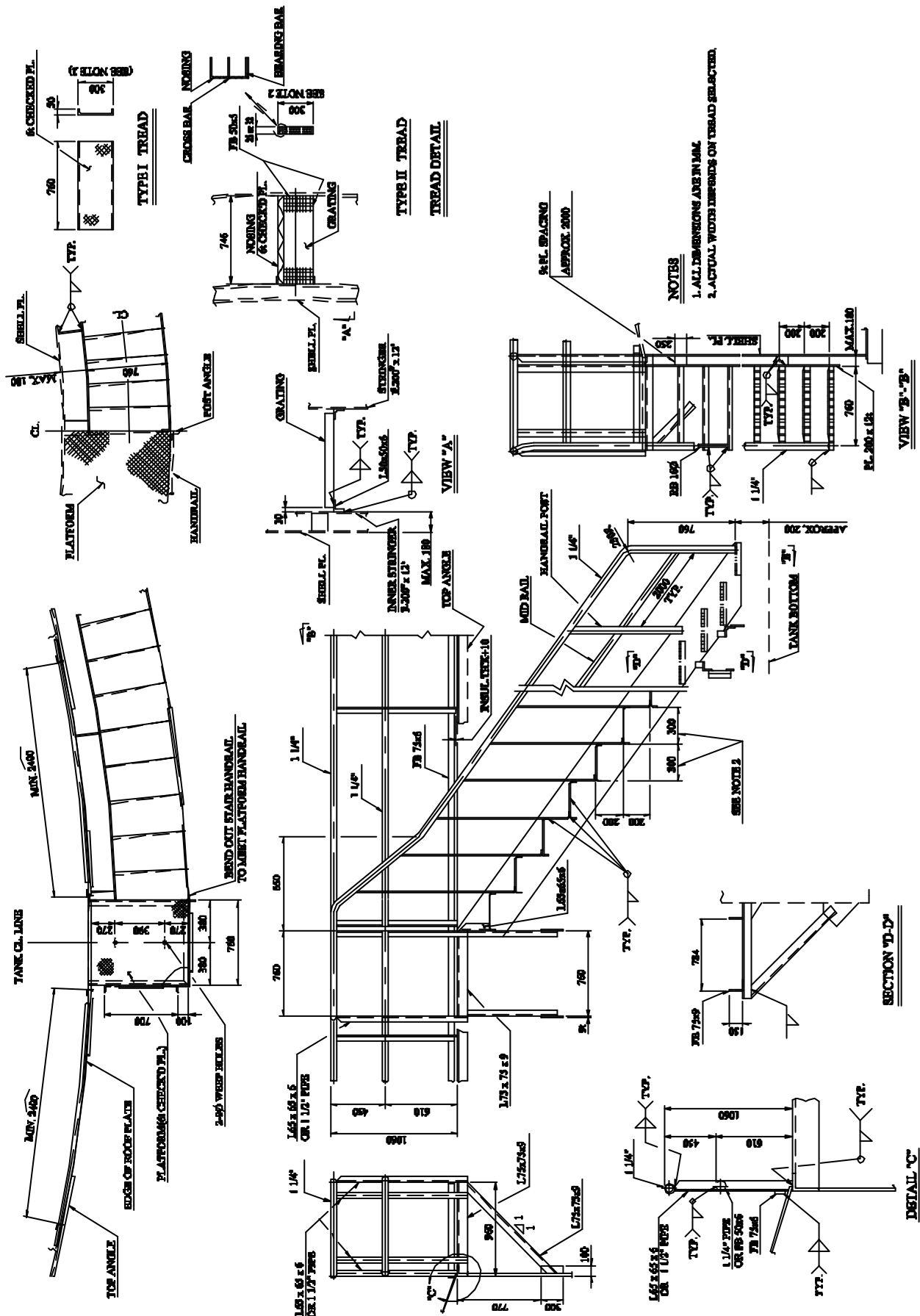
2. PIPING DESIGN REFERENCES 2.27 CIRCUMFERENTIAL STAIRWAY & PLATFORM FOR C.R.T(INSULATION)

LDP-L901

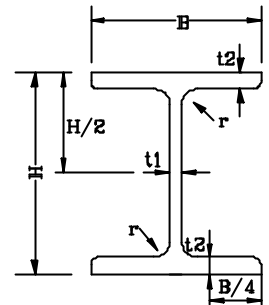
REV. 1 (OCT, 2002)

PAGE : 2 OF 2

DATE : DEC. 1995



1. H 형강(Steel H Beams)



공칭 치수 (mm) (HxB)	표준단면치수 (mm)				단면적 (cm ²)	단위중량 (kg/m)	단면 2 차모멘트 (cm ⁴)		단면계수 (cm ³)	
	H x B	t ₁	t ₂	r	A	W	I _x	I _y	Z _x	Z _y
100 x 100	100 x 100	6	8	10	21.9	17.2	383	134	76.5	26.7
125 x 125	125 x 125	6.5	9	10	30.31	23.8	847	293	136	47
150 x 75	150 x 75	5	7	8	17.85	14	666	49.5	88.8	13.2
150 x 100	148 x 100	6	9	11	26.84	21.1	1,020	151	138	30.1
150 x 150	150 x 150	7	10	11	40.14	31.5	1,640	563	219	75.1
200 x 100	198 x 95	4.5	7	11	23.18	18.2	1,580	114	160	23
	200 x 100	5.5	8	11	27.16	21.3	1,840	134	184	26.8
200 x 150	194 x 150	6	9	13	39.01	30.6	2,690	507	277	67.6
200 x 200	200 x 200	8	12	13	63.53	49.9	4,720	1,600	472	160
	200 x 204	12	12	13	71.53	56.2	4,980	1,700	498	167
	208 x 202	10	16	13	83.69	65.7	6,530	2,200	628	218
250 x 125	248 x 124	5	8	12	32.68	25.7	3,540	255	285	41.1
	250 x 125	6	9	12	37.66	29.6	4,050	294	324	47
250 x 175	244 x 175	7	11	16	56.24	44.1	6,120	984	502	113
250 x 250	244 x 252	11	11	16	82.06	64.4	8,790	2,940	720	233
	248 x 249	8	13	16	84.7	66.5	9,930	3,350	801	269
	250 x 250	9	14	16	92.18	72.4	10,800	3,650	867	292
	250 x 255	14	14	16	104.7	82.2	11,500	3,880	919	304
300 x 150	298 x 149	5.5	8	13	40.8	32	6,320	442	424	59.3
	300 x 150	6.5	9	13	46.78	36.7	7,210	508	481	67.7
300 x 200	294 x 200	8	12	18	72.38	56.8	11,300	1,600	771	160
	298 x 201	9	14	18	83.36	65.4	13,300	1,900	893	189
300 x 300	294 x 302	12	12	18	107.7	84.5	16,900	5,520	1,150	365
	298 x 299	9	14	18	110.8	87	18,800	6,240	1,270	417
	300 x 300	10	15	18	119.8	94	20,400	6,750	1,360	450
	300 x 305	15	15	18	134.8	106	21,500	7,100	1,440	466
	304 x 301	11	17	18	134.8	106	23,400	7,730	1,540	514
	310 x 305	15	20	18	165.3	130	28,150	9,460	1,810	620
	310 x 310	20	20	18	180.8	142	29,390	9,940	1,890	642
350 x 175	346 x 174	6	9	14	52.68	41.4	11,100	792	641	91
	350 x 175	7	11	14	63.14	49.6	13,600	984	775	112
	354 x 176	8	13	14	73.68	57.8	16,100	1,180	909	134
340 x 250	336 x 249	8	12	20	88.15	69.2	18,500	3,090	1,100	248
	340 x 250	9	14	20	101.5	79.7	21,700	3,650	1,280	292
350 x 350	338 x 351	13	13	20	135.3	106	28,200	9,380	1,670	534
	344 x 348	10	16	20	146	115	33,300	11,200	1,940	646
350 x 350	344 x 354	16	16	0	166.6	131	35,300	11,800	2,050	669
	350 x 350	12	19	20	173.9	137	40,300	13,600	2,300	776
	350 x 357	19	19	20	191.4	156	42,800	14,400	2,450	809

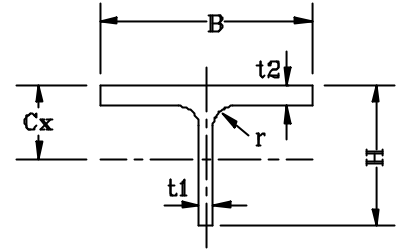
PIPING HANDBOOK

2. PIPING DESIGN REFERENCES

2.28 형강DATA

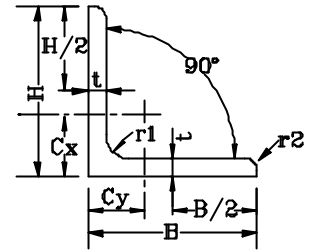
 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 2 OF 5
 DATE : DEC., 1995

2. CT 형강(Steel T Bars)



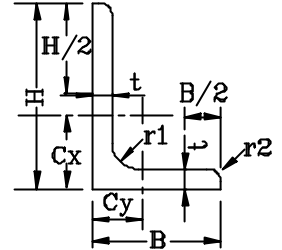
공칭 치수 (mm)	높이 (H) (mm)	폭(B) (mm)	두께		코너 반경(r) (mm)	단면적 (A) (cm ²)	단위 중량 (W) (kg/m)	단면 2 차모멘트 (cm ⁴)		단면계수 (cm ³)		중심 위치 (cm)
			웹 t ₁ (mm)	플랜지 t ₂ (mm)				I _x	I _y	Z _x	Z _y	
50 x 100	50	100	6	8	10	10.98	8.6	16.1	66.9	4.03	13.4	1
62.5 x 125	62.5	125	6.5	9	10	15.16	11.9	35	147	6.91	23.5	1.19
75 x 75	75	75	5	7	8	8.925	7.01	42.6	24.7	7.46	6.59	1.79
75 x 100	75	100	6	9	11	13.42	10.5	51.7	75.3	8.84	15.1	1.55
75 x 150	75	150	7	10	11	20.07	15.8	66.4	282	10.8	37.6	1.37
100 x 100	100	100	5.5	8	11	13.58	10.7	114	67	14.8	13.4	2.29
100 x 150	97	150	6	9	13	19.51	15.3	125	254	15.8	33.8	1.79
100 x 200	100	200	8	12	13	31.77	24.9	184	801	22.3	80.1	1.73
	100	204	12	12	13	35.77	28.1	256	851	32.4	83.4	2.09
	104	202	10	16	13	41.85	32.8	251	1,100	29.5	109	1.91
125 x 125	124	124	5	8	12	16.34	12.8	208	127	21.3	20.5	2.63
	125	125	6	9	12	18.83	12.8	248	147	25.6	23.5	2.78
125 x 175	122	175	7	11	16	28.12	22.1	289	492	29.1	56.3	2.27
125 x 250	122	252	11	11	16	41.03	32.2	445	1,470	45.3	117	2.39
	124	249	8	13	16	42.35	33.2	364	1,670	34.9	134	1.98
	125	250	9	14	16	46.06	36.2	412	1,820	39.5	146	2.08
	125	255	14	14	16	52.34	41.1	589	1,940	59.4	152	2.58
150 x 150	149	149	5.5	8	13	20.4	16	393	221	33.8	29.7	3.26
	150	150	6.5	9	13	23.39	18.4	464	254	40	33.8	3.41
150 x 200	147	200	8	12	18	36.19	28.4	572	802	48.25	80.2	2.83
	149	201	9	14	18	41.68	32.7	662	949	55.2	94.4	2.91
150 x 300	147	302	12	12	18	53.83	42.3	858	2,760	72.3	183	2.84
	149	299	9	14	18	55.4	43.5	715	3,120	57	209	2.36
	150	300	10	15	18	59.89	47	798	3,380	63.7	225	2.47
	150	305	15	15	18	67.39	52.9	1,110	3,550	92.5	233	3.03
	152	301	11	17	18	67.41	52.9	903	3,870	71.4	257	2.55
175 x 175	173	174	6	9	14	26.34	20.7	679	396	50	45.5	3.71
	175	175	7	11	14	31.57	24.8	815	492	59.3	56.2	3.75
175 x 250	168	249	8	12	20	44.08	34.6	881	1,540	64	124	3.02
	170	250	9	14	20	50.76	39.8	1,020	1,830	73.1	146	3.09
175 x 350	172	348	10	16	20	73	57.3	1,230	5,620	84.7	323	2.67
	172	354	16	16	20	83.32	65.4	1,800	5,920	131	335	3.4
	175	350	12	19	20	86.94	68.2	1,520	6,790	104	388	2.86
	175	357	19	19	20	99.19	77.9	2,200	7,220	158	404	3.59
175 x 350	169	351	13	13	20	67.63	53.1	1,420	4,690	104	267	3.21
200 x 200	198	199	7	11	16	36.08	28.3	1,190	723	76.4	72.7	4.17
	200	200	8	13	16	42.06	33	1,400	868	88.6	86.8	4.23

3. 등변 ㄱ형강(Steel Equal Angles)



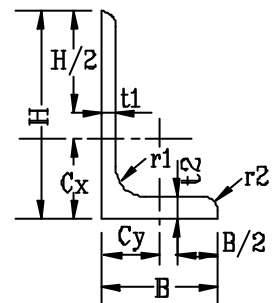
공칭 치수 (mm)	표준단면치수 (mm)				단면적 (cm ²)	단위중량 (kg/m)	중심의위치 (cm)	단면 2 차 모멘트(cm ⁴)	단면계수 (cm ³)
	H x B	t	r ₁	r ₂	A	W	C _x = C _y	I _x = I _y	Z _x = Z _y
25 x 25	25 x 25	3	4	2	1.427	1.12	0.719	0.797	0.448
30 x 30	30 x 30	3	4	2	1.727	1.36	0.844	1.42	0.661
40 x 40	40 x 40	5	4.5	3	3.755	2.95	1.17	5.42	1.91
45 x 45	45 x 45	4	6.5	3	3.492	2.74	1.24	6.5	2
	40 x 40	5	6.5	3	4.302	3.38	1.28	7.91	2.46
50 x 50	50 x 50	4	6.5	3	3.892	3.06	1.37	9.06	2.49
	50 x 50	5	6.5	3	4.082	3.77	1.41	11.1	3.08
	50 x 50	6	6.5	4.5	5.644	4.43	1.44	12.6	3.55
60 x 60	60 x 60	4	6.5	3	4.692	3.68	1.61	16	3.66
	60 x 60	5	6.5	3	5.802	4.55	1.66	19.6	4.52
	60 x 60	6	6.5	4.5	6.844	5.37	1.69	22.6	5.24
65 x 65	65 x 65	5	8.5	3	6.367	5	1.77	25.3	5.36
	65 x 65	6	8.5	4	7.527	5.91	1.81	29.4	6.26
	65 x 65	8	8.5	6	9.761	7.66	1.88	36.8	7.96
70 x 70	70 x 70	6	8.5	4	8.127	6.38	1.93	37.1	7.33
75 x 75	75 x 75	6	8.5	4	8.727	6.85	2.06	46.1	8.47
	75 x 75	9	8.5	6	12.69	9.96	2.17	64.4	12.1
	75 x 75	12	8.5	6	16.56	13	2.29	81.9	15.7
80 x 80	80 x 80	6	8.5	4	9.327	7.32	2.18	56.4	9.7
	80 x 80	7	8.5	4	10.797	8.48	2.23	64.2	11.12
90 x 90	90 x 90	6	10	5	10.55	8.28	2.42	80.7	12.3
	90 x 90	7	10	5	12.22	9.569	2.46	93	14.2
	90 x 90	8	10	7	13.764	10.8	2.5	104	16
	90 x 90	9	10	7	15.394	12.08	2.54	114	17.65
	90 x 90	10	10	7	17	13.3	2.57	125	19.5
	90 x 90	13	10	7	21.71	17	2.69	156	24.8
100 x 100	100 x 100	7	10	5	13.62	10.7	2.71	129	17.7
	100 x 100	8	10	8	15.36	12.06	2.75	144	19.86
	100 x 100	10	10	7	19	14.9	2.82	175	24.4
	100 x 100	13	10	7	24.31	19.1	2.94	220	31.1
120 x 120	120 x 120	8	12	5	18.76	14.7	3.24	258	29.5
130 x 130	130 x 130	9	12	6	22.74	17.9	3.53	366	38.7
	130 x 130	10	12	6	25.16	19.75	3.57	403	42.8
	130 x 130	12	12	8.5	29.76	23.4	3.64	467	49.9
	130 x 130	15	12	8.5	36.75	28.8	3.76	568	61.5
150 x 150	150 x 150	10	14	7	29.21	22.9	4.06	6.27	57.3
	150 x 150	12	14	7	34.77	27.3	4.14	740	68
	150 x 150	15	14	10	42.74	33.6	4.24	888	82.6
	150 x 150	19	14	10	53.38	41.9	4.4	1.09	103

4. 부등변 ㄱ형강(Steel Unequal Angles)



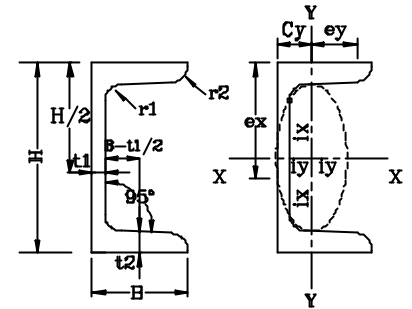
공칭 치수 (mm)	표준 단면 치수 (mm)				단면적 (cm ²)	단위중량 (kg/m)	중심 의 위치 (cm)		단면 2 차 모멘트(cm ⁴)		단면계수 (cm ³)	
	H x B	t	r ₁	r ₂			C _x	C _y	I _x	I _y	Z _x	Z _y
100 x 75	100 x 75	7	10	5	11.87	9.32	3.06	1.83	118	56.9	17	10
	100 x 75	10	10	7	16.5	13	3.17	1.94	159	76.1	23.3	13.7
125 x 75	125 x 75	7	10	5	13.62	10.7	4.1	1.64	219	60.4	26.1	10.3
	125 x 75	10	10	7	19	14.9	4.22	1.75	299	80.9	36.1	14.1
	125 x 75	13	10	7	24.31	19.1	4.35	1.87	376	101	46.1	17.9
150 x 90	150 x 90	9	12	6	20.94	16.4	4.95	1.99	485	133	48.2	19
	150 x 90	2	12	8.5	27.36	215	5.07	2.01	619	167	62.3	24.3

5. 부등변 부등후 ㄱ형강(Steel Unequal Angles)



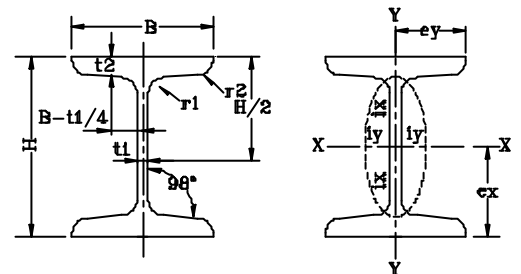
공칭 치수 (mm)	표준 단면 치수 (mm)					단면적 (cm ²)	단위중량 (kg/m)	중심 의 위치 (cm)		단면 2 차 모멘트(cm ⁴)		단면계수 (cm ³)	
	H x B	t ₁	t ₂	r ₁	r ₂			C _x	C _y	I _x	I _y	Z _x	Z _y
200 x 90	200 x 90	9	14	14	7	29.66	23.3	6.36	2.15	1,210	200	88.7	88.7
250 x 90	250 x 90	10	15	17	8.5	37.47	29.4	8.61	1.92	2,440	223	149	31.5
	250 x 90	12	16	17	8.5	42.95	33.7	8.99	1.89	2,790	238	174	33.5
300 x 90	300 x 90	11	16	19	9.5	46.22	36.3	11	1.76	4,370	245	229	33.8
	300 x 90	13	17	19	9.5	52.67	41.3	11.3	1.75	4,940	259	264	35.8
350 x 100	350 x 100	12	17	22	11	57.74	45.3	13	1.87	7,440	362	338	44.5
400 x 100	400 x 100	13	18	24	12	68.59	53.8	15.4	1.77	11,500	388	467	47.1
450 x 125	450 x 125	11.5	18	24	12	73.11	57.4	16.2	2.29	15,700	768	547	75.2

6. ㄷ 형강(Steel Channels)



표준단면치수 (mm)					단면적 (cm ²)	단위중량 (kg/m)	중심의위치 (cm)		단면 2 차 모멘트(cm ⁴)		단면 2 차반경 (cm)		단면계수 (cm ³)	
H x B	t ₁	t ₂	r ₁	r ₂	A	W	C _x	C _y	I _x	I _y	i _x	i _y	Z _x	Z _y
75 x 40	5	7	8	4	8.818	6.92	0	1.28	75.3	12.2	2.92	1.17	20.1	4.47
100 x 50	5	7.5	8	4	11.92	9.36	0	1.54	188	26	3.97	1.48	37.6	7.52
125 x 65	6	8	8	4	17.11	13.4	0	1.9	424	61.8	4.98	1.9	67.8	13.4
150 x 75	6.5	10	10	5	23.71	18.6	0	2.28	861	117	6.03	2.22	115	22.4
200 x 80	7.5	11	12	6	31.33	24.6	0	2.21	1.95	168	7.88	2.32	195	29.1
200 x 90	8	13.5	14	7	38.65	30.3	0	2.74	2.49	277	8.02	2.68	249	44.2
250 x 90	9	13	14	7	44.07	34.6	0	2.4	4.18	294	9.74	2.58	334	44.5
300 x 90	9	13	14	7	48.57	38.1	0	2.22	6.44	309	11.5	2.52	429	45.7
380 x 100	10.5	16	18	9	69.69	54.5	0	2.41	14.5	535	14.5	2.78	763	70.5
380 x 100	13	20	24	12	85.71	67.3	0	2.54	17.6	655	14.3	2.76	926	87.8

7. I 형강(Steel I Beams)



표준단면치수 (mm)					단면적 (cm ²)	단위중량 (kg/m)	중심의위치 (cm)		단면 2 차 모멘트(cm ⁴)		단면 2 차반경 (cm)		단면계수 (cm ³)	
H x B	t ₁	t ₂	r ₁	r ₂	A	W	C _x	C _y	I _x	I _y	i _x	i _y	Z _x	Z _y
125 x 75	5.5	9.5	9	4.5	20.45	16.1	0	0	538	57.5	5.13	1.68	86	15.3
150 x 75	5.5	9.5	9	4.5	21.83	17.1	0	0	819	57.5	6.12	1.62	109	15.3
200 x 100	7	10	10	5	33.06	26	0	0	2170	138	8.11	2.05	217	27.7
250 x 125	7.5	12.5	12	6	48.79	38.3	0	0	5180	337	10.3	2.63	414	53.9
300 x 150	10	18.5	19	9.5	83.47	65.5	0	0	12700	886	12.3	3.26	849	118
300 x 150	11.5	22	23	11.5	97.88	76.8	0	0	14700	1080	12.2	3.32	978	149
350 x 150	9	15	13	6.5	74.58	58.5	0	0	15200	702	14.3	3.17	870	93.5
350 x 150	12	24	25	12.5	111.1	87.2	0	0	22400	1180	14.2	3.26	1280	158
400 x 150	10	18	17	8.5	91.73	72	0	0	24100	864	16.2	3.07	1200	115
400 x 150	12.5	25	27	13.5	122.1	95.8	0	0	31700	1240	16.1	3.18	1580	165
450 x 175	11	20	19	9.5	116.8	91.7	0	0	39200	1510	18.3	3.6	1740	173
400 x 175	13	26	27	13.5	146.1	115	0	0	48800	2020	18.3	3.72	2170	231
600 x 190	13	25	25	12.5	169.4	133	0	0	98400	2460	24.1	3.81	3280	259
600 x 190	16	35	38	19	224.5	176	0	0	130000	3540	24.1	3.97	4330	373

H BEAMS

KS(JIS)	DIN	BS	AISC	REMARKS
H150 x 150 x 7 x 10	HEA160	UC152 x 152 x 37	W6 x 20	
H200 x 200 x 8 x 12	HEB200	UC203 x 203 x 52	W8 x 35	
H250 x 250 x 9 x 14	HEB240	UC254 x 254 x 73	W10 x 49	
H300 x 300 x 10 x 15	HEB300	UC305 x 305 x 97	W12 x 65	
H350 x 350 x 12 x 19	HEB360	UC358 x 368 x 153	W14 x 90	

CHANNELS

KS(JIS)	DIN	BS	AISC	REMARKS
ㄷ 300 x 90 x 9 x 13	U300	C305 x 89 x 42	MC12 x 31	
ㄷ 200 x 90 x 8 x 13.5	U220	C203 x 89 x 30	MC8 x 21.4	
ㄷ 150 x 75 x 9 x 12.5	U200	C152 x 89 x 24	MC6 x 15.1	
ㄷ 150 x 75 x 6.5 x 10	U160	C152 x 89 x 42	MC6 x 15.1	
ㄷ 100 x 50 x 5 x 7.5	U100	C102 x 51 x 10	C4 x 7.25	

ANGLES

KS(JIS)	DIN	BS	AISC	REMARKS
L150 x 150 x 12	L150 x 150 x 12	L150 x 150 x 15	L6 x 6 x 1/2	
L130 x 130 x 12	L130 x 130 x 12	L150 x 150 x 10	L5 x 5 x 1/2	
L100 x 100 x 10	L100 x 100 x 10	L100 x 100 x 12	L4 x 4 x 3/8	
L100 x 100 x 7	L100 x 100 x 7	L100 x 100 x 8	L4 x 4 x 5/16	
L90 x 90 x 10	L90 x 90 x 10	L90 x 90 x 10	L3 1/2 x 3 1/2 x 7/16	
L75 x 75 x 9	L75 x 75 x 10	L80 x 80 x 8	L3 x 3 x 3/8	
L75 x 75 x 6	L75 x 75 x 6	L80 x 80 x 6	L3 x 3 x 1/4	
L65 x 65 x 6	L65 x 65 x 6	L70 x 70 x 6	L2 1/2 x 2 1/2 x 1/4	
L50 x 50 x 6	L50 x 50 x 6	L50 x 50 x 6	L2 x 2 x 1/4	
L40 x 40 x 3	L40 x 40 x 3	L40 x 40 x 4	L2 x 2 x 1/8	

1. 일반

1.1 목적

이 Manual 은 LGE&C에서 수행하는 배관응력해석의 기준 및 자료관리를 통일하는데 필요한 사항을 규정
한 것이다. Client 로 부터 특별한 요구가 없는 한 모든 Project 에 적용한다.

2. 검토기준

2.1 검토할 배관의 선택기준

2.1.1 최고 운전온도 100°C이상의 배관계로서 호칭경 3 “ 이상의 전배관

2.1.2 최저운전온도 -50 °C이하의 배관계로서 호칭경 2 “ 이상의 전배관

2.1.3 접속기기가 민감한 Turbine, Compressor 및 Pump 의 배관계

2.1.4 상기 이외에 담당자가 검토할 필요가 있다고 생각하는 아래와 같은 배관계

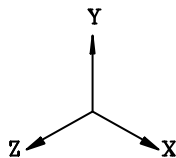
- | | |
|--|--|
| (1) 관의 직선거리가 긴 경우 ----- | OBSL 등의 RACK PIPING |
| (2) 배관접속부의 이동량이 큰 경우 ----- | 기기노즐 |
| (3) 대구경배관에 접속하는 소구경 배관 ----- | 이동량이 큰 대구경 배관에
접속되는 경우 |
| (4) 관의 두께가 두꺼운 경우 ----- | Flexibility, System 에는 문제가
없더라도 접속기기에 큰 반력
을 작용한다. |
| (5) 온전누설방지가 필요한 위험성이 높은 배관계 ----- | Flange 부분들의 누설. |
| (6) 배관재질이 고가인 배관계 ----- | 최단 배관길이를 택한다. |
| (7) 열팽창량이 큰 재질의 배관계 ----- | 알루미늄, 염화비닐관등 |
| (8) Tower 와 Tower, Tower 와 Rack 위의 기기와 연결하는
배관계 | |
| (9) 풍압이나 지진의 영향을 받는 배관계 | |
| (10) 외력을 받는 배관계 ----- | 집중하중이나 진동발생 |

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.2 배관응력간략계산법

PIPING FLEXIBILITY CHECKING FORM

1	NOMINAL PIPE SIZE	D= IN	SKETCH OF PIPE LINE	LINE NO. :
2	PIPE MAT'L :			
3	OPER. TEMP. : T= °C			
4	UNIT EXPANSION : e = mm/m			
5	TOTAL LGNGTH OF LINE : L = m			
6	ANCHOR DISTANCE : U X=()M, Y=()M, Z=()M $U = \sqrt{X^2 + Y^2 + Z^2}$ = = m			
7	MOVEMENT OF ANCHOR	YES		NO
8	THERMAL EXPANSION	ΔX	$e \times x =$ mm	-
		ΔY	$e \times y =$ mm	
		ΔZ	$e \times z =$ mm	
9	DISPLACEMENT OF ANCHOR	$\Delta X'$	mm	-
		$\Delta Y'$	mm	
		$\Delta Z'$	mm	
10	RESULTANT : Y	$Y = \sqrt{(\Delta X \pm \Delta X')^2 + (\Delta Y \pm \Delta Y')^2 + (\Delta Z \pm \Delta Z')^2}$ $= \sqrt{()^2 + ()^2 + ()^2} =$ mm		$Y = U \times e$ = mm
11	FORMULAR & RESULTANT	$\frac{DY}{8.2(L - U)^2} =$		
12	RESULTANT > 1 FORMAL CALCULATION NECESSARY ≤ 1 FORMAL CALCULATION UNNECESSARY			

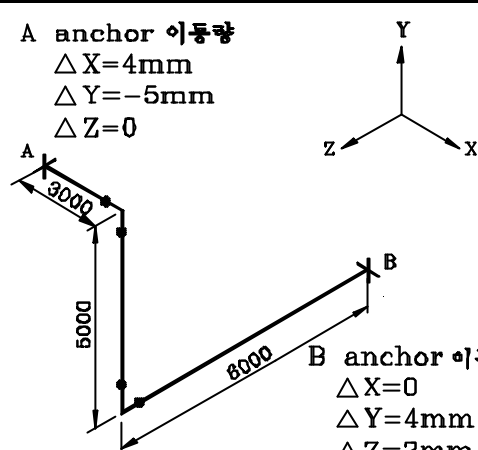
PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.2 배관응력간략계산법

 LDP-L901
REV. 1 (OCT., 2002)
PAGE : 2 OF 2
DATE : DEC., 1995

PIPING FLEXIBILITY CHECKING FORM (EXAMPLE)

1	NOMINAL PIPE SIZE	D = 6 IN	SKETCH OF PIPE LINE	LINE NO. :
2	PIPE MAT'L : STPC 38		 A anchor 이동량 $\Delta X = 4\text{mm}$ $\Delta Y = -5\text{mm}$ $\Delta Z = 0$ B anchor 이동량 $\Delta X = 0$ $\Delta Y = 4\text{mm}$ $\Delta Z = 2\text{mm}$	
3	OPER. TEMP. : T= 325°C			
4	UNIT EXPANSION : e = 4mm/m			
5	TOTAL LGNGTH OF LINE : L = 14m			
6	ANCHOR DISTANCE U $X = (3)\text{M}, Y = (5)\text{M}, Z = (6)\text{M}$ $U = \sqrt{X^2 + Y^2 + Z^2} = \sqrt{9 + 25 + 36}$ $= 8.4\text{ m}$			
7	MOVEMENT OF ANCHOR	YES		NO
8	THERMAL EXPANSION	ΔX	$e \times x = 12\text{mm}$	-
		ΔY	$e \times y = 20\text{mm}$	
		ΔZ	$e \times z = 24\text{mm}$	
9	DISPLACEMENT OF ANCHOR	$\Delta X'$	4mm	-
		$\Delta Y'$	9mm	
		$\Delta Z'$	2mm	
10	RESULTANT, Y	$Y = \sqrt{(\Delta X \pm \Delta X')^2 + (\Delta Y \pm \Delta Y')^2 + (\Delta Z \pm \Delta Z')^2}$ $= \sqrt{(12 + 4)^2 + (20 + 9)^2 + (24 + 2)^2} = 42.1\text{mm}$		$Y = U \times e$ $= \text{mm}$
11	FORMULAR & RESULTANT	$\frac{DY}{8.2(L-U)^2} = 0.98$ 상세해석 불필요		
12	RESULTANT > 1 FORMAL CALCULATION NECESSARY ≤ 1 FORMAL CALCULATION UNNECESSARY			

1. PUMP

1.1 Coordinate system

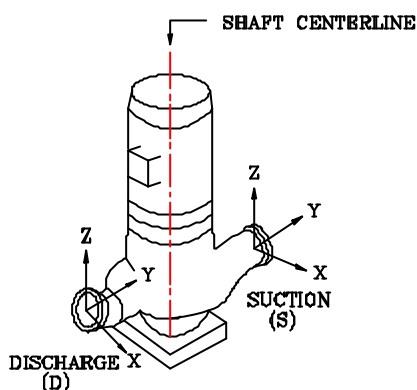


Figure 1 - Coordinate System for the Forces and Moments in Table A(B)
Vertical In-Line Pumps

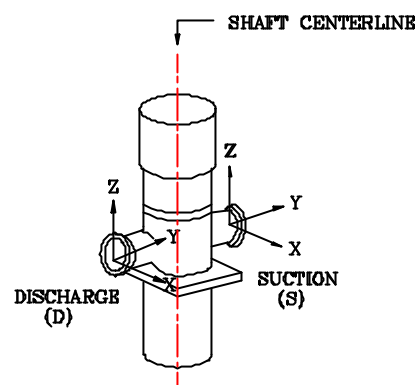


Figure 2 - Coordinate System for the Forces and Moments in Table A(B)
Vertically Suspended Double-Casing Pumps

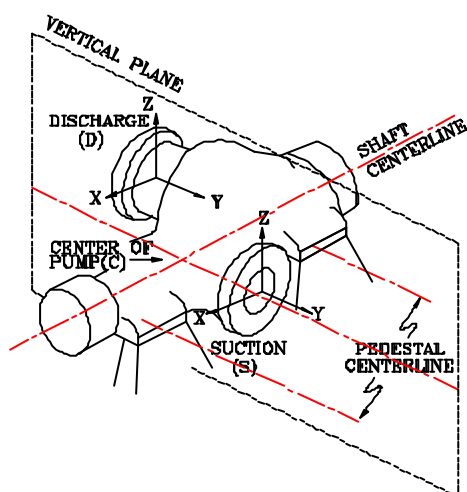


Figure 3 - Coordinate System for the Forces and Moments in Table A(B)
Horizontal Pumps with Side Suction and Side Discharge Nozzles

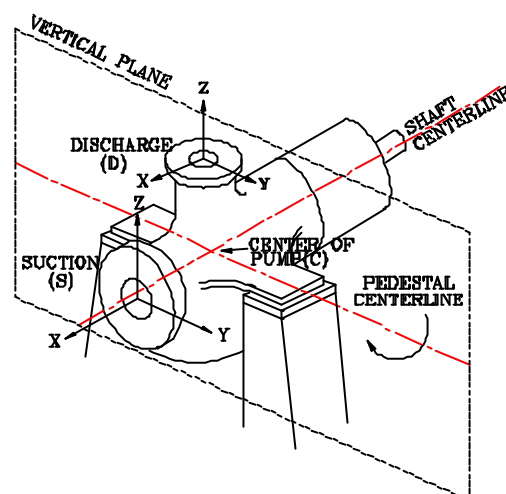


Figure 4 - Coordinate System for the Forces and Moments in table A(B)
Horizontal Pumps with End Suction and Top Discharge Nozzles

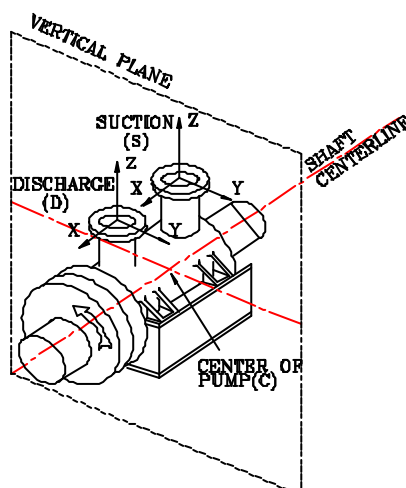


Figure 5 - Coordinate System for the Forces and Moments in Table A(B)
Horizontal Pumps with Top Nozzles

1.2 Allowable Forces and Moments

Force(kg) Moment(kg-m)	Nominal Size of Flange(NPS)								
	2	3	4	6	8	10	12	14	16
Each top nozzle									
FX	73	109	145	254	386	544	680	726	862
FY	59	91	118	209	318	454	544	590	680
FZ	91	136	181	318	499	680	816	907	1043
FR	132	195	259	458	708	998	1179	1315	1497
Each side nozzle									
FX	73	109	145	254	386	544	680	726	862
FY	91	136	181	318	499	680	816	907	1043
FZ	59	91	118	209	318	454	544	590	680
FR	132	195	259	458	708	998	1179	1315	1497
Each end nozzle									
FX	91	136	181	318	499	680	816	907	1043
FY	73	109	145	254	386	544	680	726	862
FZ	59	91	118	209	318	454	544	590	680
FR	132	195	259	458	708	998	1179	1315	1497
Each nozzle									
MX	47	97	135	235	359	512	622	650	747
MY	24	48	69	120	180	249	304	318	373
MZ	36	73	102	180	263	387	470	484	553
MR	64	131	184	319	484	691	843	871	995

Table A – Nozzle Loadings (F = force in kg ; M = moment in kg-m ; R = resultant)

Force(lb) Moment(ft-lb)	Nominal Size of Flange(NPS)								
	2	3	4	6	8	10	12	14	16
Each top nozzle									
FX	160	240	320	560	850	1200	1500	1600	1900
FY	130	200	260	460	700	1000	1200	1300	1500
FZ	200	300	400	700	1100	1500	1800	2000	2300
FR	290	430	570	1010	1560	2200	2600	2900	3300
Each side nozzle									
FX	160	240	320	560	850	1200	1500	1600	1900
FY	200	300	400	700	1100	1500	1800	2000	2300
FZ	130	200	260	460	700	1000	1200	1300	1500
FR	290	430	570	1010	1560	2200	2600	2900	3300
Each end nozzle									
FX	200	300	400	700	1100	1500	1800	2000	2300
FY	160	240	320	560	850	1200	1500	1600	1900
FZ	130	200	260	460	700	1000	1200	1300	1500
FR	290	430	570	1010	1560	2200	2600	2900	3300
Each nozzle									
MX	340	700	980	1700	2600	3700	4500	4700	5400
MY	170	350	500	870	1300	1800	2200	2300	2700
MZ	260	530	740	1300	1900	2800	3400	3500	4000
MR	460	950	1330	2310	3500	5000	6100	6300	7200

Table B – Nozzle Loadings (F = force in lb ; M = moment in ft-lb ; R = resultant)

Notes :

1. API 610, 8th Edition Table 2-1A(B) 적용
2. 위의 Table 값은 절대값임.
3. Nozzle Load 가 Table 값을 초과 시 API 610, 8th Edition Appendix F에 따라 계산하여 확인한다.
4. Vendor Data 가 있을 경우 Vendor Data 를 우선하여 적용한다.

PIPING HANDBOOK

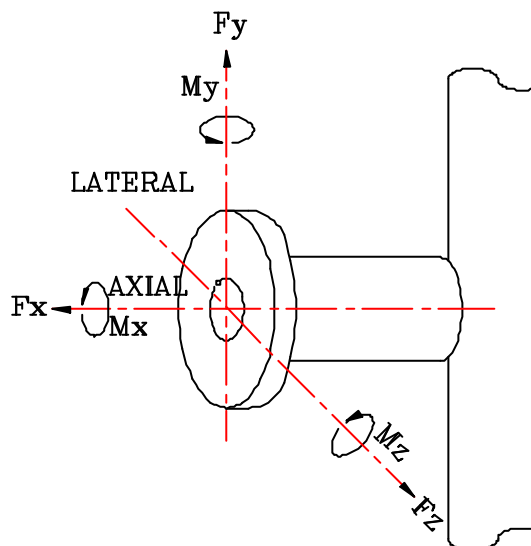
3. PIPING STRESS ANALYSIS

3.3 ALLOWABLE FORCE&MOMENT (PUMP, VESSEL, HEAT-EXCH. AND AIR COOLER)

 LDP-L901
REV. 1 (OCT., 2002)
PAGE : 3 OF 5
DATE : DEC., 1995

2. PRESSURE VESSEL & HEAT EXCHANGER

Nozzle size (inch)	Axial Force (Fx)		Lateral Force (Fy=Fz)		Moment (Mx=My=Mz)	
	kg	lb	kg	lb	kg.m	lb.ft
1.1/2	170	380	80	175	80	585
2	230	505	105	230	105	775
2.1/2	300	655	135	300	140	1010
3	405	890	185	410	190	1370
4	620	1370	285	630	290	2105
6	1315	2895	605	1335	615	4458
8	2320	5105	1070	2355	1090	7885
10	3840	8445	1770	3895	1800	12995
12	5770	12695	2660	5860	2705	19535
14	7255	15965	3350	7365	3400	24565
16	10130	22290	4670	10285	4750	34295
18	13680	30095	6310	13890	6415	46305
20	17975	39545	8295	18250	8425	60835
22	23080	50780	10650	23435	10820	78125
24	29075	63970	13420	29520	13635	98415

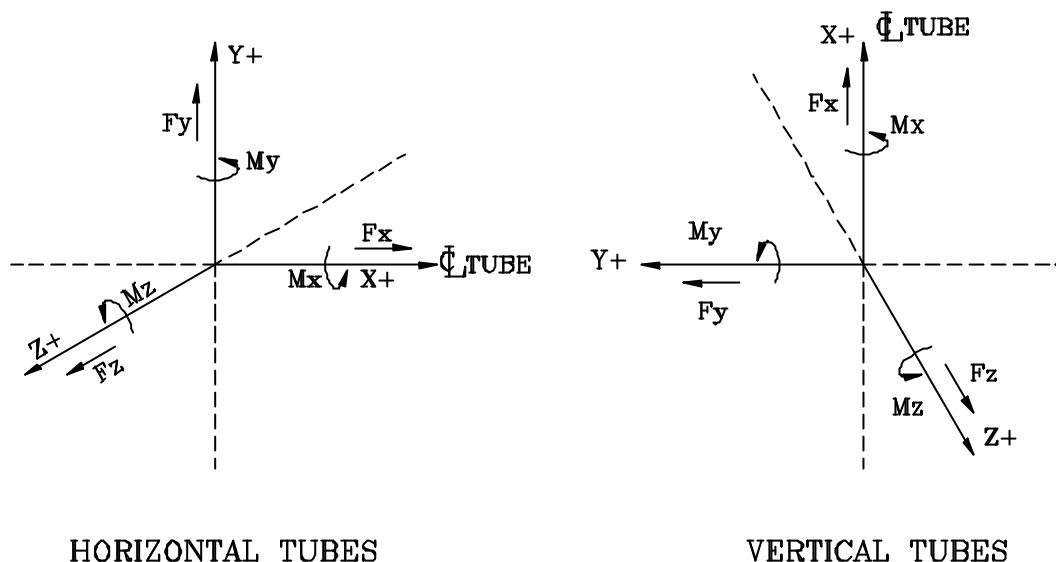


Notes :

- 위의 Table 은 Rossheim-Markl's Equation 에 따라 작성되었음.
(Reference : Design Of Piping System, M.W.KELLOGG COMPANY)
- 위의 Table 값은 절대값임.
- 위의 Table 값은 참고용이며 안전성 여부는 Stress Engineer 와 협의하여야 한다.

3. FIRED HEATER

3.1 Coordinate system



3.2 Allowable Movements

	Horizontal Tubes			Vertical Tubes		
	Δx	Δy	Δz	Δx	Δy	Δz
	mm(inches)			mm(inches)		
Radiant terminals	0	25(+1)	25(± 1)	0	25(± 1)	25(± 1)
Convection terminals	0	13(+1/2)	13($\pm 1/2$)	-	-	-

3.3 Allowable Forces and Moments

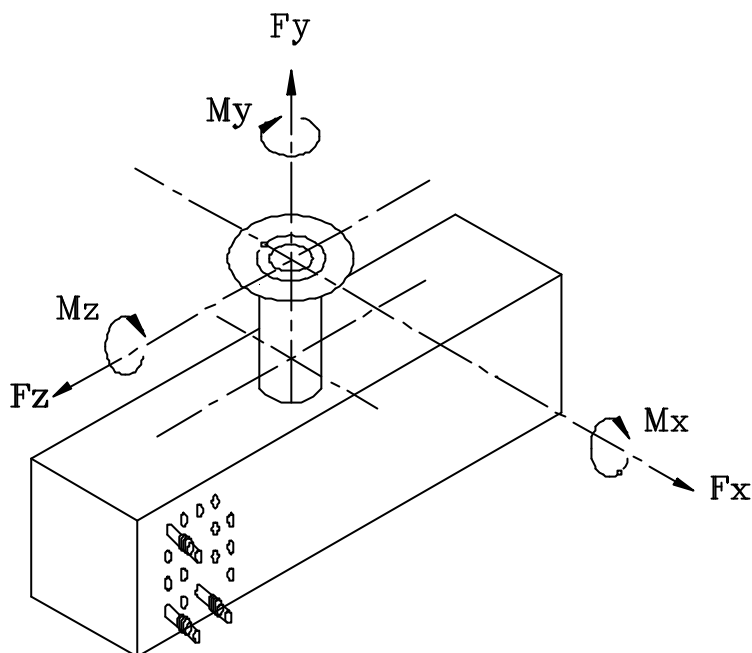
Pipe Size (inches)	Forces kg(lb)			Moments kg-m(ft-lb)		
	Fx	Fy	Fz	Mx	My	Mz
2	45 (100)	91 (200)	91 (200)	48 (350)	35 (250)	35 (250)
3	68 (150)	136 (300)	136 (300)	62 (450)	48 (350)	48 (350)
4	91 (200)	181 (400)	181 (400)	83 (600)	62 (450)	62 (450)
5	102 (225)	204 (450)	204 (450)	91 (660)	69 (500)	69 (500)
6	113 (250)	227 (500)	227 (500)	101 (730)	76 (550)	76 (550)
8	136 (300)	272 (600)	272 (600)	119 (860)	90 (650)	90 (650)
10	159 (350)	295 (650)	295 (650)	129 (930)	97 (700)	97 (700)
12	181 (400)	318 (700)	318 (700)	138 (1000)	104 (750)	104 (750)

Notes :

1. API 560, 3RD EDITION TABLE 7 적용
2. 위의 Table 값은 절대값임.
3. Vendor Data 가 있을 경우 Vendor Data 를 우선하여 적용한다.

4. AIR-FIN COOLER

4.1 Coordinate system



4.2 Maximum Allowable Nozzle Loads

Pipe Size (inches)	Forces kg(lb)			Moments kg-m(ft-lb)		
	F _x	F _y	F _z	M _x	M _y	M _z
20 (1 1/2)	68 (150)	104 (230)	68 (150)	11 (80)	15 (110)	11 (80)
50 (2)	104 (230)	136 (300)	104 (230)	15 (110)	24 (180)	15 (110)
80 (3)	204 (450)	172 (380)	204 (450)	42 (300)	62 (450)	42 (300)
100 (4)	341 (750)	272 (600)	341 (750)	83 (600)	124 (900)	83 (600)
150 (6)	408 (900)	513 (1130)	513 (1130)	218 (1580)	311 (2250)	166 (1200)
200 (8)	580 (1280)	1360 (3000)	817 (1800)	311 (2250)	622 (4500)	228 (1650)
250 (10)	680 (1500)	1360 (3000)	1021 (2250)	415 (3000)	622 (4500)	260 (1880)
300 (12)	852 (1880)	1360 (3000)	1360 (3000)	518 (3750)	622 (4500)	311 (2250)
350 (14)	1021 (2250)	1701 (3750)	1701 (3750)	622 (4500)	726 (5250)	364 (2630)

Notes :

1. API 661, 5th Edition Table 4 적용
2. 위의 Table 값은 절대값임.
3. Vendor Data 가 있을 경우 Vendor Data 를 우선하여 적용한다.

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.4 TOTAL THERMAL EXPANSION

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 1 OF 6
 DATE : DEC., 1995

1. Total Thermal Expansion, Metric Units for Metals

Unit : mm/m

Temp °C	Carbon Steel Carbon-Moly- Low-Crome (Through 3Cr-Mo)	5Cr-Mo Through 9Cr-Mo	Austenitic Stainless Steels 18Cr-8Ni	12Cr, 17Cr, 27Cr	25Cr-20Ni	UNS NO4400 Monel 67Ni-30Cu	3.1/2Ni	Copper and Copper Alloys
-250								-3.27
-240								-3.26
-230								-3.25
-220								-3.20
-210								-3.14
-200								-3.09
-190	-1.91	-1.80	-3.12	-1.65		-2.15	-1.84	-3.00
-180	-1.84	-1.73	-2.98	-1.59		-2.09	-1.79	-2.90
-170	-1.77	-1.67	-2.85	-1.52		-2.03	-1.72	-2.79
-160	-1.69	-1.60	-2.72	-1.45		-1.97	-1.66	-2.69
-150	-1.62	-1.52	-2.58	-1.39		-1.89	-1.61	-2.57
-140	-1.53	-1.45	-2.44	-1.32		-1.82	-1.55	-2.44
-130	-1.46	-1.37	-2.31	-1.25		-1.74	-1.48	-2.32
-120	-1.37	-1.29	-2.16	-1.18		-1.66	-1.41	-2.18
-110	-1.28	-1.21	-2.02	-1.10		-1.57	-1.31	-2.04
-100	-1.20	-1.13	-1.87	-1.02		-1.47	-1.22	-1.90
-90	-1.11	-1.05	-1.73	-0.95		-1.38	-1.13	-1.76
-80	-1.02	-0.96	-1.58	-0.88		-1.26	-1.04	-1.61
-70	-0.93	-0.87	-1.44	-0.80		-1.14	-0.95	-1.46
-60	-0.84	-0.79	-1.29	-0.72		-1.03	-0.86	-1.31
-50	-0.74	-0.69	-1.14	-0.64		-0.91	-0.75	-1.16
-40	-0.64	-0.60	-0.98	-0.55		-0.79	-0.65	-1.00
-30	-0.54	-0.51	-0.82	-0.46		-0.66	-0.55	-0.84
-20	-0.44	-0.41	-0.66	-0.38		-0.54	-0.44	-0.68
-10	-0.33	-0.31	-0.50	-0.29		-0.41	-0.34	-0.51
0	-0.23	-0.21	-0.34	-0.20		-0.28	-0.23	-0.35
10	-0.12	-0.11	-0.18	-0.10		-0.15	-0.12	-0.18
20	-0.01	-0.01	-0.02	-0.01		-0.02	-0.01	-0.02
30	0.10	0.09	0.15	0.08		0.12	0.10	0.15
40	0.21	0.20	0.31	0.18		0.26	0.22	0.32
50	0.32	0.30	0.48	0.28		0.39	0.33	0.49
60	0.44	0.41	0.65	0.38		0.54	0.45	0.66
70	0.55	0.52	0.82	0.48		0.68	0.56	0.84
80	0.67	0.64	0.99	0.58		0.83	0.68	1.01
90	0.79	0.75	1.16	0.68		0.97	0.80	1.18
100	0.91	0.86	1.33	0.78	1.26	1.12	0.92	1.36
110	1.03	0.98	1.50	0.89	1.41	1.27	1.04	1.54
120	1.15	1.09	1.67	0.99	1.57	1.41	1.16	1.72
130	1.28	1.20	1.85	1.10	1.73	1.56	1.29	1.90
140	1.40	1.32	2.02	1.21	1.90	1.71	1.42	2.08
150	1.53	1.44	2.20	1.31	2.06	1.86	1.54	2.26
160	1.66	1.56	2.37	1.42	2.22	2.01	1.67	2.43
170	1.79	1.68	2.55	1.53	2.39	2.17	1.80	2.62
180	1.92	1.80	2.73	1.65	2.55	2.32	1.93	2.80
190	2.06	1.92	2.91	1.76	2.71	2.48	2.06	2.98
200	2.19	2.04	3.09	1.86	2.87	2.64	2.19	3.17
210	2.33	2.16	3.27	1.98	3.04	2.79	2.32	3.35
220	2.46	2.29	3.45	2.10	3.20	2.96	2.45	3.53
230	2.60	2.41	3.63	2.21	3.36	3.12	2.58	3.71
240	2.74	2.54	3.81	2.33	3.52	3.28	2.71	3.90
250	2.88	2.67	3.99	2.44	3.68	3.45	2.84	4.09
260	3.02	2.80	4.17	2.56	3.84	3.61	2.98	4.28
270	3.16	2.92	4.36	2.68	4.01	3.78	3.12	4.46
280	3.31	3.06	4.54	2.80	4.16	3.95	3.26	4.65
290	3.45	3.19	4.73	2.93	4.32	4.11	3.40	4.84
300	3.60	3.32	4.91	3.06	4.48	4.28	3.54	5.02

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.4 TOTAL THERMAL EXPANSION

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 2 OF 6
DATE : DEC., 1995

Unit : mm/m

Temp °C	Carbon Steel Carbon-Moly- Low-Crome (Through 3Cr-Mo)	5Cr-Mo Through 9Cr-Mo	Austenitic Stainless Steels 18Cr-8Ni	12Cr, 17Cr, 27Cr	25Cr-20Ni	UNS NO4400 Monel 67Ni- 30Cu	3.1/2Ni	Copper and Copper Alloys
310	3.74	3.46	5.10	3.18	4.65	4.46	3.67	5.29
320	3.90	3.59	5.29	3.31	4.81	4.62	3.82	5.39
330	4.05	3.73	5.48	3.43	4.97	4.80	3.96	
340	4.20	3.86	5.67	3.56	5.13	4.98	4.10	
350	4.35	3.99	5.85	3.68	5.30	5.15	4.25	
360	4.51	4.14	6.04	3.81	5.46	5.33	4.39	
370	4.66	4.27	6.24	3.93	5.62	5.51	4.53	
380	4.83	4.41	6.42	4.06	5.79	5.69	4.68	
390	4.99	4.55	6.62	4.18	5.95	5.88	4.82	
400	5.15	4.70	6.82	4.32	6.11	6.05	4.98	
410	5.31	4.84	7.02	4.45	6.27	6.23	5.13	
420	5.47	4.98	7.21	4.58	6.44	6.42	5.26	
430	5.64	5.13	7.40	4.71	6.61	6.60	5.41	
440	5.81	5.28	7.60	4.84	6.77	6.78	5.56	
450	5.97	5.43	7.80	4.97	6.93	6.98	5.71	
460	6.14	5.56	8.00	5.12	7.10	7.17	5.86	
470	6.30	5.72	8.19	5.25	7.27	7.37	6.01	
480	6.46	5.87	8.38	5.38	7.43	7.56	6.16	
490	6.64	6.01	8.59	5.52	7.60	7.76	6.30	
500	6.79	6.15	8.79	5.65	7.81	7.95	6.45	
510	6.96	6.30	9.00	5.79	8.01	8.14	6.59	
520	7.13	6.45	9.21	5.93	8.20	8.33	6.74	
530	7.29	6.60	9.41	6.05	8.40	8.54	6.90	
540	7.45	6.75	9.62	6.20	8.58	8.73	7.06	
550	7.61	6.90	9.82	6.34	8.77	8.93	7.21	
560	7.79	7.05	10.03	6.46	8.94	9.14		
570	7.97	7.19	10.22	6.61	9.12	9.33		
580	8.13	7.35	10.44	6.74	9.30	9.54		
590	8.30	7.50	10.64	6.88	9.48	9.75		
600	8.48	7.64	10.84	7.01	9.65	9.94		
610	8.63	7.79	11.04	7.15	9.86	10.16		
620	8.80	7.93	11.24	7.29	10.05	10.37		
630	8.96	8.10	11.46	7.41	10.25	10.56		
640	9.11	8.24	11.66	7.55	10.44	10.78		
650	9.27	8.39	11.87	7.68	10.63	10.99		
660	9.44	8.54	12.07	7.81	10.83	11.19		
670	9.60	8.69	12.28	7.96	11.04	11.42		
680	9.78	8.84	12.47	8.10	11.24	11.62		
690	9.96	8.99	12.67	8.23	11.45	11.83		
700	10.11	9.15	12.89	8.36	11.63	12.07		
710	10.28	9.30	13.08	8.51	11.83	12.27		
720	10.45	9.45	13.29	8.63	11.99	12.49		
730	10.61	9.60	13.50	8.77	12.16	12.70		
740	10.78	9.74	13.69	8.92	12.35	12.92		
750	10.95	9.90	13.90	9.04	12.54	13.14		
760	11.12	10.04	14.10	9.18	12.72	13.36		
770			14.30					
780			14.56					
790			14.79					
800			15.02					

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.4 TOTAL THERMAL EXPANSION

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 3 OF 6
DATE : DEC., 1995

Unit : mm/m

Temp °C	Aluminum	Gray Cast Iron	Bronze	Brass	70Cu-30Ni	UNS N08XXX Series Ni-Fe-Cr	UNS N06XXX Series Ni-Fe-Cr	Ductile Iron
-250								
-240								
-230								
-220								
-210								
-200								
-190	-3.80		-3.21	-3.13	-2.56			
-180	-3.65		-3.06	-2.99	-2.46			
-170	-3.50		-2.92	-2.85	-2.36			
-160	-3.36		-2.78	-2.71	-2.26			
-150	-3.20		-2.64	-2.57	-2.16			
-140	-3.04		-2.50	-2.43	-2.06			
-130	-2.89		-2.35	-2.29	-1.96			
-120	-2.72		-2.20	-2.14	-1.85			
-110	-2.55		-2.06	-2.00	-1.73			-1.13
-100	-2.38		-1.91	-1.85	-1.61			-1.06
-90	-2.21		-1.76	-1.71	-1.50			-0.99
-80	-2.03		-1.62	-1.58	-1.37			-0.92
-70	-1.85		-1.47	-1.44	-1.25			-0.84
-60	-1.67		-1.32	-1.30	-1.13			-0.77
-50	-1.48		-1.17	-1.14	-1.00			-0.68
-40	-1.28		-1.01	-0.99	-0.86			-0.59
-30	-1.08		-0.85	-0.83	-0.72			-0.50
-20	-0.88		-0.69	-0.67	-0.59			-0.41
-10	-0.67		-0.52	-0.51	-0.45			-0.31
0	-0.46		-0.36	-0.35	-0.30			-0.21
10	-0.24		-0.19	-0.18	-0.16			-0.11
20	-0.03		-0.02	-0.02	-0.02			-0.01
30	0.20		0.15	0.15	0.13			0.09
40	0.42		0.33	0.32	0.28			0.20
50	0.65		0.50	0.49	0.43		0.38	0.30
60	0.88		0.69	0.67	0.58		0.51	0.41
70	1.12		0.87	0.85	0.74		0.64	0.52
80	1.36		1.05	1.03	0.90		0.78	0.63
90	1.60		1.24	1.21	1.05		0.92	0.74
100	1.85		1.43	1.39	1.22	1.14	1.05	0.86
110	2.09	0.93	1.61	1.57	1.38	1.29	1.19	0.98
120	2.33	1.04	1.80	1.76	1.53	1.44	1.33	1.09
130	2.58	1.15	1.98	1.94	1.70	1.60	1.47	1.21
140	2.83	1.26	2.16	2.13	1.86	1.77	1.61	1.33
150	3.08	1.38	2.35	2.32	2.02	1.94	1.76	1.45
160	3.34	1.49	2.54	2.51	2.19	2.11	1.90	1.57
170	3.59	1.61	2.73	2.71	2.36	2.28	2.04	1.70
180	3.85	1.73	2.92	2.90	2.52	2.46	2.19	1.83
190	4.11	1.84	3.10	3.09	2.69	2.63	2.33	1.95
200	4.37	1.96	3.29	3.29	2.86	2.82	2.48	2.08
210	4.64	2.08	3.48	3.49	3.03	3.01	2.62	2.21
220	4.90	2.20	3.67	3.69		3.16	2.77	2.36
230	5.17	2.33	3.86	3.89		3.32	2.91	2.50
240	5.43	2.45	4.06	4.09		3.49	3.06	2.64
250	5.71	2.58	4.25	4.30		3.66	3.20	2.79
260	5.98	2.70	4.44	4.50		3.83	3.36	2.95
270	6.25	2.83	4.63	4.71		4.00	3.50	3.10
280	6.53	2.96	4.83	4.92		4.16	3.65	3.21
290	6.81	3.09	5.03	5.13		4.34	3.80	3.35
300	7.08	3.22	5.22	5.33		4.51	3.95	3.49

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.4 TOTAL THERMAL EXPANSION

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 4 OF 6
 DATE : DEC., 1995

Unit : mm/m

Temp °C	Aluminum	Gray Cast Iron	Bronze	Brass	70Cu-30Ni	UNS N08XXX Series Ni-Fe-Cr	UNS N06XXX Series Ni-Fe-Cr	Ductile Iron
310	7.37	3.35	5.42	5.55		4.67	4.11	3.62
320	7.65	3.49	5.62	5.76		4.85	4.26	3.76
330		3.63	5.82	5.98		5.02	4.41	3.91
340		3.76	6.01	6.20		5.19	4.56	4.05
350		3.90	6.21	6.42		5.37	4.72	4.17
360		4.04	6.41	6.63		5.54	4.87	4.32
370		4.18	6.61	6.85		5.71	5.03	4.47
380		4.31	6.81	7.08		5.89	5.18	4.61
390		4.46	7.01	7.31		6.06	5.33	4.75
400		4.60	7.21	7.53		6.24	5.49	4.90
410		4.74	7.41	7.76		6.42	5.65	5.05
420		4.89	7.62	7.99		6.59	5.81	5.20
430		5.04	7.82	8.23		6.78	5.97	5.34
440		5.18	8.02	8.46		6.96	6.12	5.49
450		5.32	8.24	8.69		7.13		5.62
460		5.48	8.44	8.93		7.32		5.79
470		5.63	8.65	9.17		7.49		5.94
480		5.78	8.86	9.41		7.67		6.08
490		5.93	9.06	9.65		7.86		6.24
500		6.09	9.26	9.89		8.04		6.40
510		6.25	9.47	10.14		8.23		6.55
520		6.41	9.68	10.38		8.42		6.70
530		6.56	9.88	10.62		8.59		6.86
540		6.72	10.09	10.87		8.79		7.01
550		6.89	10.30	11.12		8.97		7.17
560			10.52	11.38		9.15		
570			10.73	11.62		9.35		
580			10.95	11.88		9.53		
590			11.17	12.13		9.71		
600			11.37	12.37		9.92		
610			11.59	12.64		10.10		
620			11.81	12.90		10.28		
630			12.02	13.16		10.49		
640			12.25	13.43		10.67		
650			12.46	13.69		10.87		
660			12.67	13.96		11.07		
670						11.28		
680						11.49		
690						11.70		
700						11.89		
710						12.11		
720						12.32		
730						12.54		
740						12.75		
750						12.95		
760						13.17		
770						13.38		
780						13.60		
790						13.82		
800						14.04		

Note : For Code references to this Appendix, see para. 319.3.1. These data are for use in the absence of more applicable data.
 It is the designer's responsibility to verify that materials are suitable for the intended service at the temperatures shown.

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.4 TOTAL THERMAL EXPANSION

2. Thermal Expansion Coefficients, Nonmetals ^{1,2}

Material Description	Mean Coefficients (Divide Table Values by 10 ⁶)			
	in./in., °F	Range, °F	mm/mm, °C	Range, °C
Thermoplastics				
Acetal AP 2012	2	...	3.6	...
Acrylonitrile-butadiene-styrene				
ABS 1208	60	...	108	...
ABS 1210	55	45-55	99	7-13
ABS 1316	40	...	72	...
ABS 2112	40	...	72	...
Cellulose acetate butyrate				
CAB MH08	80	...	144	...
CAB S004	95	...	171	...
Chlorinated poly(vinyl chloride)				
CPVC 4120	35	...	63	...
Polybutylene PB2110	72	...	130	...
Polyether, chlorinated	45	...	81	...
Polyethylene				
PE 1404	100	46-100	180	8-38
PE 2305	90	46-100	162	8-38
PE 2306	80	46-100	144	8-38
PE 3306	70	46-100	126	8-38
PE 3406	60	46-100	108	8-38
Polyphenylene POP 2125	30	...	54	...
Polypropylene				
PP 1110	48	33-67	86	1-19
PP 1208	43	...	77	...
PP 2105	40	...	72	...
Poly (vinyl chloride)				
PVC 1120	30	23-37	54	-5 to + 3
PVC 1220	35	34-40	63	1-4
PVC 2110	50	...	90	...
PVC 2112	45	...	81	...
PVC 2116	40	37-45	72	3-7
PVC 2120	30	...	54	...
Poly(vinylidene fluoride)	79	...	142	...
Poly(vinylidene chloride)	100	...	180	...
Polytetrafluoroethylene	55	73-140	99	23-60
Poly(fluorinated ethylenepropylene)	46-58	73-140	83-104	23-60
Poly(perfluoroalkoxy alkane)	67	70-212	121	21-100
Poly(perfluoroalkoxy alkane)	94	212-300	169	100-149
Poly(perfluoroalkoxy alkane)	111	300-408	200	149-209

PIPING HANDBOOK

3. PIPING STRESS ANALYSIS

3.4 TOTAL THERMAL EXPANSION

Material Description	Mean Coefficients (Divide Table Values by 10 ⁶)			
	in./in., °F	Range, °F	mm/mm, °C	Range, °C
Reinforced Thermosetting Resins And Reinforced Plastic Mortars				
Glass-epoxy, centrifugally cast	9-13	...	16-23.5	...
Glass-polyester, centrifugally cast	9-15	...	16-27	...
Glass-polyester, filament-wound	9-11	...	16-20	...
Glass-polyester, hand lay-up	12-15	...	21.5-27	...
Glass-epoxy, filament-wound	9-13	...	16-23.5	...
Other Nonmetallic Materials				
Borosilicate glass	1.8	...	3.25	...

Notes :

- 1) For Code references to this Appendix, see para. 319.3.1. These data are for use in the absence of more applicable data.
It is the designer's responsibility to verify that materials are suitable for the intended service at the temperatures shown.
- 2) Individual compounds may vary from the values shown. Consult manufacturer for specific values for products.
- 3) Related Code : ASME B31.3 Table C-5



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.1 WALL THICKNESS CALL OUT & UNIT WEIGHT TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 1 OF 6
DATE : DEC., 1995

1. Dimensions, Weights and Shipping Volume for ANSI/ASME B36.10M & B36.19M

SIZE		OD (mm)	SHIPPING VOL/M (m ³)	ANSI/ASME B36.10M (Note 4) (WELDED AND SEAMLESS WROUGHT STEEL PIPE)												ANSI/ASME B36.19M (Note 3) (STAINLESS STEEL PIPE)					
NPS (Note1)	DN (Note2)			SCH10	SCH20	STD	SCH30	SCH40	XS	SCH60	SCH80	SCH100	SCH120	SCH140	SCH160	XXS	SCH5S	SCH10S	SCH40S	SCH80S	
				t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)
				w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)
1/8	6	10.3	0.0001	-	-	1.73	-	1.73	2.41	-	2.41	-	-	-	-	-	1.24	1.73	2.41		
				-	-	0.37	-	0.37	0.47	-	0.47	-	-	-	-	-	0.28	0.37	0.47		
1/4	8	13.7	0.0002	-	-	2.24	-	2.24	3.02	-	3.02	-	-	-	-	-	1.65	2.24	3.02		
				-	-	0.63	-	0.63	0.80	-	0.80	-	-	-	-	-	0.49	0.63	0.80		
3/8	10	17.1	0.0003	-	-	2.31	-	2.31	3.20	-	3.20	-	-	-	-	-	1.65	2.31	3.20		
				-	-	0.84	-	0.84	1.10	-	1.10	-	-	-	-	-	0.63	0.84	1.10		
1/2	15	21.3	0.0004	-	-	2.77	-	2.77	3.73	-	3.73	-	-	-	4.78	7.47	1.65	2.11	2.77	3.73	
				-	-	1.27	-	1.27	1.62	-	1.62	-	-	-	1.95	2.55	0.80	1.00	1.27	1.62	
3/4	20	26.7	0.0007	-	-	2.87	-	2.87	3.91	-	3.91	-	-	-	5.56	7.82	1.65	2.11	2.87	3.91	
				-	-	1.69	-	1.69	2.20	-	2.20	-	-	-	2.90	3.64	1.03	1.28	1.69	2.20	
1	25	33.4	0.0011	-	-	3.38	-	3.38	4.55	-	4.55	-	-	-	6.35	9.09	1.65	2.77	3.38	4.55	
				-	-	2.50	-	2.50	2.24	-	2.24	-	-	-	4.24	5.45	1.30	2.09	2.50	3.24	
1.1/4	32	42.2	0.0018	-	-	3.56	-	3.56	4.85	-	4.85	-	-	-	6.35	9.70	1.65	2.77	3.56	4.85	
				-	-	3.39	-	3.39	4.47	-	4.47	-	-	-	5.61	7.77	1.65	2.70	3.39	4.47	
1.1/2	40	48.3	0.0023	-	-	3.68	-	3.68	5.08	-	5.08	-	-	-	7.14	10.15	1.65	2.77	3.68	5.08	
				-	-	4.05	-	4.05	5.41	-	5.41	-	-	-	7.25	9.56	1.91	3.11	4.05	5.41	
2	50	60.3	0.0036	-	-	3.91	-	3.91	5.54	-	5.54	-	-	-	8.74	11.07	1.65	2.77	3.91	5.54	
				-	-	5.44	-	5.44	7.48	-	7.48	-	-	-	11.11	13.44	2.40	3.93	5.44	7.48	
2.1/2	65	73	0.0053	-	-	5.16	-	5.16	7.01	-	7.01	-	-	-	9.53	14.02	2.11	3.05	5.16	7.01	
				-	-	8.63	-	8.63	11.41	-	11.41	-	-	-	14.92	20.39	3.69	5.26	8.63	11.41	
3	80	88.9	0.0079	-	-	5.49	-	5.49	7.62	-	7.62	-	-	-	11.13	15.24	2.11	3.05	5.49	7.62	
				-	-	11.29	-	11.29	15.27	-	15.27	-	-	-	21.35	27.68	4.51	6.45	11.29	15.27	
3.1/2	90	101.6	0.0103	-	-	5.74	-	5.74	8.08	-	8.08	-	-	-	-	-	2.11	3.05	5.74	8.08	
				-	-	13.57	-	13.57	18.63	-	18.63	-	-	-	-	-	5.18	7.40	13.57	18.63	
4	100	114.3	0.013	-	-	6.02	-	6.02	8.56	-	8.56	-	11.13	-	13.49	17.12	2.11	3.05	6.02	8.56	
				-	-	16.07	-	16.07	22.32	-	22.32	-	28.32	-	33.54	41.03	5.84	8.36	16.07	22.32	
5	125	141.3	1.0199	-	-	6.55	-	6.55	9.53	-	9.53	-	12.70	-	15.88	19.05	2.77	3.40	6.55	9.53	
				-	-	21.77	-	21.77	30.97	-	30.97	-	40.28	-	49.11	57.43	9.47	11.57	21.77	30.97	
6	150	168.3	0.028	-	-	7.11	-	7.11	10.97	-	10.97	-	14.27	-	18.26	21.95	2.77	3.40	7.11	10.97	
				-	-	28.26	-	28.26	42.56	-	42.56	-	54.20	-	67.56	79.22	11.32	13.84	28.26	42.56	
8	200	219.1	0.048	-	6.35	8.18	7.04	8.18	12.70	10.31	12.70	15.09	18.26	20.62	23.01	22.23	2.77	3.76	8.18	12.70	
				-	33.31	42.55	36.81	42.55	64.64	53.08	64.64	75.92	90.44	100.92	111.27	107.92	14.79	19.96	42.55	64.64	
10	250	273	0.074	-	6.35	9.27	7.80	9.27	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40	3.40	4.19	9.27	12.70	
				-	41.77	60.31	51.03	60.31	81.55	81.55	96.01	114.75	133.06	155.15	172.33	155.15	22.63	27.78	60.31	81.52	



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.1 WALL THICKNESS CALL OUT & UNIT WEIGHT TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 2 OF 6
DATE : DEC., 1995

SIZE		OD (mm)	SHIPPING VOL/M (m³)	ANSI/ASME B36.10M (Note 4) (WELDED AND SEAMLESS WROUGHT STEEL PIPE)												ANSI/ASME B36.19M (Note 3) (STAINLESS STEEL PIPE)					
NPS (Note1)	DN (Note2)			SCH10	SCH20	STD	SCH30	SCH40	XS	SCH60	SCH80	SCH100	SCH120	SCH140	SCH160	XXS	SCH5S	SCH10S	SCH40S	SCH80S	
				t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)
				w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)
12	300	323.8	0.104	-	6.35	9.53	8.38	10.31	12.70	14.27	17.48	21.44	25.40	28.58	33.32	25.40	3.96	4.57	9.53	12.70	
				-	49.73	73.88	65.20	79.73	97.46	108.96	132.08	159.91	186.97	208.14	238.76	186.97	31.25	36.00	73.88	99.43	
14	350	355.6	0.126	6.35	7.92	9.53	9.53	11.13	12.70	15.09	19.05	23.83	27.79	31.75	35.71	-	3.96	4.78	-	-	
				54.69	67.90	81.33	81.33	94.55	107.39	126.71	158.10	194.96	224.65	253.56	281.70	-	34.36	41.30	-	-	
16	400	406.4	0.165	6.35	7.92	9.53	9.53	12.70	12.70	16.66	21.44	26.19	30.96	36.53	40.49	-	4.19	4.78	-	-	
				62.64	77.83	93.27	93.27	123.30	123.30	160.12	203.53	245.56	286.64	333.19	365.35	-	41.56	47.29	-	-	
18	450	457	0.208	6.35	7.92	9.53	11.13	14.27	12.70	19.05	23.83	29.36	34.93	39.67	45.24	-	4.19	4.78	-	-	
				70.57	87.71	105.16	122.38	155.80	139.15	205.74	254.55	309.62	363.56	408.26	459.37	-	46.81	53.26	-	-	
20	500	508	0.258	6.35	9.53	9.53	12.70	15.09	12.70	20.62	26.19	32.54	38.10	44.45	50.01	-	4.78	5.54	-	-	
				78.55	117.15	117.15	155.12	183.42	155.12	247.83	311.17	381.53	441.49	508.11	564.81	-	59.25	68.61	-	-	
22	-	559	0.312	6.35	9.53	9.53	12.70	-	12.70	22.23	28.58	34.93	41.28	47.63	53.98	-	4.78	5.54	-	-	
				86.54	129.13	129.13	171.09	-	171.09	294.25	373.83	451.42	527.02	600.63	672.26	-	65.24	75.53	-	-	
24	600	610	0.372	6.35	9.53	9.53	14.27	17.48	12.70	24.61	30.96	38.89	46.02	52.37	59.54	-	5.54	6.35	-	-	
				94.53	141.12	141.12	209.64	255.41	187.06	355.26	442.08	547.71	640.03	720.15	808.22	-	82.47	94.45	-	-	
26	-	660	0.435	7.92	12.70	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				127.36	202.72	152.87	-	-	202.72	-	-	-	-	-	-	-	-	-	-	-	
28	700	711	0.505	7.92	12.70	9.53	15.88	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				137.32	218.69	164.85	271.21	-	218.69	-	-	-	-	-	-	-	-	-	-	-	
30	-	762	0.58	7.92	12.70	9.53	15.88	-	12.70	-	-	-	-	-	-	-	6.35	7.92	-	-	
				147.28	234.67	176.84	292.18	-	234.67	-	-	-	-	-	-	-	118.31	147.36	-	-	
32	800	813	0.66	7.92	12.70	9.53	15.88	17.48	12.70	-	-	-	-	-	-	-	-	-	-	-	
				157.24	250.64	188.82	312.15	342.91	250.64	-	-	-	-	-	-	-	-	-	-	-	
34	-	864	0.746	7.92	12.70	9.53	15.88	17.48	12.70	-	-	-	-	-	-	-	-	-	-	-	
				167.20	266.61	200.31	332.12	364.90	266.61	-	-	-	-	-	-	-	-	-	-	-	
36	900	914	0.835	7.92	12.70	9.53	15.88	19.05	12.70	-	-	-	-	-	-	-	-	-	-	-	
				176.96	282.27	212.56	351.70	420.42	282.27	-	-	-	-	-	-	-	-	-	-	-	
38	-	965	0.931	-	-	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				-	-	224.54	-	-	298.24	-	-	-	-	-	-	-	-	-	-	-	
40	1000	1016	1.032	-	-	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				-	-	236.53	-	-	314.22	-	-	-	-	-	-	-	-	-	-	-	
42	1100	1067	1.138	-	-	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				-	-	248.52	-	-	330.19	-	-	-	-	-	-	-	-	-	-	-	
44	-	1118	1.249	-	-	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				-	-	260.50	-	-	346.16	-	-	-	-	-	-	-	-	-	-	-	



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.1 WALL THICKNESS CALL OUT & UNIT WEIGHT TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 3 OF 6
DATE : DEC., 1995

SIZE		OD (mm)	SHIPPING VOL/M (m³)	ANSI/ASME B36.10M (Note 4) (WELDED AND SEAMLESS WROUGHT STEEL PIPE)												ANSI/ASME B36.19M (Note 3) (STAINLESS STEEL PIPE)					
NPS (Note 1)	DN (Note 2)			SCH10	SCH20	STD	SCH30	SCH40	XS	SCH60	SCH80	SCH100	SCH120	SCH140	SCH160	XXS	SCH5S	SCH10S	SCH40S	SCH80S	
				t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)
				w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)
46	-	1168	1.364	-	-	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-		
48	1200	1219	1.485	-	-	272.25	-	-	351.82	-	-	-	-	-	-	-	-	-	-		
				-	-	9.53	-	-	12.70	-	-	-	-	-	-	-	-	-	-	-	
				-	-	284.24	-	-	377.79	-	-	-	-	-	-	-	-	-	-	-	

Notes :

1. NPS (Nominal Pipe Size) is a dimensionless designator that has been substituted in the customary units section for the term *Inch Nominal Size*.
2. DN (Nominal Size) is a dimensionless designator used in the SI (metric) system to describe pipe size.
3. The suffix "S" in the Schedule Number is used to differentiate B36.19M pipe from B36.10M pipe. ANSI/ASME B36.10M includes other pipe thicknesses which are also commercially available with the stainless steel material.
4. The Schedule No. with Italic letters is not used in LG E&C's standard wall thickness call out .



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.1 WALL THICKNESS CALL OUT & UNIT WEIGHT TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 4 OF 6
DATE : DEC., 1995

2. Dimensions, Weights and Shipping Volume for JIS Standards

NOMINAL DIA.		OD (mm)	SHIPPING VOL/M (m³)	JIS G3456, G3458 & G3460										JIS G3459 (1/8" Thr. 26") (Note 2)								
						JIS G3455								JIS G3468 (6" Thr. 40") (Note 2)								
JIS G3454																						
SCH10	SCH20			SCH30	SCH40	SCH60	SCH80	SCH100	SCH120	SCH140	SCH160	SCH5S	SCH10S	SCH20S	SCH40	SCH80	SCH120	SCH160				
B	A	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)					
w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)					
1/8	6	10.5	0.0001	-	-	-	1.7	-	2.4	-	-	-	-	1.0	1.2	1.5	1.7	2.4	-	-		
				-	-	-	0.369	-	0.479	-	-	-	-	0.237	0.278	0.336	0.373	0.484	-	-		
1/4	8	13.8	0.0002	-	-	-	2.2	-	3.0	-	-	-	-	1.2	1.65	2.0	2.2	3.0	-	-		
				-	-	-	0.629	-	0.799	-	-	-	-	0.377	0.499	0.588	0.636	0.807	-	-		
3/8	10	17.3	0.0003	-	-	-	2.3	-	3.2	-	-	-	-	1.2	1.65	2.0	2.3	3.2	-	-		
				-	-	-	0.851	-	1.11	-	-	-	-	0.481	0.643	0.762	0.859	1.12	-	-		
1/2	15	21.7	0.0004	-	-	-	2.8	-	3.7	-	-	-	4.7	1.65	2.1	2.5	2.8	3.7	-	4.7		
				-	-	-	1.31	-	1.64	-	-	-	1.97	0.824	1.03	1.20	1.32	1.66	-	1.99		
3/4	20	27.2	0.0007	-	-	-	2.9	-	3.9	-	-	-	5.5	1.65	2.1	2.5	2.9	3.9	-	5.5		
				-	-	-	1.74	-	2.24	-	-	-	2.94	1.05	1.31	1.54	1.76	2.26	-	2.97		
1	25	34.0	0.0011	-	-	-	3.4	-	4.5	-	-	-	6.4	1.65	2.8	3.0	3.4	4.5	-	6.4		
				-	-	-	2.57	-	3.27	-	-	-	4.36	1.33	2.18	2.32	2.59	3.31	-	4.4		
1.1/4	32	42.7	0.0018	-	-	-	3.6	-	4.9	-	-	-	6.4	1.65	2.8	3.0	3.6	4.9	-	6.4		
				-	-	-	3.47	-	4.57	-	-	-	5.73	1.69	2.78	2.97	3.51	4.61	-	5.79		
1.1/2	40	48.6	0.0023	-	-	-	3.7	-	5.1	-	-	-	7.1	1.65	2.8	3.0	3.7	5.1	-	7.1		
				-	-	-	4.10	-	5.47	-	-	-	7.27	1.93	3.19	3.41	4.14	5.53	-	7.34		
2	50	60.5	0.0036	-	-	-	3.9	-	5.5	-	-	-	8.7	1.65	2.8	3.5	3.9	5.5	-	8.7		
				-	-	-	5.44	-	7.46	-	-	-	11.1	2.42	4.02	4.97	5.50	7.54	-	11.2		
2.1/2	65	76.3	0.0053	-	-	-	5.2	-	7.0	-	-	-	9.5	2.1	3.0	3.5	5.2	7.0	-	9.5		
				-	-	-	9.12	-	12.0	-	-	-	15.6	3.88	5.48	6.35	9.21	12.1	-	15.8		
3	80	89.1	0.0079	-	-	-	5.5	-	7.6	-	-	-	11.1	2.1	3.0	4.0	5.5	7.6	-	11.1		
				-	-	-	11.3	-	15.3	-	-	-	21.4	4.55	6.43	8.48	11.5	15.4	-	21.6		
3.1/2	90	101.6	0.0103	-	-	-	5.7	-	8.1	-	-	-	12.7	2.1	3.0	4.0	5.7	8.1	-	12.7		
				-	-	-	13.5	-	18.7	-	-	-	27.8	5.20	7.37	9.72	13.6	18.9	-	28.1		
4	100	114.3	0.013	-	-	-	6.0	-	8.6	-	11.1	-	13.5	2.1	3.0	4.0	6.0	8.6	11.1	13.5		
				-	-	-	16.0	-	22.4	-	28.2	-	33.6	5.87	8.32	11.0	16.2	22.6	28.5	33.9		
5	125	139.8	1.0199	-	-	-	6.6	-	9.5	-	12.7	-	15.9	2.8	3.4	5.0	6.6	9.5	12.7	15.9		
				-	-	-	21.7	-	30.5	-	39.8	-	48.6	9.56	11.6	16.8	21.9	30.8	40.2	49.1		
6	150	165.2	0.028	-	-	-	7.1	-	11.0	-	14.3	-	18.2	2.8	3.4	5.0	7.1	11.0	14.3	18.2		
				-	-	-	27.7	-	41.8	-	53.2	-	66.0	11.3	13.7	20.0	28.0	42.3	53.8	66.6		
8	200	216.3	0.048	-	6.4	7.0	8.2	10.3	12.7	15.1	18.2	20.6	23.0	2.8	4.0	6.5	8.2	12.7	18.2	23.0		
				-	33.1	36.1	42.1	52.3	63.8	74.9	88.9	99.4	110.0	14.9	21.2	34.0	42.5	64.4	89.8	111.0		



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATIRIAL WORK

4.1 WALL THICKNESS CALL OUT & UNIT WEIGHT TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 5 OF 6
DATE : DEC., 1995

NOMINAL DIA.		OD (mm)	SHIPPING VOL/M (m³)	JIS G3456, G3458 & G3460										JIS G3459 (1/8" Thr. 26") (Note 2)							
						JIS G3455								JIS G3468 (6" Thr. 40") (Note 2)							
B	A			JIS G3454																	
				SCH10	SCH20	SCH30	SCH40	SCH60	SCH80	SCH100	SCH120	SCH140	SCH160	SCH5S	SCH10S	SCH20S	SCH40	SCH80	SCH120	SCH160	
				t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)	t (mm)
				w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)	w (kg/m)		
10	250	267.4	0.074	-	6.4	7.8	9.3	12.7	15.1	18.2	21.4	25.4	28.6	3.4	4.0	6.5	9.3	15.1	21.4	28.6	
				-	41.2	49.9	59.2	79.8	93.9	112	130	152	168	22.4	26.2	42.2	59.8	94.9	131.0	170.0	
12	300	318.5	0.104	-	6.4	8.4	10.3	14.3	17.4	21.4	25.4	28.6	33.3	4.0	4.5	6.5	10.3	17.4	25.4	33.3	
				-	49.3	64.2	78.3	107	129	157	184	204	234	31.3	35.2	50.5	79.1	131.0	185.0	237.0	
14	350	355.6	0.126	6.4	7.9	9.5	11.1	15.1	19.0	23.8	27.8	31.8	35.7	4.0	5.0	8.0	11.1	19.0	27.8	35.7	
				55.1	67.7	81.1	94.3	127	158	195	225	254	282	35.0	43.7	69.3	95.3	159.0	227.0	284.0	
16	400	406.4	0.165	6.4	7.9	9.5	12.7	16.7	21.4	26.2	30.9	36.5	40.5	4.5	5.0	8.0	12.7	21.4	30.9	40.5	
				63.1	77.6	93.0	123	160	203	246	286	333	365	45.1	50.0	79.4	125.0	205.0	289.0	369.0	
18	450	457.2	0.208	6.4	7.9	11.1	14.3	19.0	23.8	29.4	34.9	39.7	45.2	4.5	5.0	8.0	14.3	23.8	34.9	45.2	
				71.1	87.5	122	156	205	254	310	363	409	459	50.7	56.3	89.5	158.0	257.0	367.0	464.0	
20	500	508.0	0.258	6.4	9.5	12.7	15.1	20.6	26.2	32.5	38.1	44.4	50.0	5.0	5.5	9.5	15.1	26.2	38.1	50.0	
				79.2	117	155	184	248	311	381	441	508	565	62.6	68.8	118.0	185.0	314.0	446.0	570.0	
22	550	558.8	0.312	-	-	-	15.9	22.2	28.6	34.9	41.3	47.6	54.0	5.0	5.5	9.5	15.9	28.6	41.3	54.0	
				-	-	-	213	294	374	451	527	600	672	69.0	75.8	130.0	215.0	378.0	532.0	679.0	
24	600	609.6	0.372	-	-	-	17.5	24.6	31.0	38.9	46.0	52.4	59.5	5.5	6.5	9.5	17.5	31.0	46.0	59.5	
				-	-	-	256	355	442	547	639	720	807	82.8	97.7	142.0	258.0	447.0	646.0	815.0	
26	650	660.4	0.435	-	-	-	18.9	26.4	34.0	41.6	49.1	56.6	64.2	5.5	8.0	12.7	17.5	34.0	49.1	64.2	
				-	-	-	299	413	525	635	740	843	944	89.7	130.0	205.0	280.0	531.0	748.0	953.0	
28	700	711.2	0.505	-	-	-	-	-	-	-	-	-	-	5.5	8.0	12.7	17.5	-	-	-	
				-	-	-	-	-	-	-	-	-	-	96.7	140.0	221.0	302.0	-	-	-	
30	750	762.0	0.58	-	-	-	-	-	-	-	-	-	-	6.5	8.0	12.7	17.5	-	-	-	
				-	-	-	-	-	-	-	-	-	-	122.0	150.0	237.0	325.0	-	-	-	
32	800	812.8	0.66	-	-	-	-	-	-	-	-	-	-	-	8.0	127.0	17.5	-	-	-	
				-	-	-	-	-	-	-	-	-	-	-	160.0	253.0	347.0	-	-	-	
34	850	863.6	0.746	-	-	-	-	-	-	-	-	-	-	-	8.0	12.7	17.5	-	-	-	
				-	-	-	-	-	-	-	-	-	-	-	171.0	269.0	369.0	-	-	-	
36	900	914.4	0.835	-	-	-	-	-	-	-	-	-	-	-	8.0	12.7	19.1	-	-	-	
				-	-	-	-	-	-	-	-	-	-	-	181.0	285.0	426.0	-	-	-	
40	1000	1016	1.032	-	-	-	-	-	-	-	-	-	-	-	9.5	14.3	26.2	-	-	-	
				-	-	-	-	-	-	-	-	-	-	-	238.0	357.0	646.0	-	-	-	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.1 WALL THICKNESS CALL OUT & UNIT WEIGHT TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 6 OF 6
DATE : DEC., 1995

Notes :

1.	STANDARD NO.	DESCRIPTION	LETTER SYMBOL
	JIS G3454	CARBON STEEL PIPES FOR PRESSURE SERVICE	STPG
	JIS G3455	CARBON STEEL PIPES FOR HIGH PRESSURE SERVICE	STS
	JIS G3456	CARBON STEEL PIPES FOR HIGH TEMPERATURE SERVICE	STPT
	JIS G3458	ALLOY STEEL PIPE	STPA
	JIS G3459	STAINLESS STEEL PIPES	SUS-TP
	JIS G3460	STEEL PIPES FOR LOW TEMPERATURE SERVICE	STPL
	JIS G3468	LARGE DIAMETER WELDED STAINLESS STEEL PIPES	SUS-TPY

2. The above unit weight (w) for JIS G3459 and G3468 is used only for 304, 304H, 304L, 321 and 321H grades.

The weight of other grades shall be calculated from following formula.

SYMBOL OF GRADE	FORMULA
SUS304, 304H, 304L, 321, 321H	$W=0.02491 t (D-t)$
SUS 309, 309S, 310, 310S, 316, 316H, 316L, 316Ti, 317, 317L, 347, 347H	$W=0.02507 t (D-t)$
SUS 329J1, 329J3L, 329J4L	$W=0.02450 t (D-t)$
SUS 405, 409L, 444	$W=0.02435 t (D-t)$
SUS 430, 430LX, 430J1L, 436L	$W=0.02419 t (D-t)$
SUS 836L	$W=0.02532 t (D-t)$
SUS 890L	$W=0.02529 t (D-t)$

W : unit weight of pipe (kg/m)
t : wall thickness of pipe (mm)
D : outside diameter of pipe (mm)

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

B16.5 TABLE 1A - LIST OF MATERIAL SPECIFICATIONS

Material Groups		Product Forms		
Mat'l GR. No.	Nominal Designation Steel	Forgings	Castings	Plates
1.1	Carbon	A105 (1)(2)	A216-WCB(1)	A515-70 (1)
		A350-LF2		A516-70 (1)
	C-Mn-Si			A537-Cl. 1
1.9	1Cr-1/2Mo	A182-F12 (4)		
	1.1/4Cr-1/2Mo	A182-F11 (4)	A217-WC6 (4)	A387-11 Cl.2
1.13	5Cr-1/2Mo	A182-F5	A217-C5 (4)	
		A182-F5a		
1.14	9Cr-1Mo	A182-F9	A217-C12(4)	
2.1	18Cr-8Ni	A182-F304 (5)	A351-CF3	A240-304 (5)(6)
		A182-F304H	A351-CF8 (5)	A240-304H
2.2	16Cr-12Ni-2Mo	A182-F316 (5)		A240-316 (5)(6)
		A182-F316H		A240-316H
	18Cr-13Ni-3Mo			A240-317 (5)(6)
			A351-CF3M	
			A351-CF8M (5)	
2.3	18Cr-8Ni	A182-F304L		A240-304L
	16Cr-12Ni-2Mo	A182-F316L		A240-316L
2.4	18Cr-10Ni-Ti	A182-F321 (5)		A240-321 (5)(6)
		A182-F321H		A240-321H
2.5	18Cr-10Ni-Cb	A182-F347 (5)	A351-CF8C (5)	A240-347 (5)(6)
		A182-F347H		A240-347H
		A182-F348 (5)		A240-348 (5)(6)
		A182-F348H		A240-348H
3.7	Ni-Mo Alloy B2	B335-N10665 (9)(10)		B333-N10665 (9)
3.8	Ni-Mo-Cr Alloy C276	B574-N10276 (9)(10)		B575-N10276 (9)
3.14	Ni-Cr-Fe-Mo-Cu Alloy G	B581-N06007 (9)(10)		B582-N06007 (9)

Notes :

- (1) Upon prolonged exposure to temperatures above about 800°F (427°C), the carbide phase of carbon steel may be converted to graphite.
- (2) Only killed steel shall be used above 850°F (454°C).
- (4) Use normalized and tempered material only.
- (5) At temperatures over 1000°F (538°C), use only when the carbon contents is 0.04% or higher.
- (6) For temperatures above 1000°F (538°C), use only if the material is heat treated by heating it to a temperature of at least 1900°F (1038°C) and quenching in water or rapidly cooling by other means.
- (9) Use solution annealed material only.
- (10) The chemical composition, mechanical properties, heat treating requirement, and grain size requirements shall conform to the applicable ASTM specification. The manufacturing procedures, tolerances, tests, certification, and markings shall be in accordance with ASTM B 564.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 2 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-1.1 Working Pressure

Temperature		150#		300#		600#		900#		1500#		2500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	285	20	740	52	1480	104	2220	156	3705	260	6170	434
200	93	260	18	675	47	1350	95	2025	142	3375	237	5625	395
300	149	230	16	655	46	1315	92	1970	139	3280	231	5470	385
400	204	200	14	635	45	1270	89	1900	134	3170	223	5280	371
500	260	170	12	600	42	1200	84	1795	126	2995	211	4990	351
600	316	140	10	550	39	1095	77	1640	115	2735	192	4560	321
650	343	125	9	535	38	1075	76	1610	113	2685	189	4475	315
700	371	110	8	535	38	1065	75	1600	112	2665	187	4440	312
750	399	95	7	505	36	1010	71	1510	106	2520	177	4200	295
800	427	80	6	410	29	825	58	1235	87	2060	145	3430	241
850	454	65	5	270	19	535	38	805	57	1340	94	2230	157
900	482	50	4	170	12	345	24	515	36	860	60	1430	101
950	510	35	2	105	7	205	14	310	22	515	36	860	60
1000	538	20	1	50	4	105	7	155	11	260	18	430	30

Note : 800 °F 이상에서의 사용은 Not Recommended 입니다

B16.5 Rating, Table 2-1.9 Working Pressure

Temperature		150#		300#		600#		900#		1500#		2500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	290	20	750	53	1500	105	2250	158	3750	264	6250	439
200	93	260	18	750	53	1500	105	2250	158	3750	264	6250	439
300	149	230	16	720	51	1445	102	2165	152	3610	254	6015	423
400	204	200	14	695	49	1385	97	2080	146	3465	244	5775	406
500	260	170	12	665	47	1330	94	1995	140	3325	234	5540	390
600	316	140	10	605	43	1210	85	1815	128	3025	213	5040	354
650	343	125	9	590	41	1175	83	1765	124	2940	207	4905	345
700	371	110	8	570	40	1135	80	1705	120	2840	200	4730	333
750	399	95	7	530	37	1065	75	1595	112	2660	187	4430	311
800	427	80	6	510	36	1015	71	1525	107	2540	179	4230	297
850	454	65	5	485	34	975	69	1460	103	2435	171	4060	285
900	482	50	4	450	32	900	63	1350	95	2245	158	3745	263
950	510	35	2	320	22	640	45	955	67	1595	112	2655	187
1000	538	20	1	215	15	430	30	650	46	1080	76	1800	127
1050	566	0	0	145	10	290	20	430	30	720	51	1200	84
1100	593	0	0	95	7	190	13	290	20	480	34	800	56
1150	621	0	0	60	4	125	9	185	13	310	22	515	36
1200	649	0	0	40	3	75	5	115	8	190	13	315	22

Note : Use normalized and tempered material only, 1000 °F 이상에서의 사용은 Not Recommended 입니다.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 3 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-1.13 Working Pressure

Temperature		150#		300#		600#		900#		1500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	290	20	750	53	1500	105	2250	158	3750	264
200	93	260	18	745	52	1490	105	2235	157	3725	262
300	149	230	16	715	50	1430	101	2150	151	3580	252
400	204	200	14	705	50	1410	99	2115	149	3530	248
500	260	170	12	665	47	1330	94	1995	140	3325	234
600	316	140	10	605	43	1210	85	1815	128	3025	213
650	343	125	9	590	41	1175	83	1765	124	2940	207
700	371	110	8	570	40	1135	80	1705	120	2840	200
750	399	95	7	530	37	1055	74	1585	111	2640	186
800	427	80	6	510	36	1015	71	1525	107	2540	179
850	454	65	5	485	34	965	68	1450	102	2415	170
900	482	50	4	370	26	740	52	1110	78	1850	130
950	510	35	2	275	19	550	39	825	58	1370	96
1000	538	20	1	200	14	400	28	595	42	995	70
1050	566	0	0	145	10	290	20	430	30	720	51
1100	593	0	0	100	7	200	14	300	21	495	35
1150	621	0	0	60	4	125	9	185	13	310	22
1200	649	0	0	35	2	70	5	105	7	170	12

Note : Use normalized and tempered material only.

B16.5 Rating, Table 2-1.14 Working Pressure

Temperature		150#		300#		600#		900#		1500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	290	20	750	53	1500	105	2250	158	3750	264
200	93	260	18	750	53	1500	105	2250	158	3750	264
300	149	230	16	730	51	1455	102	2185	154	3640	256
400	204	200	14	705	50	1410	99	2115	149	3530	248
500	260	170	12	665	47	1330	94	1995	140	3325	234
600	316	140	10	605	43	1210	85	1815	128	3025	213
650	343	125	9	590	41	1175	83	1765	124	2940	207
700	371	110	8	570	40	1135	80	1705	120	2840	200
750	399	95	7	530	37	1065	75	1595	112	2660	187
800	427	80	6	510	36	1015	71	1525	107	2540	179
850	454	65	5	485	34	975	69	1460	103	2435	171
900	482	50	4	450	32	900	63	1350	95	2245	158
950	510	35	2	375	26	755	53	1130	79	1885	133
1000	538	20	1	255	18	505	36	760	53	1270	89
1050	566	0	0	170	12	345	24	515	36	855	60
1100	593	0	0	115	8	225	16	340	24	565	40
1150	621	0	0	75	5	150	11	225	16	375	26
1200	649	0	0	50	4	105	7	155	11	255	18

Note : Use normalized and tempered material only.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 4 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-2.1 Working Pressure

Temperature		150#		300#		600#		900#		1500#		2500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	275	19	720	51	1440	101	2160	152	3600	253	6000	422
200	93	230	16	600	42	1200	84	1800	127	3000	211	5000	352
300	149	205	14	540	38	1080	76	1620	114	2700	190	4500	316
400	204	190	13	495	35	995	70	1490	105	2485	175	4140	291
500	260	170	12	465	33	930	65	1395	98	2330	164	3880	273
600	316	140	10	435	31	875	62	1310	92	2185	154	3640	256
650	343	125	9	430	30	860	60	1290	91	2150	151	3580	252
700	371	110	8	425	30	850	60	1275	90	2125	149	3540	249
750	399	95	7	415	29	830	58	1245	88	2075	146	3460	243
800	427	80	6	405	28	805	57	1210	85	2015	142	3360	236
850	454	65	5	395	28	790	56	1190	84	1980	139	3300	232
900	482	50	4	390	27	780	55	1165	82	1945	137	3240	228
950	510	35	2	380	27	765	54	1145	81	1910	134	3180	224
1000	538	20	1	320	22	640	45	965	68	1605	113	2675	188
1050	566	0	0	310	22	615	43	925	65	1545	109	2570	181
1100	593	0	0	255	18	515	36	770	54	1285	90	2145	151
1150	621	0	0	200	14	400	28	595	42	995	70	1655	116
1200	649	0	0	155	11	310	22	465	33	770	54	1285	90
1250	677	0	0	115	8	225	16	340	24	565	40	945	66
1300	704	0	0	85	6	170	12	255	18	430	30	715	50
1350	732	0	0	60	4	125	9	185	13	310	22	515	36
1400	760	0	0	50	4	95	7	145	10	240	17	400	28
1450	788	0	0	35	2	70	5	105	7	170	12	285	20
1500	816	0	0	25	2	55	4	80	6	135	9	230	16

Note : A182 F304 일 경우 1000°F 이상의 온도에서 사용할 경우 Carbon content 는 0.04% 이상이어야 한다.
 CF3 은 800°F 초과 해서 사용할 수 없다.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 5 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-2.2 Working Pressure

Temperature		150#		300#		600#		900#		1500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	275	19	720	51	1440	101	2160	152	3600	253
200	93	235	17	620	44	1240	87	1860	131	3095	218
300	149	215	15	560	39	1120	79	1680	118	2795	197
400	204	195	14	515	36	1025	72	1540	108	2570	181
500	260	170	12	480	34	955	67	1435	101	2390	168
600	316	140	10	450	32	900	63	1355	95	2255	159
650	343	125	9	445	31	890	63	1330	94	2220	156
700	371	110	8	430	30	870	61	1305	92	2170	153
750	399	95	7	425	30	855	60	1280	90	2135	150
800	427	80	6	420	30	845	59	1265	89	2110	148
850	454	65	5	420	30	835	59	1255	88	2090	147
900	482	50	4	415	29	830	58	1245	88	2075	146
950	510	35	2	385	27	775	54	1160	82	1930	136
1000	538	20	1	350	25	700	49	1050	74	1750	123
1050	566	0	0	345	24	685	48	1030	72	1720	121
1100	593	0	0	305	21	610	43	915	64	1525	107
1150	621	0	0	235	17	475	33	710	50	1185	83
1200	649	0	0	185	13	370	26	555	39	925	65
1250	677	0	0	145	10	295	21	440	31	735	52
1300	704	0	0	115	8	235	17	350	25	585	41
1350	732	0	0	95	7	190	13	290	20	480	34
1400	760	0	0	75	5	150	11	225	16	380	27
1450	788	0	0	60	4	115	8	175	12	290	20
1500	816	0	0	40	3	85	6	125	9	205	14

Note : A182 F316 일 경우 1000°F 이상의 온도에서 사용할 경우 Carbon content 는 0.04% 이상이어야 한다.
 CF3M 은 850°F 초과 해서 사용할 수 없다. CF8M 은 1000°F 초과해서 사용할 수 없다

B16.5 Rating, Table 2-2.3 Working Pressure

Temperature		150#		300#		600#		900#		1500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	230	16	600	42	1200	84	1800	127	3000	211
200	93	195	14	505	36	1015	71	1520	107	2530	178
300	149	175	12	455	32	910	64	1360	96	2270	160
400	204	160	11	415	29	825	58	1240	87	2065	145
500	260	145	10	380	27	765	54	1145	81	1910	134
600	316	140	10	360	25	720	51	1080	76	1800	127
650	343	125	9	350	25	700	49	1050	74	1750	123
700	371	110	8	345	24	685	48	1030	72	1715	121
750	399	95	7	335	24	670	47	1010	71	1680	118
800	427	80	6	330	23	660	46	985	69	1645	116
850	454	65	5	320	22	645	45	965	68	1610	113

Note : A182 F304L 일 경우 800°F 초과 해서 사용하지 말 것.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 6 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-2.4 Working Pressure

Temperature		150#		300#		600#		900#		1500#		2500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	275	19	720	51	1440	101	2160	152	3600	253	6000	422
200	93	245	17	645	45	1290	91	1935	136	3230	227	5380	378
300	149	230	16	595	42	1190	84	1785	125	2975	209	4960	349
400	204	200	14	550	39	1105	78	1655	116	2760	194	4600	323
500	260	170	12	515	36	1030	72	1545	109	2570	181	4285	301
600	316	140	10	485	34	975	69	1460	103	2435	171	4060	285
650	343	125	9	480	34	955	67	1435	101	2390	168	3980	280
700	371	110	8	465	33	930	65	1395	98	2330	164	3880	273
750	399	95	7	460	32	915	64	1375	97	2290	161	3820	269
800	427	80	6	450	32	900	63	1355	95	2255	159	3760	264
850	454	65	5	445	31	895	63	1340	94	2230	157	3720	262
900	482	50	4	440	31	885	62	1325	93	2210	155	3680	259
950	510	35	2	385	27	775	54	1160	82	1930	136	3220	226
1000	538	20	1	355	25	715	50	1070	75	1785	125	2970	209
1050	566	0	0	315	22	625	44	940	66	1565	110	2605	183
1100	593	0	0	270	19	545	38	815	57	1360	96	2265	159
1150	621	0	0	235	17	465	33	710	50	1185	83	1970	139
1200	649	0	0	185	13	370	26	555	39	925	65	1545	109
1250	677	0	0	140	10	280	20	420	30	705	50	1170	82
1300	704	0	0	110	8	220	15	330	23	550	39	915	64
1350	732	0	0	85	6	170	12	255	18	430	30	715	50
1400	760	0	0	65	5	130	9	195	14	325	23	545	38
1450	788	0	0	50	4	105	7	155	11	255	18	430	30
1500	816	0	0	40	3	75	5	115	8	190	13	315	22

Note : A182 F321H 일 경우 1000°F 이상의 온도에서 사용할 경우 2000°F 이상의 온도에서 열처리 할 것.
 A182 F321 일 경우 1000°F 초과해서 사용하지 말 것.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 7 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-2.5 Working Pressure

Temperature		150#		300#		600#		900#		1500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	275	19	720	51	1440	101	2160	152	3600	253
200	93	255	18	660	46	1320	93	1980	139	3300	232
300	149	230	16	615	43	1230	86	1845	130	3070	216
400	204	200	14	575	40	1145	81	1720	121	2870	202
500	260	170	12	540	38	1080	76	1620	114	2700	190
600	316	140	10	515	36	1025	72	1540	108	2570	181
650	343	125	9	505	36	1010	71	1510	106	2520	177
700	371	110	8	495	35	990	70	1485	104	2470	174
750	399	95	7	490	34	985	69	1475	104	2460	173
800	427	80	6	485	34	975	69	1460	103	2435	171
850	454	65	5	485	34	970	68	1455	102	2425	170
900	482	50	4	450	32	900	63	1350	95	2245	158
950	510	35	2	385	27	775	54	1160	82	1930	136
1000	538	20	1	365	26	725	51	1090	77	1820	128
1050	566	0	0	360	25	720	51	1080	76	1800	127
1100	593	0	0	325	23	645	45	965	68	1610	113
1150	621	0	0	275	19	550	39	825	58	1370	96
1200	649	0	0	170	12	345	24	515	36	855	60
1250	677	0	0	125	9	245	17	370	26	615	43
1300	704	0	0	95	7	185	13	280	20	465	33
1350	732	0	0	70	5	135	9	205	14	345	24
1400	760	0	0	55	4	110	8	165	12	275	19
1450	788	0	0	40	3	80	6	125	9	205	14
1500	816	0	0	35	2	70	5	105	7	170	12

Note : A182 F347H 일 경우 1000°F 이상의 온도에서 사용할 경우 2000°F 이상의 온도에서 열처리 할 것.

A182 F347 일 경우 1000°F 초과해서 사용하지 말 것.

CF8C 를 1000°F 이상에서 사용할 경우 Carbon content 가 0.04% 이상일 것

B16.5 Rating, Table 2-3.7 Working Pressure

Temperature		150#		300#		600#		900#		1500#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	290	20	750	53	1500	105	2250	158	3750	264
200	93	260	18	750	53	1500	105	2250	158	3750	264
300	149	230	16	730	51	1455	102	2185	154	3640	256
400	204	200	14	705	50	1410	99	2115	149	3530	248
500	260	170	12	665	47	1330	94	1995	140	3325	234
600	316	140	10	605	43	1210	85	1815	128	3025	213
650	343	125	9	590	41	1175	83	1765	124	2940	207
700	371	110	8	570	40	1135	80	1705	120	2840	200
750	399	95	7	530	37	1065	75	1595	112	2660	187
800	427	80	6	510	36	1015	71	1525	107	2540	179

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.2 PRESSURE TEMPERATURE RATING

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 8 OF 8
 DATE : DEC., 1995

B16.5 Rating, Table 2-3.8 Working Pressure

Temperature		150#		300#		600#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	290	20	750	53	1500	105
200	93	260	18	750	53	1500	105
300	149	230	16	730	51	1455	102
400	204	200	14	705	50	1410	99
500	260	170	12	665	47	1330	94
600	316	140	10	605	43	1210	85
650	343	125	9	590	41	1175	83
700	371	110	8	570	40	1135	80
750	399	95	7	530	37	1065	75
800	427	80	6	510	36	1015	71
850	454	65	5	485	34	975	69
900	482	50	4	450	32	900	63
950	510	35	2	385	27	775	54
1000	538	20	1	365	26	725	51
1050	566			360	25	720	51
1100	593			325	23	645	45
1150	621			275	19	550	39
1200	649			185	13	370	26
1250	677			145	10	295	21
1300	704			110	8	215	15

B16.5 Rating, Table 2-3.14 Working Pressure

Temperature		150#		300#		600#	
°F	°C	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²	lb/in ²	kg/cm ²
100	38	275	19	720	51	1440	101
200	93	245	17	645	45	1290	91
300	149	230	16	600	42	1195	84
400	204	200	14	560	39	1125	79
500	260	170	12	535	38	1070	75
600	316	140	10	520	37	1035	73
650	343	125	9	510	36	1020	72
700	371	110	8	505	36	1015	71
750	399	95	7	500	35	1005	71
800	427	80	6	495	35	995	70
850	454	65	5	485	34	975	69
900	482	50	4	450	32	900	63
950	510	35	2	385	27	775	54
1000	538	20	1	365	26	725	51

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.3 SHORT CODE LIST

S_CODE	DESIGNATION	ABB. CODE	REMARK
P	PIPE	P00	
P1	SPECIAL PIPE	P00	
PW	TUBE	PW0	
NBE	NIPPLE BE	NBE	
NPE	NIPPLE PE	NPE	
NT0	NIPPLE TOE	NT0	
NTB	NIPPLE TBE	NTB	
NBS	SPECIAL NIPPLE BE	NBE	
NPS	SPECIAL NIPPLE PE	NPE	
NTT	SPECIAL NIPPLE TOE	NT0	
NTS	SPECIAL NIPPLE TBE	NTB	
E9	ELBOW 90	E90	
ES9	ELBOW 90 SR	ES9	
E4	ELBOW 45	E40	
EB	ELBOW BEND	EB0	
RB	ELBOW RED.	RB0	
EU	RETURN	EU0	
CR	CROSS	CR0	
TE	TEE	TE0	
TR	TEE RED.	TR0	
TL	LATERAL Y	TL0	
RL	RED. LATERAL Y	RL0	
RC	REDUCER CON.	RC0	
RE	REDUCER ECC.	RE0	
RC1	SWAGE CON BE	RC1	
RCP	SWAGE CON PE	RCP	
RCT	SWAGE CON TE	RCT	
RCB	SWAGE CON B-P	RCB	
RC3	SWAGE CON B-T	RC3	
RC2	SWAGE CON P-T	RC2	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.3 SHORT CODE LIST

S_CODE	DESIGNATION	ABB. CODE	REMARK
RE1	SWAGE ECC BE	RE1	
REP	SWAGE ECC PE	REP	
REB	SWAGE ECC B-P	REB	
RET	SWAGE ECC TE	RET	
RE3	SWAGE ECC B-T	RE3	
RE2	SWAGE ECC P-T	RE2	
RMW	CONNECTOR-M	RMW	
RFW	CONNECTOR-F	RFW	
C	CAP	C00	
CT	CAP THD	CT0	
TMW	BRANCH TEE - M	TMW	
U	UNION	U00	
UW	TUBING UNION	UW0	
CF	COUPLING FULL	CF0	
CFX	COUPLING FULL SW-TH	CFX	
TC	COUPLING HALF SW	TC0	
TCT	COUPLING HALF THD	TCT	
RBS	BUSHING	RBS	
TW9	BOSS 90	TW9	
TS9	BOSS 90 THD	TS9	
TW5	BOSS 50	TW5	
TS5	BOSS 50 THD	TS5	
TW4	BOSS 45	TW4	
TS4	BOSS 45 THD	TS4	
TWO	REINFORCED BRANCH WELDED OUTLET	TWO	
PLG	PLUG	PLG	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.3 SHORT CODE LIST

S_CODE	DESIGNATION	ABB. CODE	REMARK
TET	REINFORCED BRANCH ELBOW OUTLET THREADED	TET	
TNW	REINFORCED BRANCH NIPPLE OUTLET	TNW	
TLW	REINFORCED BRANCH OUTLET LATERAL 45	TLW	
TLT	REINFORCED BRANCH OUTLET LATERAL 45 THD	TLT	
T6W	REINFORCED BRANCH OUTLET LATERAL 60	T6W	
T6T	REINFORCED BRANCH OUTLET LATERAL 60 THD	T6T	
TSW	REINFORCED BRANCH OUTLET SWEEPOLET	TSW	
D	STUB-END	D00	
F	FLANGE	F00	
F1	SPECIAL FLANGE	F00	
F2	SPECIAL FLANGE	F00	
FB	FLANGE BLIND	FB0	
FB1	SPECIAL FLANGE BLIND	FB0	
FB2	SPECIAL FLANGE BLIND	FB0	
TSO	REINFORCED BRANCH SOCKET OUTLET	TSO	
TTO	REINFORCED BRANCH THREADED OUTLET	TTO	
TEW	REINFORCED BRANCH ELBOW OUTLET	TEW	
RF	FLANGE REDUCING	RF0	
FSB	SPECTACLE BLIND	FSB	
G	GASKET	G00	
G1	SPECIAL GASKET	G00	
G2	SPECIAL GASKET	G00	
B	BOLT	B00	
BZ	SPECIAL BOLT	B00	FOR LIMAS INPUT
VGA	GATE VA	VGA	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.3 SHORT CODE LIST

S_CODE	DESIGNATION	ABB. CODE	REMARK
VG1	SPECIAL GATE VA	VG1	
VGW	GATE VA BW	VGW	
VGX	GATE VE SW-THD	VGX	
VGf	GATE VA EQUIP	VGf	
VGQ	GATE VALVE Q OPEN	VGQ	
VGB	GATE VALVE BELLOW	VGB	
VGE	GATE VA EXT BON	VGE	
VGS	GATE VA FULL BORE	VGS	
RVG	REDUCING GATE VA	RVG	
VKA	KNIFE GATE VA	VKA	
VLA	GLOBE VA	VLA	
VL1	SPECIAL GLOBE VA	VL1	
VLW	GLOBE VA BW	VLW	
RVB	REDUCING BALL VA	RVB	
VNE	NEEDLE VA	VNE	
VNX	NEEDLE VA SW-THD	VNX	
VNF	NEEDLE VA EQUIP	VNF	
VAN	ANGLE VA	VAN	
RVA	REDUCING ANGLE VA	RVA	
VUA	BUTTERFLY VA	VUA	
VDA	DIAPH VA	VDA	
VKO	COCK VA	VKO	
VTT	FLOAT VA	VTT	
RVP	REDUCING PLUG VA	RVP	
VBA	BALL VA	VBA	
VBG	BALL VA G-LAW	VBG	
VBF	BALL VA EQUIP	VBF	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.4 VALVE TRIM TABLE

1. BASIC TRIM MATERIALS(API STD600 TABLE 13)

Part	Combination number	Material description	Brinell hardness
Stem ¹⁾	1 and 4 through 8A	13Cr	200 HB min. 275 HB max.
	2	18Cr – 8Ni	3)
	3	25Cr – 20Ni	3)
	9 or 11	NiCu alloy	3)
	10 or 12	18Cr – 8Ni – Mo	3)
	13 or 14	19Cr – 29Ni	3)
Seating surfaces ²⁾	1	13Cr	250 HB min.
	2	18Cr – 8Ni	3)
	3	25Cr – 20Ni	3)
	4	13Cr	750 HB min.
	5 or 5A	HF	350 HB min.
	6	13Cr/ CuNi	250 HB min. 175 HB min.
	7	13Cr/ 13Cr	250 HB min. 750 HB min.
	8 or 8A	13Cr/ HF	250 HB min. 350 HB min.
	9	NiCu alloy	3)
	10	18Cr – 8Ni – Mo	3)
	11 or 11A	NiCu alloy/ HF	3)
	12 or 12A	18Cr – 8Ni – Mo/ HF	3)
	13	19Cr – 29Ni	3)
	14 or 14A	19Cr – 29Ni/ HF	3)

Notes :

- 1) Steams shall be wrought material.
- 2) Backseat surfaces for CN 1 and 4 through 8A shall have a minimum hardness of 250 HB.
- 3) Not specified.

Regends :

- 1) Cr = chromium ; Ni = Nickel ; Co = cobalt ; Mo = Molybdenum.
- 2) HF = Hard Facing using CoCr or NiCr welding alloy. The suffix A applies to NiCr.
- 3) Free machining grades of 13 Cr shall not be used.
- 4) For CN 1, a differential hardness of at least 50 Brinell points is required between mating surfaces.
- 5) When two materials are separated by a slash this denotes two separate materials, one for the seat ring seating surface and the other for the gate seating surface without implying a preference for which is to be applied to other part.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.5 APPLICABLE ASTM SPECIFICATIONS

 LDP-L901
REV. 1 (OCT., 2002)
PAGE : 1 OF 3
DATE : DEC., 1995

MATERIAL			PRODUCT FORMS								
MATERIAL GROUP	Nominal Designation	P-No.	Forgings	Wrought Fittings	Castings	Plates	Pipes	EFW Pipes	ROD/BAR	TUBES	Remarks
1.1	Carbon	1	A105 A181CL. 60 or 70	A234Gr. WPB	A216Gr.WCA, WCB&WCC	A285Gr.A.B, &C	A53Gr.A&B	A671Gr. CA55 A672Gr. A45-A55 A135Gr. A&B	A696-C	A179 (Seamless)	Note 1
		1	A105 A181CL. 60 or 70	A234Gr. WPB	A216Gr.WCA, WCB&WCC	A515Gr.55-70 A516Gr.55-70	A106Gr.A& B API 5L	A672Gr. B55-B70 A672Gr.C55- C70	A696-C	A179 (Seamless)	Note 1
		1	A350-LF2	A420-WPL6	A352-LCB	A516-70	A333-1 or 6	A671-CC60 CC70	()	A179 (Seamless)	Note 1
1.2	3 1/2 Ni	3	A350-LF3	A420-WPL3	A352-LC3	A203- A,B,D,E	A333-3	A671-CF65 CF71	()	A334Gr.3	Note 1
1.5	C-1/2 Mo	3	A182-F1	A234-WP1	A217-WC1	A204-A,B&C	A335-P1	A691-CM65 CM75	()	A209Gr.T1	
1.9	1Cr-1/2 Mo	4	A182-F12 CL.1&2	A234-WP12 CL.1&2	A217-WC6	A387-12 CL.1&2	A335-P12	A691-Gr.1CR	()	A213Gr.T12	Note 1
	1 1/4 Cr - 1/2 Mo	4	-F11 CL.1,2&3	-WP11 CL.1,2&3	A217-WC6	-11CL.1,2&3	-P11	-Gr.1 1/4 CR	A739-B11	A213Gr.T11	Note 1
1.10	2 1/4 Cr-1Mo	5A	A182-F22 CL1&3	A234-WP22 CL.1&3	A217-WC9	A387- 22CL.1&2	A335-P22	A691- Gr.2 1/4CR	A739-B22	A213Gr.T22	Note 1
1.11	3Cr-1Mo	5A	A182-F21	()	()	A387-21CL.2	A335-P21	A691-Gr.3CR	()	A213Gr.T21	Note 1
1.13	5Cr-1/2Mo	5B	A182-F5(a) Flange Only	A234-WP5	A217-C5	A387-5CL.2	A335-P5	A691-Gr.5CR	()	A213Gr.T5	Note 1
1.14	9Cr-1Mo	5B	A182-F9	A234-WP9	A217-C12	A387-9CL.2	A335-P9	A691-Gr.9CR	()	A213Gr.T9	Note 1
	13Cr	6	A182-F6a	()	A217-CA15	A240-410	A268-TP410	()	A276-410	A268Gr.TP 410	
2.1	18Cr-8Ni	8	A182-F304	A403- WP304	A351-CF8 (A744-CF8)	A204-304	A312-TP304	A358-304	A479-304	A249Gr.Tp 304	
		8	-F304H	-WP304H	()	-304H	-TP304H	-304H	-304H	-304H	
2.2	16Cr-12Ni- 2Mo	8	A182-F316	A403- WP316	A351-CF8M (A744-CF8M)	A240-316	A312-TP316	A358-316	A479-316	-316	
		8	-F316H	-WP316H	()	-316H	-TP316H	-316H	-316H	-316H	
	18Cr-13Ni- 3Mo	8	-F317	-WP317	A351-CG8M (A744-CG8M)	-317	-TP317	()	A276-317	-317	
2.3	18Cr-8Ni	8	A182-F304L	A403- WP304L	A351-CF3 (A744-CF3)	A240-304L	A312-TP304	A358-304L	A479-304L	-304L	
	16Cr-12Ni- 2Mo	8	-F316L	-WP316	A351-CF3M (A744-CF3M)	-316L	-TP316L	-316L	-316L	-316L	
2.4	18Cr-10Ni-Ti	8	A182-F321	A403- WP321	()	A240-321	A312-TP321	A358-321	A479-321	-321	
		8	-F321H	-WP321H	()	-321H	-TP321H	()	-321H	-321H	
2.5	18Cr-10Ni- Cb	8	A182-F347	A403- WP347	A351-CF8c (A744-CF8C)	A240-347	A312-TP347	A358-347	A479-347	-347	
		8	-F347H	-WP347H	()	-347H	-TP347H	()	-347H	-347H	
2.6	23Cr-12Ni	8	()	A403- WP309	A351-CH20	A240-309S	A312-TP309	A358-309	(-)	-309	
2.7	25Cr-20Ni	8	A182-F310	A403- WP310	A351-CK20	A240-310S	A312-TP310	A358-310	A479-310S	-310	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.5 APPLICABLE ASTM SPECIFICATIONS

MATERIAL			PRODUCT FORMS								
MATERIAL GROUP	Nominal Designation	P-No.	Forgings	Wrought Fittings	Castings	Plates	Pipes	EFW Pipes	ROD/BAR	TUBES	Remarks
3.1	Cr-Ni-Fe-Mo-Cu-Cb ALLOY 20 Cb	45	B462-N08020	B366-WP20CB	A351-CN7M	B463-N08020	B464-N08020	B474-N08020	B473-N08020	B468-N08020	
3.2	NICKEL ALLOY 200	41	B564-N02200	B366-WPN	()	B162-N02200	B161-N02200	B725-N02200	B160-N02200	B163-N02200	
3.3	Ni-LOW C ALLOY 201	41	B160-N02201	B366-WPNL	()	B162-N02201	B161-N02201	B725-N02201	B160-N02201	B163-N02201	
3.4	Ni-Cu ALLOY 400 (Monel 400)	42	B564-N04400	B366-WPNC	A494-M-35-1	B127-N04400	B165-N04400	()	B164-N04400	B163-N04400	
	ALLOY 450 (Monel450)	34	B151-C71500	()	()	B402-C71500	B466-C71500	B467-C71500	B151-C71500	B111-C71500	
3.5	Ni-Cr-Fe ALLOY 600 (Incoloy 600)	43	B564-N06600	B366-WPNCI	A494-Cy40-1	B168-N06600	B167-N06600	B517-N06600	B166-N06600	B516-N06600	
3.6	Ni-Fe-Cr ALLOY 800 (Incoloy 800)	45	B564-N08800	B366-WPNCI	()	B409-N08800	B407-N08800	B514-N08800	B408-N08800	B163-N08800	
3.7	Ni-Mo ALLOY B-2 (Hastelloy B-2)	49	B564-N10665	B366-WPHB-2	()	B333-N10665	B622-N10665	B619-N10665	B335-N10665	B626-N10665	
3.8	Ni-Mo-Cr ALLOY C-276 (Hastelloy C-276)	44	B564-N10276	B366-WPHC276	A494-CW-12MW-1	B575-N10276	B622-N10276	B619-N10276	B574-N10276	B626-N10276	
	Ni-Cr-Mo-Cb ALLOY 625 (Inconel 625)	43	B564-N06625	B366-WPNCMC	()	B443-N06625	B444-N06625	B705-N06625	B446-N06625	B704-N06625	
	Ni-Mo ALLOY B (Hastelloy B)	44	B335-N10001	B366-WPHB	A494-N-12MV-1	B333-N10001	B622-N10001	B619-N10001	B335-N10001	B626-N10001	
	Ni-Mo-Cr ALLOY C-22 (Hastelloy C-22)	44	B564-N06022	B366-WPHC22	()	B575-N06022	B622-N06022	B619-N06022	B574-N06022	B626-N06022	
	Ni-Mo-Cr-Fe ALLOY N (Hastelloy N)		B573-N10003	B366-WPHN	()	B434-N10003	()	()	B573-N10003	()	
	Ni-Mo-Cr ALLOY C-4 (Hastelloy C-4)	44	B574-N06455	B366-WPHC4	()	B575-N06455	B622-N06455	B619-N06455	B574-N06455	B626-N06455	
	Ni-Fe-Cr-Mo-Cu ALLOY 825 (Incoloy 825)		B564-N08825	B366-WPNCI	()	B424-N08825	B423-N08825	B705-N08825	B425-N08825	B704-N08825	
3.9	Ni-Cr-Mo-Fe ALLOY X (Hastelloy X)	43	B572-N06002	B366-WPHX	()	B435-N06002	B622-N06002	B619-N06002	B572-N06002	B626-N06002	
3.10	Ni-Fe-Cr-Mo-Cb ALLOY 700 (JS700)		B672-N08700	()	()	B599-N08700	()	()	B672-N08700	()	
3.11	Ni-Fe-Cr-Mo-Cu-Lowc ALLOY 904L		B649-N08904	B366-WP904L	()	B625-N08904	B677-N08904	B673-N08904	B649-N08904	B674-N08904	
3.12	Ni-Fe-Cr-Mo ALLOY 20 Mod.		B621-N08320	()	()	B620-N08320	B622-N08320	B619-N08320	B621-N08320	B626-N08320	
	Ni-Cr-Fe-Mo-Cu ALLOY G-3 (Hastelloy G-3)		B581-N06985	B366-WPHG3	()	B582-N06985	B622-N06985	B619-N06985	B581-N06985	B626-N06985	
3.13	Ni-Cr-Fe-Mo-Cu ALLOY G-2 (Hastelloy G-2)		B581-N06975	()	()	B582-N06975	B622-N06975	B619-N06975	B581-N06975	B626-N06975	
3.14	Ni-Cr-Fe-Mo-Cu ALLOY G (Hastelloy G)	45	B581-N06007	B366-WPHG	()	B582-N06007	B622-N06007	B619-N06007	B581-N06007	B626-N06007	
	Ni-Cr-Fe-Mo-Cu ALLOY G-30 (Hastelloy G-30)		B581-N06030	B366-WPHG30	()	B582-N06030	B622-N06030	B619-N06030	B581-N06030	B626-N06030	

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.5 APPLICABLE ASTM SPECIFICATIONS

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 3 OF 3
 DATE : DEC., 1995

MATERIAL			PRODUCT FORMS								
MATERIAL GROUP	Nominal Designation	P-No.	Forgings	Wrought Fittings	Castings	Plates	Pipes	EFW Pipes	ROD/BAR	TUBES	Remarks
3.15	Ni-Fe-Cr ALLOY 800 (Incoloy 800)	45	B564-N08810	B366-WPNIC10	()	B409-N08810	B407-N08810	B514-N08810	B408-N08810	B163-N08810	
	Ni-Fe-Cr ALLOY 800HT (Incoloy 800HT)	45	B564-N08811	B366-WPNIC11	()	B409-N08811	B407-N08811	()	B408-N08811	()	
3.16	Ni-Fe-Cr-Si ALLOY 20 (RA-330)		B511-N08330	B366-WP330	()	B536-N08330	B535-N08330	B710-N08330 B546-N08330	B511-N08330	B739-N08330	
	TITANIUM UNALLOYED	51	B381-F2	B363-WPT2	B367-C2	B265-2	B337-2	()	B348-2	B338-2	
	TITANIUM LOW ALLOYED	51	B381-F7	B363-WPT7	B367-Ti-Pd7B or B367-C7	B265-7	B337-7	()	B348-7	B338-7	
	TITANIUM ALLOYS	51	B381-F12	B363-WPT12	()	B265-12	B337-12	()	B348-12	B338-12	
	ALUMINUM 3003	21	B247-(3003)	B361-(WP3003)		B209-(3003)	B241-(3003)		B211-(3003)	B210-(3003)	

Note :

1. User shall specify material grade for each item in accordance with design condition.



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 1 OF 7
DATE : DEC., 1995

FERROUS METALS

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A 36 Structural Steel	K02600	SMS 400A / SM 400A	D3515 / G3106	(23)	St 44-2 St 44-2	17100 17100	1.0044 1.0044	<1.1/2 in (38mm)Thick (25)	4360 -	43B -	>5/8 in. (16mm)(6) -
A 53 Welded and Seamless Steel Pipe Grade A	K02504	SPPS38 / STPG370	D3562/G3454	(16)	St 37.2 St 35	1626 1629	1.0036 1.0308	(18)Welded (18)Seamless	3601 -	320 -	BW,S,ERW -
Grade B	K03005	SPPS42 / STPG410	D3562/G3454	(16)	St 45 St 42-2	1629 1626	1.0408 1.0040	(18)Seamless (18)Welded	3601 -	410 -	BW,S,ERW -
A 105 Carbon Steel Forgings for Piping Components	K03504	SFVC2A/SFVC2A	D1/22/G3202	(22)	19 Mn 5	17155	1.0482	(3b)(15)	1503	221-490	-
A 106 Seamless C-Steel Pipe for High Temperature Service Grade A	K02501	SPHT38/STPT370	D3570 / G3456	(16)(30)	St 35.8	17175	1.0305	-	3602	HFS 360	-
Grade B	K03006	SPHT42/STPT410	D3570 / G3456	(16)(30)	St 45.8	17175	1.0405	-	3602	HFS 410	-
A 126 Gray Iron Castings for Valves, Flanges and Pipe Fittings Class A	F11501	GC 200 / FC 200	D4301 / G5501	-	GG 15	1691	6015	-	1452	Grade 150	-
Class B	F12102	GC 250 / FC 250	D4301 / G5501	-	GG 25	1691	0.6025	-	1452	Grade 220	-
A 179 Seamless Cold Drawn Low-C Steel Heat Exchanger and Condenser Tubes	K01200	STBH 340 / STB 35	D3563 / G3461	-	St 35.4 St 35.8	1629 17175	1.0309 1.0305	- Plus DIN 2391 (18) Gutegrad C.NBK	3606 -	CFS 320 -	- -
A 181 C-Steel Forgings for General Purpose Piping Class 60	K03502	SFVC1 / SF VC1	D4122 / G3202	-	St 44-2	17100	1.0044	Per Ad- Merkblatt W-13 (18)	1503	221-430	-
Class 70		SFVC2A / SF VC2A	D4122 / G3202	-	C22 19 Mn 5 20 Mn 5	17200 - -	1.0402 1.0482 1.1133	WBL 620 (3b) WBL 610 (3b) WBL 550 (3b)	- 1503 -	- 221-490 -	- - -
A 182 Forged or Rolled Alloy Steel Pipe Flanges, Fittings and Valves for High Temperature Service Grade F 1	K12822	SFVA F1 / SFVA F1	D4123 / G3203	(10)	16 Mo 5	-	1.5423	(3a)	1503	245-420	(6)
Grade F 5	K42544	SFVA F5B / SFVA F5B	D4123 / G3203	(10)	12 CrMo 19 5	-	1.7362	WBL-400&590(3b)	1503	625-520	-
Grade F 6a	-	-	-	(3)	X10 Cr 13	17440	1.4006	(3a)	1503	410S21	(4)
Grade F 11	K11572	SFVA F11 / SFVA F11	D4123 / G3203	(10)	13 CrMo 44	17175	1.7335	WBL-620(3b)(8)	1503	621-460	-
Grade F 12	K11564	SFVA F12 / SFVA F12	D4123 / G3203	(10)	13 CrMo 44	17175	1.7335	WBL-620(3b)	1503	620-540	-
Grade F 22	K21590	SFVA F22B/ SFVA F22B	D4123 / G3203	(10)	10 CrMo 9 10	17175	1.7380	WBL-610(3b)	1503	622-560	-
Grade F 304	S30400	STS F304 / SUS F304	D4115 / G3214	-	X5 CrNi 18 9	17440	1.4301	(3b)	1503	304S31	-
Grade F 304H	S30409	STS F 304H / SUS F 304H	D4115 / G3214	-	-	-	-	(3)	1503	304S51	-
Grade F 304L	S30403	STS F304L / SUS F 304L	D4115 / G3214	-	X2 CrNi 18 9	17440	1.4306	(3b)	1503	304S11	-
Grade F 310	S31000	STS F310S / SUS F 310S	D4115 / G3214	-	-	-	-	(3)	1503	310S31	-
Grade F 316	S31600	STS F316 / SUS F316	D4115 / G3214	-	X5 CrNiMo 18 10	17440	1.4401	(3b)	1503	316S31	Also 316S33
Grade F 316H	S31609	STS F316H / SUS F316H	D4115 / G3214	-	-	17440	-	(3)	1503	316S51	-
Grade F 316L	S31603	STS F316L / SUS F316L	D4115 / G3214	-	-	17440	1.4404	(3b)	1503	316S11	-
Grade F 321	S32100	STS F321/ SUS F321	D4115 / G3214	-	X2 CrNiMo18 10	17440	1.4541	(3b)	1503-821	321S31	-
Grade F 347	S34700	STS F347 / SUS F347	D4115 / G3214	-	X10 CrNiNb18 9	17440	1.4550	(3b)	1503	347S31	-



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 2 OF 7
DATE : DEC., 1995

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A192 Seamless C-Steel Boiler Tubes for High Pressure Service	K01201	STBH 340 / STB 340	D3563 / G3461	(30)	St 35.8	17175	1.0305	-	3059	320	(27)(30)
A193 Alloy Steel Bolting Materials for High Temperature Service											
Grade B 6	S41000	STS 410 / SUS 410	D3706 / G4303	(3a)	X 7 Cr 13	17440	1.4000	(3a)	1506-713	-	Cond.R(3A)-
Grade B 7	G41400	SNB 7 / SNB 7	D3755 / G4107	(3a)	42 CrMo 4	17200	1.7225	(3c)	1506-621	A	Cond. T
					24 CrMo 5	17240	1.7258	Limited to 500 °C	-	-	-
Grade B 7M	G41400	SNB 7 / SNB 7	D3755 / G4107	(3a)(20)	42 CrMo 4	17200	1.7225	(3c)(20)	1506-621	A	Cond. R(20)
Grade B 8	S30400	STS 304 / SUS 304	D3706 / G4303	(3a)	X5 CrNi 18 9	17440	1.4301	(3c)	1506-801	B	-
Grade B 8C	S34700	STS 347 / SUS 347	D3706 / G4303	(3a)	X10 CrNiNb 18 9	17440	1.4550	(3c)	1506-821	Nb	-
Grade B 8M	S31600	STS 316 / SUS 316	D3706 / G4303	(3a)	X5 CrNiMo 18 10	17440	1.4401	(3c)	1506-845	-	-
Grade B 8T	S32100	STS 321 / SUS 321	D3706 / G4303	(3a)	X10 CrNiTi 18 9	17440	1.4541	(3c)	1506-821	Ti	-
Grade B 16	K14072	SNB 16 / SNB 16	D3755 / G4107	(3a)	40 CrMoV 5 5	17240	1.7711	(3c)	1506-661	-	Order to B.S.4882
A 194 C-and Alloy Steel Nuts for Bolts for High Temperature Service											
Grade 2 H	K04002	SM 45C / S45C	D3752 / G4051	(3a)	C 35	17240	1.1181	(3c)	1506-162	-	Cond. TX
Grade 4	K14510	-	-	(3)	24 CrMo 5	17240	1.7258	(3c)	1506-240	-	Order to B.S. 4882
Grade 6	S41000	STS 410 / SUS 410	D3706 / G4303	(3c)	X7 Cr 13	17440	1.4000	(3a)	1506-713	-	Cond. R(3a)
Grade 6F (with sulfur)		-	-	(3)	-	-	-	(3)	-	-	(3)
Grade 8	S30400	STS304 / SUS 304	D3706 / G4303	(3a)	X5 CrNi 18 9	17440	1.4301	(3c)	1506-801	B	-
Grade 8M	S31600	STS 316 / SUS 316	D3706 / G4303	(3a)	X5CrNiMo 18 10	17440	1.4401	(3c)	1506-845	-	-
A 199 Seamless Cold Drawn Intermediate Alloy Steel Heat Exchanger and Condenser Tubes											
T 5	K41545	STHA 24 / STBA 25	D3572 / G3462	(35)	12 CrMo 19 5	-	1.7362	(3a)	3606	CFS 625	(35)
T 11	K11597	STHA 22 / STBA 23	D3572 / G3462	(35)	13 CrMo 44	17175	1.7335	(8)	3606	CFS 621	(35)
T 22	K21590	STHA 23 / STBA 24	D3572 / G3462	(35)	10 CrMo 9 10	17175	1.7380	-	3606	CFS 622	(35)
A 203 Nickel Steel Boiler Plates											
Grade D	K31718	SL 3N 225 / SL 3N 225	K3586 / G3127	-	10 Ni 14	-	1.5637	WBL-680 (3a)	1501-503	-	-
Grade E	K32018	SL 3N 275 / SL 3N 275	D3586 / G3127	-	-	-	-	(3)	-	-	(3)
A 204 Mo-Steel Plates for Boiler and Other Pressure Vessels											
Grade A	K11820	SB 450M / SB 450M	D3560 / G3103	-	16Mo 5	-	1.5423	Order with DIN 50049-3.1C(3a)	1501-240	-	(6)
Grade B	K12020	SB 480M / SB 480M	K3560 / G3103	-	16 Mo 5	-	1.5423	Order with DIN 50049-3.1C(3a)	-	-	(3)
A 209 Seamless C-Mo Steel Boiler and Superheater Tubes											
Grade T 1	K11522	STHA 12 / STBA 12	D 3572 / G 3462	(30)(24)	16 Mo 5	-	1.5423	(3a)	-	-	-
Grade T 1a	K12023	STHA 13 / STBA 13	D 3572 / G 3462	(30)(24)	16 Mo 5	-	1.5423	(3a)	-	-	-
A 210 Seamless Medium-Carbon Steel Boiler and Superheater Tubes											
Grade A-1	K02707	STBH 410 / STB 410	D 3563 / G 3461	(30)(24)	St 45.8	17175	1.0405	-	3059	320	(30)

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 3 OF 7
DATE : DEC., 1995

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A 213 Seamless Alloy Steel Boiler and Heat Exchanger Tubes											
Grade T 5	K41545	STHA 24 / STBA 25	D 3572 / G 3462	(30)(24)	12 CrMo 19 5	-	1.7362	(3a)	3606	625	(30)
Grade T 11	K11597	STHA 22 / STBA 23	D 3572 / G 3462	(30)(24)	13 CrMo 44	17175	1.7335	(8)(32)	3606	621	(30)
Grade T 12	K11562	STHA 21 / STBA 22	D 3572 / G 3462	(30)(24)	13 CrMo 44	17175	1.7335	(32)	3606	620	(30)
Grade T 22	K21590	STHA 23 / STBA 24	D 3572 / G 3462	(30)(24)	10 CrMo 9 10	17175	1.7380	(32)	3606	622	(30)(32)
TP 304	S30400	STS 304TB / SUS 304TB	D 3577 / G 3463	(30)(24)	X5 CrNi 18 9	17440	1.4301	(3b)	3606	304S25	(30)
TP 304L	S31403	STS 304LTB/SUS 304LTB	D 3577 / G 3463	(30)(24)	X2 CrNi 18 9	17440	1.4306	(3b)	3606	304S22	(30)
TP 310	S31000	STS 310STB/SUS 310STB	D 3577 / G 3463	(30)(24)	X12 CrNi 2528	-	1.4845	WBL-470(3b)	-	-	(3)
TP 316	S31600	STS 316TB / SUS 316TB	D 3577 / G 3463	(30)(24)	X5 CrNiMo 18 10	17440	1.4401	(3b)	3606	316S30	(30)
TP 316L	S31603	STS 316LTB/SUS 316LTB	D 3577 / G 3463	(30)(24)	X2 CrNiMo 18 10	17440	1.4404	(3b)	3606	316S29	(30)
TP 321	S32100	STS 321TB / SUS 321TB	D 3577 / G 3463	(30)(24)	X10 CrNiTi 18 9	17440	1.4541	(3b)	3606	321S22	(30)
TP 347	S34700	STS 347TB / SUS 347TB	D 3577 / G 3463	(30)(24)	X10 CrNiNb 18 9	17440	1.4550	(3b)	3606	347S17	(30)
A 214 Electric Resistance Welded Heat Exchanger and Condenser Tubes	K01807	STBH 340 / STB 35 STBH 410 / STB 42 STBH 510 / STB 52	D 3563 / G 3461 D 3563 / G 3461 D 3563 / G 3461	(24) (24) (24)	St 37-2	1626	1.0036	(3b)ERW Only	3606	ERW30	-
A 216 C-Steel Castings Suitable for Fusion Welding for High Temperature Service											
WCA	J02502	SCPH 1 / SCPH 1	D 4107 / G 5151	-	GS-C 25	17245	1.0619	-	1504-161	430	-
WCB	J03002	SCPH 2 / SCPH 2	D 4107 / G 5151	-	-	-	-	(3)	1504-161	480	-
A 217 Alloy Steel Castings for Pressure Containing Parts Suitable for High Temperature Service											
WC 1	J12524	SCPH 11 / SCPH 11	D 4107 / G 5151	-	GS-22 Mo 4	17245	1.5419	-	1504-240	-	-
WC 6	J12072	SCPH 21 / SCPH 21	D 4107 / G 5151	-	GS-17 CrMo 5 5	17245	1.7357	-	1504-621	-	-
WC 9	J21890	-	-	(3)	-	-	-	-	-	-	-
C5	J42045	SCPH 61 / SCPH 61	D 4107 / G 5151	-	GS-12 CrMo 19 5	-	1.7363	WBL-595(3b)	1504-625	-	-
C 12	J82090	-	-	(3)	G-X-12 CrMo 10	-	1.7389	WBL-595(3b)	1504-629	-	-
CA 15	J91150	-	-	(3)	-	-	-	(3)	1504-713	-	-
A 234 Wrought C- and Alloy Piping Fittings for Moderate and Elevated Temperatures											
Grade WPB	K03006	SPHT 42 / STPT 42	D 3570 / G 3456	(3b)	St 45.8	17175	1.0405	-	1503	221-460	(28)
Grade WPC	K03501	SPHT 49 / STPT 49	D 3570 / G 3456	(3b)	-	-	-	(3)	1503	221-510	(28)
Grade WP1	K12821	SPA 10 / STPA 12	D 3573 / G 3458	(3b)	16 Mo 5	-	1.5423	(3a)	1503	245-420	(28)
Grade WP5	K41545	SPA 24 / STPA 25	D 3573 / G 3458	(3b)	12 CrMo 19 5	-	1.7362	(3a)	1503	625-520	(36)
Grade WP11	-	SPA 22 / STPA 23	D 3573 / G 3458	(3b)	13 CrMo 44	17175	1.7335	(8)	1503	621-460	(28)
Grade WP12	K12062	SPA 21 / STPA 22	D 3573 / G 3458	(3b)	13 CrMo 44	17175	1.7335	-	1503	620-440	(28)
Grade WP22	K21590	SPA 23 / STPA 24	D 3573 / G 3458	(3b)	10 CrMo 9 10	17175	1.7380	-	1503	622-490	(28)
A 240 Heat-Resisting Cr and Cr-Ni Steel Plate and Sheet for Pressure Vessels											
Type 304	S30400	STS 304 / SUS 304	D 3693 / G 3601	-	X5 CrNi 18 9	17440	1.4301	(3b)	1501	304S15	-
Type 304L	S30403	STS 304L / SUS 304L	D 3693 / G 3601	-	X2 CrNi 18 9	17440	1.4306	(3b)	1501	304S12	-
Type 316	S31600	STS 316 / SUS 316	D 3693 / G 3601	-	X5 CrNiMo 18 10	17440	1.4401	(3b)	1501	316S16	-
Type 316L	S31603	STS 316L / SUS 316L	D 3693 / G 3601	-	X2 CrNiMo 18 10	17440	1.4404	(3b)	1501	316S12	-
Type 317	S31700	STS 317 / SUS 317	D 3693 / G 3601	-	-	-	-	(3)	-	-	(3)
Type 317L	S31703	STS 317L / SUS 317L	D 3693 / G 3601	-	-	-	-	(3)	-	-	(3)
Type 321	S32100	STS 321 / SUS 321	D 3693 / G 3601	-	X10 CrNiTi 18 9	17440	1.4541	(3b)	1501	321S12	-
Type 347	-	STS 347 / SUS 347	D 3693 / G 3601	-	X10 CrNiNb 18 9	17440	1.4550	(3b)	1501	347S17	-
Type 405	S40500	STS 405 / SUS 405	D 3693 / G 3601	-	X7 CrAl 13	17440	1.4002	(3b)	1501	405S17	-
Type 410	S41000	STS 410 / SUS 410	D 3693 / G 3601	-	X10 Cr 13	17440	1.4006	(3b)	-	-	-
Type 410S	S41008	STS 410S / SUS 410S	D 3693 / G 3601	-	X7 Cr 13	17440	1.4000	(3b)	1501-713	-	-
Type 430	S43000	STS 430 / SUS 430	D 3693 / G 3601	-	X8 Cr 17	17440	1.4016	(3b)	-	-	-

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 4 OF 7
DATE : DEC., 1995

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A 263 Corrosion-Resisting Cr-Ni Steel Clad Plate, Sheet and Strip											
Type 405	S40500	STS 405 / SUS 405	D 3693 / G 3601	-	X7 CrAl 13	17440	1.4002	(3a)	3740	1	(3b)
Type 410S	S41008	STS 410S / SUS 410S	D 3693 / G 3601	-	X7 Cr 13	17440	1.4000	(3a)	-	-	(3)
A 264 Corrosion-Resisting Cr Steel Clad Plate, Sheet and Strip											
Type 304	S30400	STS 304 / SUS 304	D 3693 / G 3601	-	X5 CrNi 18 9	17440	1.4301	(3b)	3740	2	(3b)
Type 304L	S30403	STS 304L / SUS 304L	D 3693 / G 3601	-	X2 CrNi 18 9	17440	1.4306	(3b)	3740	7	(3b)
Type 316	S31600	STS 316 / SUS 316	D 3693 / G 3601	-	X5 CrNiMo 18 10	17440	1.4401	(3b)	3740	8	(3b)
Type 316L	S31603	STS 316L / SUS 316L	D 3693 / G 3601	-	X2 CrNiMo 18 10	17440	1.4404	(3b)	3740	8	(3b)
Type 317	S31700	STS 317 / SUS 317	D 3693 / G 3601	-	-	-	-	(3)	-	-	(3)
Type 317L	S31703	STS 317L / SUS 317L	D 3693 / G 3601	-	-	-	-	(3)	-	-	(3)
Type 321	S32100	STS 321 / SUS 321	D 3693 / G 3601	-	X10 CrNiTi 18 9	17440	1.4541	(3b)	3740	3	(3b)
Type 347	S34700	STS 347 / SUS 347	D 3693 / G 3601	-	X10 CrNiNb 18 9	17440	1.4550	(3b)	3740	4	(3b)
A 265 Ni and Ni Base Alloy Clad Steel Plate											
70/30 Ni-Cu	-	-	-	(3)	NiCu 30 Fe	17743	2.4360	Nicorrous; Silverin(3b)	-	-	Colclad Monel(3b)
A 266 C-Steel Forgings for Pressure Vessels											
Class 1	K 03506	SFVC / SFVC 1	D 4122 / G 3202	-	Ck 22	17200	1.1151	(3b)	1503	221-440	(10)
Class 4	K 03017	SFVC 28 / SFVC 2B	D 4122 / G 3202	-	Ck 22	17200	1.1151	(3b)	1503	221-490	(10)
A 268 Seamless and Welded Ferritic Stainless Steel Tubing for General Service											
Type 405	S 40500	-	-	(3)	X7 CrAl	17440	1.4002	(3b)	-	-	(3b)
Type 410	S 41000	STS 405 TB / SUS 405 TB	D 3577 / G 3463	-	X10 Cr 13	17440	1.4006	(3b)	-	-	(3b)
A 269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service											
Type 304	S 30400	STS 304TB / SUS 304TB	D 3577 / G 3463	-	X5 CrNi 18 9	17440	1.4301	(3b)	-	-	(3)
Type 304L	S 30403	STS 304LTB / SUS 304LTB	D 3577 / G 3463	-	X2 CrNi 18 9	17440	1.4306	(3b)	-	-	(3)
Type 316	S 31600	STS 316TB / SUS 316TB	D 3577 / G 3463	-	X5 CrNiMo 18 10	17440	1.4401	(3b)	-	-	(3)
Type 316L	S 31603	STS 316LTB / SUS 316LTB	D 3577 / G 3463	-	X2 CrNiMo 18 10	17440	1.4404	(3b)	-	-	(3)
Type 317	S 31700	/ SUS 317TB	D 3577 / G 3463	-	-	-	-	(3)	-	-	(3)
Type 321	S 32100	STS 321TB / SUS 321TB	D 3577 / G 3463	-	X10 CrNiTi 18 9	17440	1.4541	(3b)	-	-	(3)
Type 347	S 34700	STS 347TB / SUS 347TB	D 3577 / G 3463	-	X 10 CrNiNb 18 9	17440	1.4550	(3b)	-	-	(3)
A 285 Low and Intermediate Tensile Strength C-Steel Plates for Pressure Vessels											
Grades A & B	K01700	-	-	(3)	HI	17155	1.0345	-	1501-151	360	-
Grade C	K02801	SB 410 / SB 410	D 3560 / G 3103	-	III	17155	1.0425	-	1501-151	400	-
A 302 Mn-Mo and Mn-Mo-Ni Steel Plates for Pressure Vessels											
Grade A	K 12021	SBV 1A / SBV 1A	D 3638 / G 3119	-	-	-	-	(3)	-	-	(3)
Grade B	K 12022	SBV 1B / SBV 1B	D 3638 / G 3119	-	-	-	-	(3)	-	-	(3)



PIPING DISCIPLINE
PROCEDURE

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 5 OF 7
DATE : DEC., 1995

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A 312 Seamless and Welded Austenitic Stainless Steel Pipe											
TP 304	S 30400	STS 304TP / SUS 304TP	D 3576 / G 3459	(16)	X5CrNi 18 9	17440	1.4301	(3b)	3605	304S18	-
TP 304H	S 30409	STS 304HTP/SUS 304HTP	D 3576 / G 3459	(16)	-	-	-	(3)	3605	304S59	-
TP 304L	S 30403	STS 304LTP / SUS 304LTP	D 3576 / G 3459	(16)	X2 CrNi 18 9	17440	1.4306	(3b)	3605	304S14	-
TP 310	S 31000	STS 310STP / SUS 310STP	D 3576 / G 3459	(16)	-	-	-	(3)	-	-	-
TP 316	S 31600	STS 316TP / SUS 316TP	D 3576 / G 3459	(16)	X5 CrNiMo 18 10	17440	1.4401	(3b)	3605	316S18	-
TP 316H	S 31609	STS 316HTP/SUS 316HTP	D 3576 / G 3459	(16)	-	-	-	(3)	3605	316S59	-
TP 316L	S 31603	STS 316LTP / SUS 321LTP	D 3576 / G 3459	(16)	X2 CrNiMo 18 10	17440	1.4404	(3b)	3605	316S14	-
TP 321	S 32100	STS 321TP / SUS 321TP	D 3576 / G 3459	(16)	X10 CrNiTi 18 9	17440	1.4541	(3b)	3605	321S18	-
TP 347	S 34700	STS 347TP / SUS 347TP	D 3576 / G 3459	(16)	X5 CrNiNb 18 9	-	1.4543	(3b)	3605	347S18	-
TP 347H	S 34709	STS 347HTP/SUS 347HTP	D 3576 / G 3459	(16)	-	-	-	(3)	-	-	-
A 333 Seamless and Welded Pipe for Low-Temperature Service											
Grade 1	K 03008	SPLT 39 / STPL 380	D 3569 / G 3460	(16)	TT St 41 N	-	1.0437	WBL-680(3b)	-	-	(3)
Grade 3	K 31918	SPLT 46 / STPL 450	D 3569 / G 3460	(16)	10 Ni 14	-	1.5637	WBL-680(3b)	3603	HFS 503 LT 100	CAT. 2
Grade 6	K 03006	-	-	(3)	TT St 45 N	-	1.0456	WBL-680(3b)	3603	HFS 410 LT 50	CAT. 2
Grade 8	K 81340	SPLT 70 / STPL 690	D 3569 / G 3460	(16)	X8 Ni 9	-	1.5662	WBL-680(3b)	3603	HFS 590 LT 196	CAT. 2
A 334 Seamless and Welded C- and Alloy Steel Tubes for Low-Temperature Service											
Grade 1	K 03008	STLT 39 / STBL 380	D 3571 / G 3464	-	TT St 41 N	-	1.0437	WBL-680(3b)	-	-	-
Grade 3	K 31918	STLT 46 / STBL 450	D 3571 / G 3464	-	10 Ni 14	-	1.5637	WBL-680(3b)	3603	HFS 503 LT 100	CAT. 2
Grade 6	K 03006	-	-	(3)	TT St 45 N	-	1.0456	WBL-680(3b)	3603	HFS 410 LT 50	CAT. 2
Grade 8	K 31340	STLT 70 / STBL 690	D 3571 / G 3464	-	X8 Ni 9	-	1.5662	WBL-680(3b)	3603	HFS 590 LT196	CAT. 2
A 335 Seamless Ferritic Alloy Steel Pipe for High Temperature Service											
P 1	K 11522	SPA 12 / STPA 12	D 3573 / G 3458	(16)	16 Mo 5	-	1.5423	(3a)	-	-	(3)
P 5	K 41545	SPA 25 / STPA 25	D 3573 / G 3458	(16)	12 CrMo 19 5	-	1.7362	WBL-590(3b)	3604	HFS625	CAT. 2
P 9	S 50400	SPA 26 / STPA 26	D 3573 / G 3458	(16)	-	-	-	(3)	-	HFS629- 470	CAT. 2
P 11	K11597	SPA 23 / STPA 23	D 3573 / G 3458	(16)	13 CrMo 44	17175	1.7335	(8)	3604	HFS621	CAT. 2
P 12	K11562	SPA 22 / STPA 22	D 3573 / G 3458	(16)	13 CrMo 44	17175	1.7335	-	3604	HFS620- 440	CAT. 2
P 22	K21590	SPA 24 / STPA 24	D 3573 / G 3458	(16)	10 CrMo 9 10	17175	1.7380	-	3604	HFS622	CAT. 2
A 350 Forged or Rolled C- and Alloy Steel Flanges, Forged Fittings, and Valves for Low Temperature Service											
Grade LF 1	K 03009	SFL 1 / SFL 1	D 4125 / G 3205	-	TT 41	-	1.0437	WBL-680(3c)	1503	221-430	-
Grade LF 2	K 03011	SFL 2 / SFL 2	D 4125 / G 3205	-	TT StE 315	17102	1.0508	(3c)	1640 1503	WPL-0 221-490	-
Grade LF 3	K 32025	SFL 3 / SFL 3	D 4125 / G 3205	-	10 Ni 14	-	1.5637	WBL-680(3c)	1640 1503	WPL-3 503-490	-

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 6 OF 7
DATE : DEC., 1995

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A 351 Austenitic Steel Castings for High Temperature Service											
CF 8	J92600	SSC 13 / SCS 13A	D 4103 / G 5121	-	G-X CrNi 18 9	17445	1.4308	(3a)	1504-304	C 15	-
CF 8M	J92900	SSC 14 / SCS 14A	D 4103 / G 5121	-	G-X6 CrNiMo 18 10	17445	1.4408	(3a)	1504-316	C 16	-
CK 20	J94202	SSC 18 / SCS 18	D 4103 / G 5121	(3b)	G-X15 CrNiSi 25 20	-	1.4849	WBL-595(3b)	1504-310	C 40	-
HK 40	J94204	HRSC 22 / SCH 22	D 4105 / G 5122	-	G-X40 CrNiSi 25 20	17445	1.4848	(3a)	-	-	(3)
A 352 Ferritic Steel Castings for Low Temperature Service											
Grade LCB	J 03003	SCPL 1 / SCPL 1	D 4111 / G 5152	-	GS-CK24	1.1156	-	WBL-685(3b)	1504-161	480	(1)
Grade LC2	J 22500	SCPL 21 / SCPL 21	D 4111 / G 5152	-	-	-	-	(3)	-	-	(3)
Grade LC3	J31550	SCPL 31 / SCPL 31	D 4111 / G 5152	-	GS-10 Ni 14	1.5638	-	WBL-685(3b)	1504-503	LT60	(1)
A 358 Electric-Fusion Welded Austenitic Cr-Ni Alloy Steel Pipe for High- Temperature Service											
Grade 304	S 30400	STS304TPY / SUS304TPY	D 3588 / G 3468	-	X5 CrNi 18 9	17440	1.4301	(3b)	3605	304S25	LWHT(3b)
Grade 310	S 31000	STS310TPY/SUS310TPY	D 3588 / G 3468	-	X12 CrNi 25 21	-	1.4845	WBL-470(3b)	-	-	(3)
Grade 316	S 31600	STS316TPY / SUS316TPY	D 3588 / G 3468	-	X5 CrNiMo 18 10	17440	1.4401	(3b)	3605	316S26	LWHT(3b)
Grade 321	S 32100	STS321TPY / SUS321TPY	D 3588 / G 3468	-	X10 CrNiTi 18 9	17440	1.4541	(3b)(17)	3605	321S22	LWHT(3b)
Grade 347	S 34700	STS347TPY / SUS347TPY	D 3588 / G 3468	-	X10 CrNiNb 18 9	17440	1.4550	(3b)(17)	3605	347S17	LWHT(3b)
A 387 Cr-Mo Steel Plates for Boilers and Other Pressure Vessels											
Grade 5 Class 1	K 41545	SCMV 6 / SCMV 6	D 3543 / G 4109	-	12 CrMo 19 5	-	1.7362	WBL-590(3a)	-	-	(3)
Class 2	-	-	-	-	12 CrMo 19 5	-	1.7362	(3a)	-	-	(3)
Grade 11 Class 1	K 11789	SCMV 3 / SCMV 3	D 3543 / G 4109	-	-	-	-	(3)	1501-621	A	-
Class 2	-	-	-	(3)	-	-	-	(3)	1501-621	A	(6)
Grade 12 Class 1	K 11757	SCMV 2 / SCMV 2	D 3543 / G 4109	-	13 CrMo 44	17155	1.7335	-	1501-620	27 A	-
Class 2	-	-	-	(3)	13 CrMo 44	17155	1.7335	(3a)	1501-620	31 A	-
Grade 21 Class 1	K 31545	SCMV 5 / SCMV 5	D 3543 / G 4109	-	-	-	-	(3)	-	-	(3)
Class 2	-	-	-	(3)	-	-	-	(3)	-	-	(3)
Grade 22 Class 1	K 21590	SCMV 4 / SCMV 4	D 3543 / G 4109	-	10 CrMo 9 10	-	1.7380	(3b)	1501-622	31 A	-
Class 2	-	-	-	(3)	10 CrMo 9 10	-	1.7380	(3a)	1501-622	31 A	(6)
A 395 Ferritic Ductile Iron Pressure Castings for Elevated Temperatures	F 32800	-	-	(3)	-	-	-	(3)	-	-	(3)
A 403 Wrought Austenitic Stainless Steel Piping Fittings	S 30400	-	-	(3)	-	-	-	(3)	-	-	(3)
A 515 Carbon Steel Plates for Pressure Vessels for Intermediate and Higher Temperature Service											
Grade 55	K 02001	-	-	(3)	III	17155	1.0425	-	1501-161	360	-
Grade 60	K 02401	SB 410 / SB 410	D 3560 / G 3103	-	III	17155	1.0435	-	1501-161	400	-
Grade 65	K 02800	SB 450 / SB 450	D 3560 / G 3103	-	III	17155	1.0445	-	1501-161	430	-
Grade 70	K 03101	SB 480 / SB 480	D 3560 / G 3103	-	19 Mn 5	17155	1.0485	-	-	-	(3)
A 516 Carbon Steel Plates for Pressure Vessels for Moderate and Lower Temperature Service											
Grade 55	K 01800	-	-	(3)	A St 41	17135	1.0426	-	1501-224	360	-
Grade 60	K 02100	SGV 410 / SGV 410	D 3540 / G 3118	-	A St 45	17135	1.0436	-	1501-224	400	(14)
Grade 65	K 02403	SGV 450 / SGV 450	D 3540 / G 3118	-	A St 45	17135	1.0436	-	-	-	(3)
Grade 70	K 02700	SGV 480 / SGV 480	D 3540 / G 3118	-	A St 52	17135	1.0843	-	-	-	(3)

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.6 MATERIAL COMPARISON TABLE

LDP-L901
REV. 1 (OCT., 2002)
PAGE : 7 OF 7
DATE : DEC., 1995

ASTM STANDARD	UNS NO.	KOREAN / JAPANESE			GERMAN				BRITISH		
		KS / JIS Symbol	KS / JIS Number	Remarks	DIN Type	DIN Number	Material Number	Remarks	B.S Number	B.S Grade	Remarks
A 536 Ductile Iron Castings Grade 60-40-18	F 32800	-	-	(3)	-	-	-	(3)	-	-	(3)
A 671 Electric-Fusion Welded Pipe for Atmospheric and Lower Temperatures		-	-	(3)	-	-	-	(3)	-	-	(3)
A 672 Electric-Fusion Welded Pipe for High-Pressure Service at Moderate Temperatures		-	-	(3)	-	-	-	(3)	-	-	(3)
A 675 C-Steel Bars Hot-Rolled Special Quality		-	-	(3)	-	-	-	(3)	-	-	(3)
A 691 Electric-Fusion-Welded C- and Alloy Steel Pipe for High Temperatures		-	-	(3)	-	-	-	(3)	-	-	(3)

EXPLANATORY NOTES (Ferrous) :

- (1) Specify impact tests per ASTM Standard.
- (2) Siemens-Martin(open-hearth), basic oxygen or electric furnace only.
- (3) Normally available to or will be furnished to ASTM Standard.
- (3a) Specify mechanical properties, tests and inspection in accordance with ASTM Standard.
- (3b) Test and inspect the product to ASTM Standard except for chemical analysis and mechanical properties of the steel.
- (3c) Specify heat treatment, test requirements and inspection in accordance with ASTM Standard.
- (4) Specify tempering heat treatment per ASTM Standard.
- (5) Specify type and strength required.
- (6) Recognize lower minimum tensile or yield strength of substitute steel in design or specify minimum tensile and yield strengths per ASTM Standard.
- (7) Order with DIN 50 049 Inspection Certificate C and Quality Grade III.
- (8) Specify chromium content of 1% minimum.
- (9) Available in sizes up to 8 in.(200mm) diameter.
- (10) Specify hardness not to exceed ASTM limits.
- (11) Specify carbon content of 0.15% maximum.
- (12) Specify heat treatment per ASTM Standard.
- (13) Specify maximum hardness of 79 HRB or 143 HB.
- (14) Specify silicon content of 0.15 to 0.4%.
- (15) Specify silicon content of 0.35% maximum.
- (16) Pipe dimensions are different from those of USA Standards.
- (17) Specify carbon content of 0.08% maximum.
- (18) The temperature limitation of 300°C (572 °F) established for this material by German regulations does not necessarily apply for applications outside Germany.
- (19) Specify ASTM A285 or equivalent JIS steel plate except where steel plate Standards A36, A570, A611, and A283, or JIS equivalents are acceptable. For all grades, specify qualification of welding procedure and hydrostatic test per ASTM Standard.
- (20) Specify maximum hardness of 99 HRB or 235 HB.
- (21) Specify silicon content of 0.15-0.50%.
- (22) Specify maximum hardness of 187 HB.
- (23) Consider differences in dimensions and tolerances.
- (24) Specify hardness test per supplementary requirement Z1.1 of JIS Standard.
- (25) Specify silicon content of 0.15 to 0.40% for plates over 1-1/2 in. (38 mm) thick.
- (26) Specify mechanical properties and heat treatment per JIS G3201-SF50.
- (27) Specify maximum hardness of 137 HB or 77 HRB.
- (28) Specify maximum hardness of 197 HB.
- (29) Specify maximum hardness of 90 HRB or 190 HB.
- (30) Specify seamless.
- (31) Specify maximum hardness of 137 HB.
- (32) Specify maximum hardness of 163 HB or 85 HRB.
- (33) Specify seamless, cold drawn, and annealed to maximum hardness of 72 HRB.
- (34) Specify maximum hardness of 150 HB.
- (35) Specify cold drawn and maximum hardness of 85 HRB.
- (36) Specify maximum hardness of 217 HB.
- (37) Specify maximum hardness of 146 HB or 80 HRB.
- (38) Specify maximum hardness of 143 HB or 79 HRB.

규격재료 (ASTM)의 온도별 적용범위(Non Corrosive Service 용)

	DESIGN TEMPERATURE(°C)	PLATE	PIPE	WROUGHT FITTINGS	FORGINGS	BOLTING
Cryogenic	-254 -196	A240 Gr.TP 304, 304L, 347	A312 Gr.TP 304, 304L, 347	A403 Gr.WP304, Gr.WP304L Gr.WP347	A182 Gr. F304, F304L, F347	Bolts : A320 Gr. B8 Nuts : A194 Gr. 8
	-196 -101	A240 Gr.TP 304, 304L, 316, 316L,	A312 Gr.TP 304, 304L, 316, 316L	A420 Gr.WPL8	A182 Gr. F304, F304L, F316	
Low Temperatures	-101 -58	A203 Gr.D or E	A333 Gr. 3	A420 Gr.WPL3	A350 Gr. LF3	Bolts : A320 Gr. L7 Nuts : A194 Gr. 4
	-58 48	A203 Gr.A or B	A333 Gr. 3		A350 Gr. LF3	
	48 -29	A516 all Gr. impact Tested	A333 Gr. 1	A420 Gr.WPL6	A350 Gr. LF1 or LF2	Bolts : A193 Gr. B7 Nuts : A194 Gr. 2H or Gr. 4
	-29 -14	A516 all Gr.(over 25mm th' k) impact tested				
	-14 0	A516 all Gr.(over 50mm th' k) impact tested		A234 Gr.WPB		
Intermediate	0 15	A285 Gr.C, A515 Gr. 55, 60, 65, (38mm thick max.) A516 all Gr.	A53 (seamless) or A106		A181 A105	
	15 427	A283Gr.C(D.T.<343°C) A515 Gr. 55, 60, 65 (38mm thick max.) A516 all Gr. A204 Gr.B				
Elevated Temperatures	427 468	A204 Gr. B or C	A335 Gr.P1	A234 Gr.WP1	A182 Gr. F1	Bolt : A193 Gr. B16 Nuts : A194 Gr. 4
	468 537	A387 Gr. 11 Cl.1 A387 Gr. 12 Cl.1	A335 Gr.P11 A335 Gr.P12	A234 Gr.WP11 Gr.WP12	A182 Gr. F11 A192 Gr. F12	
	537 592	A387 Gr. 22 Cl.1	A335 Gr.P22	A234 Gr.WP22	A182 Gr. F22	Bolt : A193 Gr. B5 Nuts : A194 Gr. 3
	592 816	A240 Gr.TP 304H, 316H 321H, 347H,	A312 Gr.TP 304H, 316H 321H, 347H	A403 Gr.TP347H	A182 Gr.TP304H, 316H, 321H, 347H	Bolt : A193 Gr. B8 Nuts : A194 Gr.8
	816	A240 Gr.TP 310				

Notes :

- 상기 표는 비 부식성 분위기에서 온도만을 고려한 야금학적인 추천 범위이다. 부식 분위기 및 압력과 두께에 따라 해당 Code 에서는 별도의 제한을 둔 것이 많으므로 주의를 요한다.
- Bolt & Nuts 의 경우 Flange Rating 에 따라서도 해당 Code 에서는 별도의 제한을 두기도 하므로 주의를 요한다.
- S.S 304, 304L, 347 & 36%Ni 강은 D.T ≤ -254°C 일 경우, 충격시험 해야 한다.
- 저온충격시험은 ASTM A20 에 따라 실시한다.
- 고온의 한계는 정확히 규정짓기는 어렵다. 예를 들어 일부 금속 야금 기술자들은 흑연화 및 H₂ 침입을 방지 하기 위해 C.S 에 대해서는 288°C 이내에서의 사용을 추천하고 있음.
- A36 을 0°C 이하에서 사용할 경우는 Silicon-Killed Fine Grain Practice 가 되어야 한다.

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.8 CHEMICAL RESISTANCE OF METAL

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 2 OF 4
 DATE : DEC., 1995

Chemical	강종	Iron and Steel	Red Brass	Commercial Bronze	Lead	Copper	Aluminum	Nickel	Inconel	Monel Metal	Type 304 S.S	Type 316 S.S	Type 347 S.S	Carpenter 20	Hastelloy B & C
Calcium hypochlorite		☒	☒		☒	☒	☒	☒	☒	☒	☒		☒	☒	☒
Carbolic acid, phenol	(10)	☒				☒	(11)				☒		☒		
Carbon dioxide, dry															
Carbon dioxide, wet		☒			☒	☒									
Carbon tetrachloride		☒	☒			☒					☒		☒		
Chlorine, dry							☒				☒	(12)	☒	(13)	
, wet		☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	(14)
Chromic acid		☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	(8)
Citric acid		☒				☒									
Ethers		☒													
Ethylene glycol															
Ferric chloride		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	(19)
Ferric sulfate		☒	☒	☒		☒	(16)	☒	☒	☒					
Formaldehyde	(17)											☒	☒		
Formic acid		☒									(18)	(18)	☒		
Freon, dry															
Furfural				☒	☒	☒									
Gasoline, sour		☒	☒	☒		☒				☒					
, refined															
Glycerin, glycerol	(17)														
Hydrochloric acid, <150°F		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	(24)	
Hydrofluoric acid, cold <65%		☒	☒	☒		☒	☒	☒	☒		☒	☒	☒		(31)
>65%		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒		(31)
, hot <65%		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	(31)
>65%		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	(31)
Hydrogen gas, cold															
Hydrogen peroxide		☒	☒		☒	☒	☒	☒	☒	☒			☒		
Hydrogen sulfide, dry (20)			☒	☒	☒	☒		☒		☒	☒				
, wet		☒	☒	☒	☒	☒		☒	☒	☒	☒				
Lacquers (solvents)		☒	☒	☒		☒									
Lactic acid		☒			☒	☒		☒	☒	☒	☒				
Lubricating oils, refined															
Magnesium chloride					☒			(21)	(21)	(21)	☒	☒	☒		(15)
Magnesium hydroxide			☒	☒	☒	☒									
Magnesium sulfate		☒		☒	☒		☒						☒		☒
Mercury			☒	☒	☒	☒			☒				☒	☒	☒
Natural gas			☒	☒		☒									
Nitric acid, crude		☒	☒	☒	☒	☒	(22)	☒		☒					☒

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.8 CHEMICAL RESISTANCE OF METAL

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 3 OF 4
 DATE : DEC., 1995

Chemical \ 강 종	Iron and Steel	Red Brass	Commercial Bronze	Lead	Copper	Aluminum	Nickel	Inconel	Monel Metal	Type 304 S.S	Type 316 S.S	Type 347 S.S	Carpenter 20	Hastelloy B & C
, diluted	☐	☐	☐	☐	☐	(22)	☐		☐					☐
, concentrated	☐	☐	☐	☐	☐	(22)	☐		☐					☐
Oleic acid	☐			☐	☐	(16)								(16)
Oxalic acid	☐			☐	☐	☐				☐		☐		
Palmitic acid	☐	☐	(23)	☐	☐									
석유 oils, < 500°F-crude		☐	☐		☐		☐		☐	☐		☐		
Phosphoric acid	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			(26)	
Potassium hydroxide	☐	☐	☐	☐	☐	☐				☐	☐	☐	☐	(16)
Potassium sulfate	☐		☐									☐	☐	
Propane														
Sewage (gas)	☐	☐	☐		☐		☐		☐			☐	☐	☐
Soda ash(sodium carbonate)					☐	☐								
Sodium bisulfate	☐					☐	☐	☐	☐					
Sodium chloride					☐	☐	(25)	(25)	(25)	☐	☐	☐		
Sodium cyanide		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		
Sodium hydroxide		☐			☐	☐								
Sodium hypochlorite	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐		(9)
Sodium nitrate							(25)	(25)	(25)					☐
Sodium peroxide	☐	☐	☐	☐	☐			☐				☐	☐	(32)
Sodium sulfate				(27)			(25)	(25)	(25)					
Sodium sulfide		☐	☐		☐	☐	(28)	(28)	(28)	☐				(16)
Sodium thiosulfate, "hypo"	(29)	☐	☐		☐	☐	☐	☐	☐					☐
Stearic acid					☐	(11)	(4)	(4)	(4)					(25)
Sulfur				☐	☐					☐	☐	☐		
Sulfur dioxide, dry										☐		☐		(8)
, wet	☐					☐	☐		☐	☐		☐		☐
Sulfuric acid, < 10% , cold	☐	☐	☐		☐	☐	☐	☐		☐		☐		
, hot	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐		
10-75% , cold	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐		
, hot	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐		
75-95% , cold		☐	☐		☐	☐	☐	☐				☐	(26)	(15)
, hot		☐	☐		☐	☐	☐	☐	☐	☐	☐	☐		☐
, fuming		☐	☐		☐	(16)	☐	☐	☐	☐		☐	(26)	☐
Sulfurous acid	☐						☐	☐	☐	☐		☐	(26)	
Tartaric acid	☐	☐	☐		☐		☐	☐	☐	☐		☐		(14)
Toluene														(30)
Trichloroethylene, dry										☐		☐		☐
, wet	☐			☐	☐	☐	☐	☐	☐	☐	☐	☐		☐

PIPING HANDBOOK

4. PIPING MATERIAL WORK

4.8 CHEMICAL RESISTANCE OF METAL

 LDP-L901
 REV. 1 (OCT., 2002)
 PAGE : 4 OF 4
 DATE : DEC., 1995

Chemical 강 종	Iron and Steel	Red Brass	Commercial Bronze	Lead	Copper	Aluminum	Nickel	Inconel	Monel Metal	Type 304 S.S	Type 316 S.S	Type 347 S.S	Carpenter 20	Hastelloy B & C
Turpentine	■	■	■		■		■							
Water, fresh (tap, boiler feed, etc)						■								
Water, sea water	■				■	■	■			■	■	■		
Whiskey and wines	■	■	■	■		■			■			■		■
Zinc chloride	■	■	■		■	■	■	■				■		
Zinc sulfate	■	■	■	■		■	■	■				■		

Notes :

- 1) Oxygen 이 없는 곳.
- 2) Max. 52°C
- 3) 모든 농도 (22°C에서)
- 4) Boiling Point 까지
- 5) 5% (상온에서)
- 6) 50°C까지
- 7) Iron & Steel 은 Water, Air 중에서 녹이 발생 될 수도 있음.
- 8) Hastelloy 'C' 는 70°C까지
- 9) Hastelloy 'C' 는 41°C까지 추천됨.
- 10) Color가 중요치 않은 곳에는 C.P Acid 를 사용 하지 말 것.
- 11) 상온에서 100°C까지이고 습기의 접근을 금함.
- 12) Gas (21°C에서)
- 13) 260°C까지
- 14) Hastelloy 'C' 는 상온 시 임.
- 15) 70°C까지
- 16) 상온에서
- 17) 탈색이 불가피한 곳
- 18) Max. 5%, Max. 66°C
- 19) 상온에서 70°C까지 부식은 온도뿐만 아니라 농도의 증가에 따라서도 심화된다.
- 20) Ni Alloy 는 고온에서 높은 부식성을 나타냄.
/여기서는 상온에서 Dry Gas 상태 기준임.
- 21) 48%/166°C에서 Boiling 되는 기준임.
- 22) 80%이상 (상온에서)
- 23) 199°C이하에서
- 24) 상온에서 희석 시킨 것.
- 25) 93°C까지
- 26) 80°C까지
- 27) Max. 10% / Boiling 상태임.
- 28) 50%, 160°C
- 29) Iron 오염이 허용되지 않는 곳에는 사용불가.
- 30) 10%, (상온에서)
- 31) 부분적으로 액체가 잠길 때 부식은 증가함.
또한 Fume 은 부식이 아주 심함.
- 32) Hastelloy 'C' 는 100°C까지임

1. Calculation Table for Wrapping Tape Quantity

The data in this table are calculated on the basis of 1 Meter pipe.

NPS (inch)	OD. (inch)	Pipe Surface Area (m ² /m)	Primer (ℓ/m)	Tape Width (inch)	Tape Length (M)		Qt'y of Tape Roll (Roll/30M)	
					1" overlap	50% overlap	1" overlap	50% overlap
1/2	0.840	0.067	0.009	2	2.596	2.596	0.087	0.087
3/4	1.050	0.084	0.011	2	3.245	3.245	0.108	0.108
1	1.315	0.105	0.014	2	4.064	4.064	0.135	0.135
1.1/4	1.660	0.132	0.018	2	5.130	5.130	0.171	0.171
1.1/2	1.900	0.152	0.021	2	5.872	5.872	0.196	0.196
2	2.375	0.189	0.026	2	7.340	7.340	0.245	0.245
2.5	2.875	0.229	0.031	2	8.885	8.885	0.296	0.296
3	3.500	0.279	0.038	2	10.817	10.817	0.361	0.361
3.5	4.000	0.319	0.043	2	12.362	12.362	0.412	0.412
4	4.500	0.359	0.049	2	13.907	13.907	0.464	0.464
6	6.625	0.528	0.072	4	6.825	10.237	0.227	0.341
8	8.625	0.688	0.093	4	8.885	13.328	0.296	0.444
10	10.750	0.857	0.116	4	11.074	16.612	0.369	0.554
12	12.750	1.017	0.138	4	13.135	19.702	0.438	0.657
14	14.000	1.117	0.152	6	8.654	14.423	0.288	0.481
16	16.000	1.276	0.173	6	9.890	16.483	0.330	0.549
18	18.000	1.436	0.195	6	11.126	18.543	0.371	0.618
20	20.000	1.595	0.216	6	12.362	20.604	0.412	0.687
22	22.000	1.755	0.238	6	13.598	22.664	0.453	0.755
24	24.000	1.914	0.260	6	14.835	24.724	0.494	0.824
26	26.000	2.074	0.281	6	16.071	26.785	0.536	0.893
28	28.000	2.233	0.303	6	17.307	28.845	0.577	0.962
30	30.000	2.393	0.325	6	18.543	30.906	0.618	1.030
32	32.000	2.552	0.346	9	12.362	21.977	0.412	0.733
34	34.000	2.712	0.368	9	13.135	23.351	0.438	0.778
36	36.000	2.871	0.390	9	13.907	24.724	0.464	0.824
38	38.000	3.031	0.411	9	14.680	26.098	0.489	0.870
40	40.000	3.190	0.433	9	15.453	27.472	0.515	0.916
42	42.000	3.350	0.455	9	16.225	28.845	0.541	0.962
44	44.000	3.509	0.476	9	16.998	30.219	0.567	1.007
46	46.000	3.669	0.498	9	17.771	31.592	0.592	1.053
48	48.000	3.828	0.519	9	18.543	32.966	0.618	1.099

Notes :

- Each calculated data is net quantity, so allowance quantities shall be considered for construction.
- The data for overlap size, tape length, width and unit length per roll can be changed according to the requirements of project specification or manufacturer's standard.
- Where tape width or overlap size are different from above table, the following equation can be used in calculation of tape length for wrapping pipe.

Total Tape Length for Pipe Wrapping (m) =

$$\frac{\text{Pipe OD. (mm)} \times 3.14 \times \text{Pipe length (m)}}{\text{Tape width (mm)} - \text{Overlap size (mm)}}$$

2. Materials for Tape Wrap System

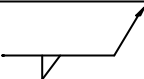
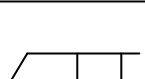
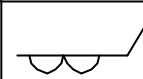
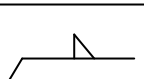
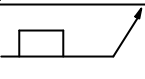
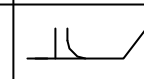
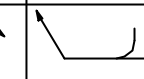
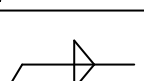
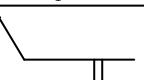
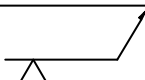
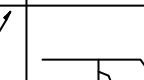
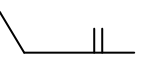
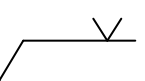
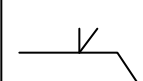
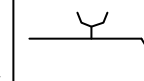
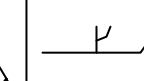
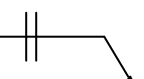
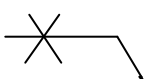
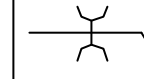
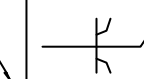
(Product : POLYKEN)

APPLICATION		LINE PIPE WRAPPING		FIELD JOINT & FITTING WRAPPING	
		Product No.	Thickness (Note 2)	Product No.	Thickness (Note 2)
NORMAL	PRIMER	#1027	-	#1027	-
TEMPERATURE	INNER TAPE	#989	20 mils (0.508mm)	#930	35 mils (0.889 mm)
(-34 °C ~ 85 °C)	OUTER TAPE	#955	15 mils (0.381mm)	#955	15 mils (0.381mm)
	FILLER TAPE (Note 1)	-	-	#931	35 mils (0.889 mm)
HIGH	PRIMER	#1627	-	#1627	-
TEMPERATURE	INNER TAPE	#1600	30 mils (0.76 mm)	#1636	30 mils (0.76 mm)
(-34 °C ~ 121 °C)	OUTER TAPE	#1600	30 mils (0.76 mm)	#1636	30 mils (0.76 mm)
	FILLER TAPE (Note 1)	-	-	#1631	35 mils (0.889 mm)

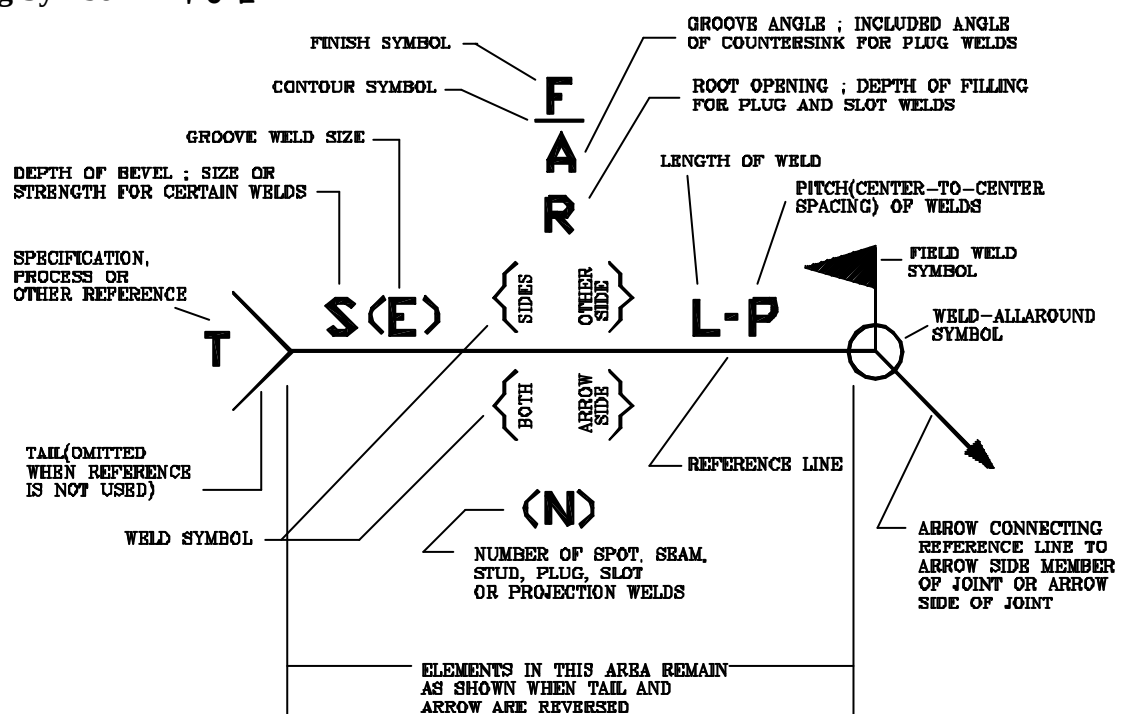
Notes :

1. Filler Tape is used for filling voids tees, elbows, valves, couplings and other irregular shapes
2. The thicknesses in this table are for normal application, another thickness can be applied as per project specification.

1. Welding Symbols

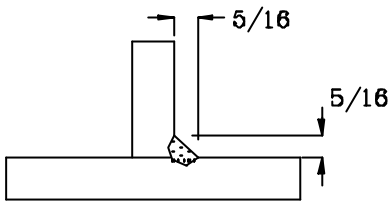
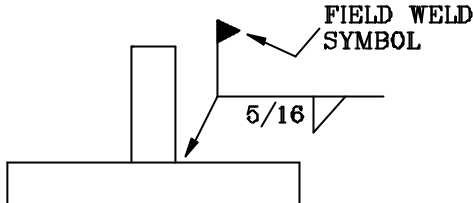
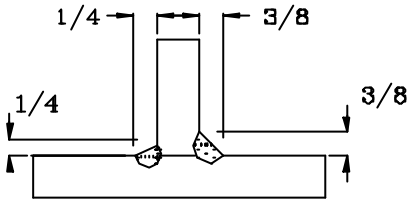
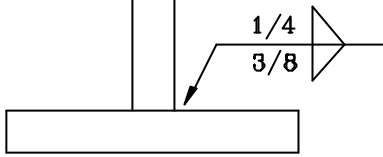
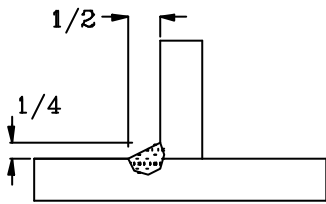
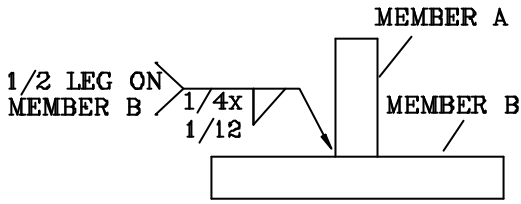
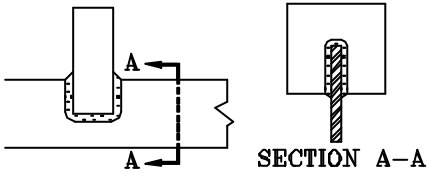
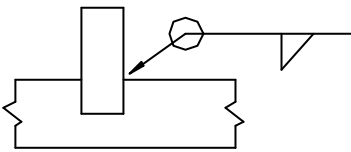
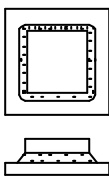
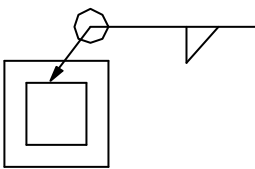
Basic Welding Symbols and Their Location Significance					
Location Significance	Fillet	Plug or Slot	Surfacing	Flange Corner	Flange Edge
Arrow Side					
Other Side			Not Used		
Both Sides		Not Used	Not Used	Not Used	Not Used
No Arrow Side of Other Side Significance	Not Used	Not Used	Not Used	Not Used	Not Used
Location Significance	Groove				
	Square	V	Bevel	U	J
Arrow Side					
Other Side					
Both Sides					

2. Welding Symbol 표기 방법

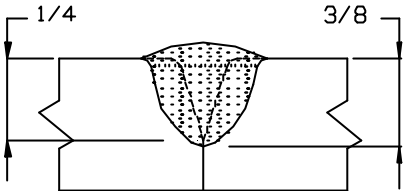
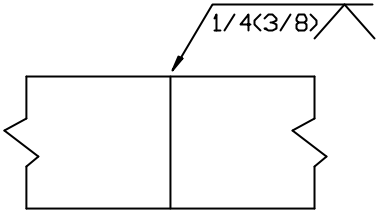
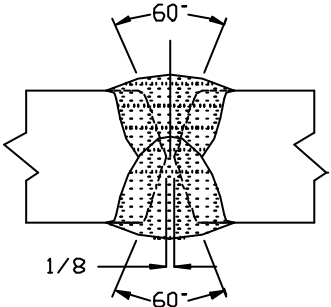
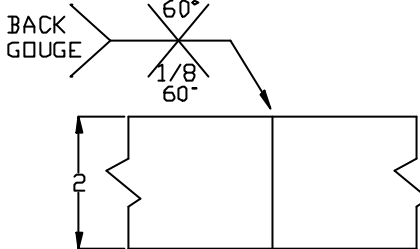
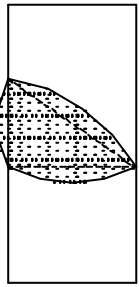
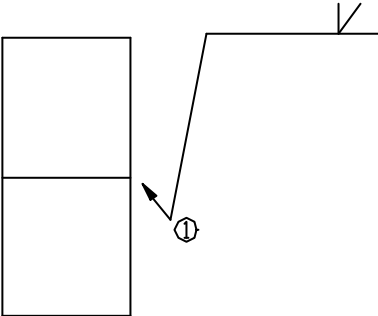


3. 용접기호 적용 예

3.1 Fillet weld

WELDS	SYMBOL
	
	
	
	
	

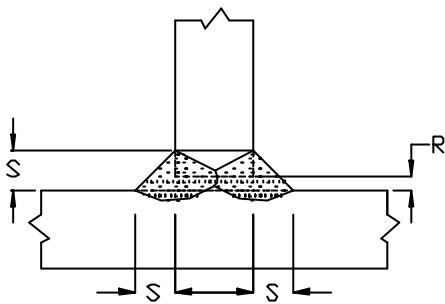
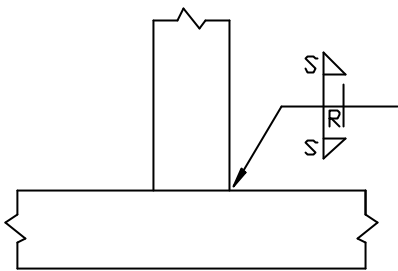
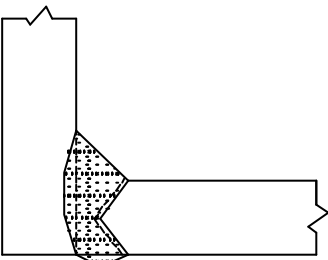
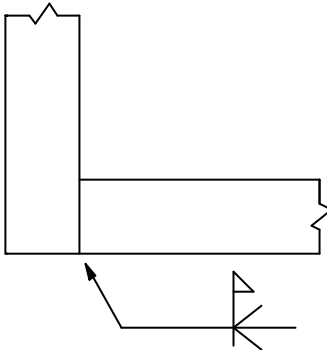
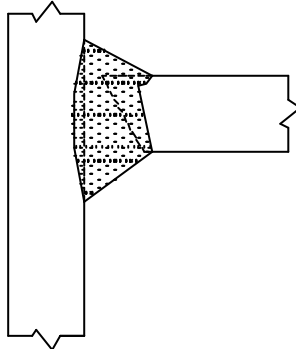
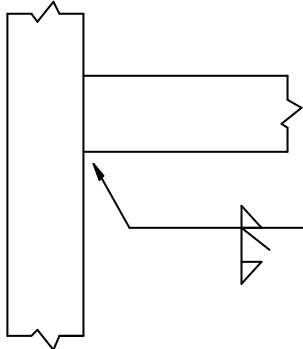
3.2 Groove weld

WELDS	SYMBOL
	
	
	

Note :

When only one joint member is to have a bevel, J-groove, or flange the arrow shall have a break, and point toward that member . The arrow need not be broken when it is obvious which member is to have a bevel, J-groove, or flange.

3.3 Combination of weld symbols

WELDS	SYMBOL
	
	
	

PIPING HANDBOOK

5. CONSTRUCTION

5.2 WELDING ROD SELECTION TABLE

1. ASTM

No.	Group No.	PIPE	SMAW		GTAW	
			Electrode	Spec.	Electrode	Spec.
1	1, 2	A106 Gr.B or C, A A53 Gr.B API 5L Br.B A672 Gr. A55~D70	E6010 E7016 E7018	AWS A5.1	ER70S-2	AWS A5.18
3	1, 3	A335 Gr.P1 A672 L65 ~ L75	E7010-A1	AWS A5.5	ER80S-D2	AWS A5.28
4	1	A335 Gr.P11	E8018-B2	AWS A5.5	ER80S-B2	AWS A5.28
5	1, 3	A335 Gr.22	E9018-B3	AWS A5.5	ER90S-B3 ER90S-B3L	AWS A5.28
	2, 3	A335 Gr.5 A335 Gr.9	E502 E505	AWS A5.4	ER502 ER505	AWS A5.9
8	1	A312 Gr.TP304 A312 Gr. TP304L A312 Gr. TP304H A312 Gr.TP316 A312 Gr.TP316L A312 Gr.TP321 A312 Gr.TP347	E308 E308L E308L-15 E308H E316 E316L E316L-15 E347 E347 E347-15	AWS A5.4	ER308 ER308L ER308H ER316 ER316L ER347 ER321 ER347	AWS A5.9
	2	A312 Gr.310S	E310	AWS A5.4	ER310	AWS A5.9
9A 9B		A333-3 A333-7	E8018-C1 E8018-C2 ENiCrFe-3	AWS A5.4 AWS A5.4 AWS A5.11	ER70S-2 ENiCr-3	AWS A5.18 AWS A5.14
42	Monel-400 (UNS 4400)	B165	ENiCu-7	AWS A5.11	ERNiCu-7	AWS A5.14
43	Inconel 600 (UNS 6600)	B567 B167	ENiCrFe-1 ENiCrFe-3	AWS A5.11	ERNiCrFe-5 ERNiCr-3	AWS A5.14
	Incinel 625 (UNS 6625)	B444	ENiCrMo-3	AWS A5.11	ERNiCrMo-3	AWS A5.14
44	Hastelloy B-2 (UNS N10665)	B619 B622	ENiMo-7	AWS A5.11	ERNiMo-7	AWS A5.14
	Hastelloy C-276 (UNS N10276)	B619 B622	ENiCrMo-4	AWS A5.11	ERNiCrMo-4	AWS A5.14
45	Alloy 800	B514-800, 800H B407-800, 800H	ENiCrFe-2 ENiCrFe-3	AWS A5.11	ERNiCr-3	AWS A5.14
	Alloy 20Cb-3 (UNS8020)	B464	E320LR	AWS A5.4	ER320LR	AWS A5.9
	Alloy 825	B423-825	-		ERNiFeCr-1	AWS A5.14

Notes :

1. P. No.(Parent No.) : ASTM Sec. IX 에서 정의한 모재의 Grouping No.
2. Group No. : P No. 로 구분된 강종을 다시 세분하는 구분
3. F No.(Filler Metal No.) : 각 용접재료 자체의 용접성 및 화학성분을 고려하여 용접봉에 부여한 No.
4. A No.(Analysis No.) : 용접금속의 화학분석에 의한 유사 Material 별 Grouping.

PIPING HANDBOOK

5. CONSTRUCTION

5.2 WELDING ROD SELECTION TABLE

2. JIS

P.NO		PIPE	ROOT PASS				FILLER PASS				
			JIS(ASME)	F.NO ASME SEC IX	A.NO ASME SEC IX	TRADE NAME (KOBE)	JIS (ASME)	F.NO ASME SEC IX	B.NO ASME SEC IX	TRADE NAME (KOBE)	
B A S S M A T E R I A L N O A S M E , A N S I	P-1	SGP STPY41 STPG38 STPG42	D4316”(E7016)	4	1	LB52U	D4301()	(3)	1	B17,B14	
							D4303()	(3)	1	TB24,TB44	
			TIG (TGS50 상당)	6	1	TGS50	D4311(E6011)	3	1	KOBE6011	
							D4316(E7016)	4	1	LB26	
		STS38,STS42 STPT38,STP42	TIG (TGS50 상당)	6	1	TGS50	D4316(E7016)	4	1	LB26 LB27	
		STS49 STPT49	TIG (TGS50 상당)	6	1	TGS50	D5016(E7016)	4	1	LB52	
	P-3	STPL39	TIG (TGSIN 상당)	6	10	TGSIN	DL5016-C-1 (E8016-G)	4	10	NBIN	
			STPA12	TIG (TGSM 상당)	6	2	TGSM	DJ1216 (E7016-A1)	4	2	CMA76 CMB76
	P-4	STPA20	TIG (TGSCM 상당)	6	3	TGSCM	- (E8016-B1)	4	3	CMB86	
			STPA22 STPA23	TIG (TGSICM 상당)	6	3	TGSICM	DT2316 (E8016-B2)	4	3	CMA96 CMB96
	P-5	STPA24	TIG (TGS2CM 상당)	6	4	TGS2CM	DT2416 (E9016-B3)	4	4	CMA106 CMB106	
			STPA25	TIG(ER502)	6	4	TGS5CM	DT2516 (E502-16)	4	4	CM5
			STPA26	TIG(ER505)	6	5	TGS9CM	- (E505-16)	4	5	CM9
	P-6	SUS304TP SUS304HTP	Y308(ER308)	6	8	TGS308	D308 (E308)	5	8	NC38 NCA308	
		SUS304LPT	Y308L(ER308L)	6	8	TGS308L	D308 (E308L)	5	8	NC38L NCA306L	
		SUS321TP SUS321HTP SUS347TP SUS347HTP	Y347(ER347)	6	8	TGS347	D347(E347)	5	8	NC37	
		SUS316TP SUS316HTP	Y316(ER316)	6	8	TGS316	D316(E316)	5	8	NC36 NCA316	
		SUS316LTP	Y316L(ER316L)	6	8	TGS316L	D316L(E316L)	5	8	NC36L NC316L	
		SUS309STP	Y309(ER309)	6	8	TGS309	D309(E309)	5	8	NC39 NCA309	
		SUS310STP	Y310(ER310)	6	10	TGS310	D310(E310)	5	9	NC30	
		SUS329JITP	Y309(ER309)	6	8	TGS309	D309(E309)	8	8	NC309 NCA309	
	P-9B	STPL46	TIG (TGS3N 상당)	6	10	TGS3N	DL5D16-E:3 (E7D16-G)	4	10	NB3N	
	P-11A	STPL70	TIG (ERNiCrFe6)	43	-	TGS7ONT	DNiCrFe-J1 (ENiCrFe-1)	43	-	NIC70A	
			Y310(ER310)	6	10	TGS310	DNiCrFe-2 (ENiCrFe-2)	43	-	NIC70S	
							DNiCrFe-3 (ENiCrFe-3)	43	-	NIC703A	

PIPING HANDBOOK

5. CONSTRUCTION

5.2 WELDING ROD SELECTION TABLE

3. 이종금속

 ELECTRODE SELECTION CHART FOR WELDING DISSIMILAR METALS ^{1,2,3}

Type of steel	20Cr-30 Ni Alloy 20 Cr-3	18Cr-8Ni Type 321 & 347	18Cr-8Ni Type 316L	18Cr-8Ni Type 316	18Cr-8Ni Type 304L	18Cr-8Ni Type 304	17 Chrome Type 430	12 Chrome Type 410S	7 to 9 Cr-Mo	5 Cr-Mo	2-1/4 Cr-Mo	1-1/4 Cr-Mo	Carbon Moly	Carbon Steel
Carbon Steel	E309 INCO-182 E-320LR	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E430 E309	E309 INCO-182	E7018-A1	E7018-A1	E7018 E7018-A1	E7018 E7018-A1	E7018 E6010	E7018 E6010
Carbon-Moly	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309	E309 INCO-182	E7018-A1	E7018-A1	E7018-A1 E9018-B3	E7018-A1 E8018-B2	E7018-A1 E7010-A1	
1-1/4 Chrome-Moly	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309	E309 INCO-182	E8018-B2	E8018-B2	E8018-B2 E8018-B3	E8018-B2		
2-1/4 Cr-1 Mo	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309	E309 INCO-182	E9018-B3	E9018-B3	E9018-B3			
5 Cr-1/2 Mo	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309	E309 INCO-182	E502 E505	E502				
7 to 9 Cr-Mo	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309	E309 INCO-182	E505					
12 Chrome	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309 INCO-182	E309	E309 E430 INCO-182						
17 Chrome Type 430	E320LR E309	E309	E309	E309	E309	E309	E430							
18 Cr-8Ni Type 304	E309 E308 E320LR	E308 E347	E308 E316	E308 E316	E308 E308L	E308								
18 Cr-8Ni Type 304L	E308L E316L E320LR	E308L E347	E308L E316L	E308 E316	E308L									
18 Cr-8Ni Type 316	E309Mo E316	E308 E316	E316 E316L	E316										
18 Cr-8Ni Type 316L	E316L E320LR	E316L E347	E316L											
18 Cr-8Ni Type 321 & 347	E320LR	E347												
20 Cr-30 Ni Alloy 20 Cr-3	E320LR													

Notes :

1. Root passes of pipe welds made by other processes (o.g., GTAW or GMAW) should be performed with matching composition filler metal.
2. In this table the electrode which is listed first is preferred except that for 18 Cr-8 Ni stainless steels welded to carbon steels use INCO Inconel-182 for operating temperatures above 500°F if it has sufficient corrosion resistance.
3. INCO Weld A or INCO-112 may be substituted for INCO-182 ; and EXX 15 or EXX16 may be substituted for EXX18.

Unit : kg / Dia-inch

TH' K(Sch.)	PIPE SIZE	1/2"	3/4"	1"	1.1/2"	2"	2.1/2"
5	TH' K(mm)	1.65	1.65	1.65	1.65	1.65	2.11
	TIG	-	0.019	0.019	0.019	0.017	0.028
	ARC	-	-	-	-	-	-
	TOTAL	-	0.019	0.019	0.019	0.017	0.028
10	TH' K(mm)	2.11	2.11	2.77	2.77	2.77	3.05
	TIG	0.028	0.024	0.031	0.028	0.026	0.036
	ARC	-	-	-	-	-	-
	TOTAL	0.028	0.024	0.031	0.028	0.026	0.036
20	TH' K(mm)	-	-	-	-	-	-
	TIG	-	-	-	-	-	-
	ARC	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-
40	TH' K(mm)	2.77	2.87	3.38	3.68	3.91	5.16
	TIG	0.040	0.033	0.036	0.037	0.038	0.012
	ARC	-	-	-	-	-	0.070
	TOTAL	0.040	0.033	0.036	0.037	0.038	0.082
80	TH' K(mm)	3.73	3.91	4.55	5.08	5.54	7.01
	TIG	0.054	-	0.050	0.055	0.013	0.012
	ARC	-	-	-	-	0.081	0.011
	TOTAL	0.054	-	0.050	0.055	0.093	0.023
160	TH' K(mm)	4.75	5.54	6.35	7.14	8.71	9.52
	TIG	0.070	0.013	0.014	0.013	0.013	0.012
	ARC	-	0.080	0.087	0.100	0.155	0.174
	TOTAL	0.070	0.093	0.101	0.113	0.167	0.186
XXS	TH' K(mm)	7.47	7.82	9.09	10.16	11.07	14.02
	TIG	0.020	0.015	0.014	0.013	0.013	0.012
	ARC	0.152	0.131	0.123	0.240	0.225	1.978
	TOTAL	0.172	0.145	0.137	0.253	0.238	1.990

Unit : kg / Dia-inch

TH K(Sch.)	PIPE SIZE	3"	3 1/2"	4"	5"	6"	8"
5	TH K(mm)	2.11	2.11	2.11	2.77	2.77	2.77
	TIG	0.029	0.028	0.028	0.034	0.033	0.018
	ARC	-	-	-	-	-	-
	TOTAL	0.029	0.028	0.028	0.034	0.033	0.018
10	TH K(mm)	3.05	3.05	3.05	3.40	3.40	3.76
	TIG	0.039	0.038	0.037	0.040	0.051	0.055
	ARC	-	-	-	-	-	-
	TOTAL	0.039	0.038	0.037	0.040	0.051	0.055
20	TH K(mm)	-	-	-	-	-	6.35
	TIG	-	-	-	-	-	0.017
	ARC	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	0.017
40	TH K(mm)	5.49	5.74	6.02	6.55	7.11	8.18
	TIG	0.012	0.012	0.019	0.018	0.017	0.017
	ARC	0.081	0.082	0.073	0.086	0.121	0.145
	TOTAL	0.093	0.094	0.091	0.105	0.138	0.162
60	TH K(mm)	-	-	-	-	-	10.31
	TIG	-	-	-	-	-	0.038
	ARC	-	-	-	-	-	0.203
	TOTAL	-	-	-	-	-	0.241
80	TH K(mm)	7.62	8.08	8.56	9.52	10.97	12.70
	TIG	0.012	0.012	0.019	0.018	0.017	0.016
	ARC	0.126	0.134	0.134	0.158	0.235	0.279
	TOTAL	0.138	0.146	0.152	0.176	0.252	0.296
100	TH K(mm)	-	-	-	-	-	15.06
	TIG	-	-	-	-	-	0.016
	ARC	-	-	-	-	-	0.366
	TOTAL	-	-	-	-	-	0.382
120	TH K(mm)	-	-	11.13	12.70	14.27	18.24
	TIG	-	-	0.019	0.015	0.016	0.015
	ARC	-	-	0.204	0.290	0.345	0.457
	TOTAL	-	-	0.223	0.305	0.361	0.472
140	TH K(mm)	-	-	-	-	-	20.62
	TIG	-	-	-	-	-	0.015
	ARC	-	-	-	-	-	0.502
	TOTAL	-	-	-	-	-	0.517
160	TH K(mm)	11.13	-	13.49	15.87	18.24	23.01
	TIG	0.012	-	0.019	0.015	0.015	0.015
	ARC	0.194	-	0.282	0.412	0.513	0.732
	TOTAL	0.206	-	0.301	0.427	0.528	0.747
XS	TH K(mm)	7.62	-	8.56	9.52	10.97	12.70
	TIG	-	-	-	-	-	-
	ARC	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-
XXS	TH K(mm)	15.24	16.15	17.12	19.05	21.95	22.22
	TIG	0.012	0.012	0.019	0.015	0.014	0.015
	ARC	0.360	0.400	0.423	0.452	0.698	0.649
	TOTAL	0.373	0.412	0.441	0.467	0.712	0.663

Unit : kg / Dia-inch

TH' K(Sch.)	PIPE SIZE	10"	12"	14"	16"	18"	20"
5	TH' K(mm)	3.40	4.19	3.96	4.19	4.19	4.78
	TIG	0.50	0.011	-	-	-	-
	ARC	-	0.065	-	-	-	-
	TOTAL	0.050	0.076	-	-	-	-
10	TH' K(mm)	4.19	4.57	6.35	6.35	6.35	6.35
	TIG	0.011	0.011	0.010	0.010	0.016	0.016
	ARC	0.066	0.072	0.102	0.102	0.074	0.094
	TOTAL	0.077	0.083	0.112	0.112	0.090	0.110
20	TH' K(mm)	6.35	6.35	7.92	7.92	7.92	9.52
	TIG	0.011	0.011	0.010	0.010	0.016	0.016
	ARC	0.070	0.108	0.113	0.137	0.129	0.168
	TOTAL	0.081	0.119	0.123	0.147	0.145	0.184
40	TH' K(mm)	9.27	10.31	11.13	12.70	14.27	15.06
	TIG	0.017	0.017	0.016	0.010	0.016	0.016
	ARC	0.173	0.199	0.210	0.266	0.347	0.339
	TOTAL	0.189	0.216	0.225	0.276	0.362	0.355
60	TH' K(mm)	-	-	15.06	16.66	19.05	20.62
	TIG	0.016	0.016	0.015	0.015	0.015	0.015
	ARC	0.578	0.330	0.336	0.336	0.540	0.563
	TOTAL	0.295	0.347	0.351	0.352	0.556	0.579
80	TH' K(mm)	15.06	17.45	19.05	21.41	23.80	26.19
	TIG	0.016	0.016	0.015	0.015	0.015	0.015
	ARC	0.864	0.337	0.493	0.644	0.770	0.848
	TOTAL	0.881	0.353	0.508	0.659	0.785	0.862
100	TH' K(mm)	18.24	21.41	23.80	26.19	29.36	32.54
	TIG	0.016	0.016	0.015	0.015	0.015	0.015
	ARC	0.494	0.639	0.719	0.739	1.096	1.193
	TOTAL	0.510	0.654	0.734	0.754	1.111	1.207
120	TH' K(mm)	21.41	25.40	27.76	30.94	34.92	38.10
	TIG	0.015	0.015	0.014	0.015	0.014	0.014
	ARC	0.647	0.779	0.855	1.094	1.338	1.563
	TOTAL	0.662	0.794	0.869	1.108	1.352	1.577
140	TH' K(mm)	25.40	28.57	31.75	36.53	39.67	44.45
	TIG	0.015	0.015	0.014	0.014	0.014	0.014
	ARC	0.688	0.954	1.157	1.450	1.679	2.054
	TOTAL	0.703	0.969	1.170	1.463	1.693	2.068
160	TH' K(mm)	28.57	33.32	35.71	40.46	45.24	49.99
	TIG	0.014	0.014	0.014	0.013	0.014	0.013
	ARC	0.966	1.370	1.396	1.742	2.123	2.534
	TOTAL	0.980	1.384	1.409	1.755	2.137	2.547
XS	TH' K(mm)	12.70	12.70	12.70	12.70	12.70	12.70
	TIG	-	-	0.016	0.010	0.015	-
	ARC	-	-	0.258	0.266	0.261	-
	TOTAL	-	-	0.274	0.276	0.276	-
XXS	TH' K(mm)	25.40	25.40	-	-	-	-
	TIG	-	-	-	-	-	-
	ARC	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-

Unit : kg / Dia-inch

TH'K(Sch.)	PIPE SIZE	24"	28"	30"	32"	34"	36"	42"
5	TH'K(mm)	5.54	-	6.35	-	-	-	-
	TIG	-	-	-	-	-	-	-
	ARC	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-
10	TH'K(mm)	6.35	7.92	7.92	7.92	7.92	7.92	-
	TIG	0.016	0.016	0.016	0.016	0.016	0.016	-
	ARC	0.094	0.129	0.126	0.129	0.129	0.129	-
	TOTAL	0.110	0.145	0.143	0.145	0.145	0.145	-
20	TH'K(mm)	9.52	12.70	12.70	12.70	12.70	12.70	-
	TIG	0.016	0.016	0.016	0.016	0.016	0.016	0.016
	ARC	0.168	0.537	0.258	0.258	0.258	0.258	0.016
	TOTAL	0.184	0.553	0.274	0.274	0.274	0.274	0.032
40	TH'K(mm)	17.45	-	-	17.48	17.48	19.05	-
	TIG	0.016	-	0.021	0.016	0.016	0.016	0.016
	ARC	0.431	-	0.495	0.429	0.429	0.496	0.499
	TOTAL	0.446	-	0.516	0.445	0.445	0.512	0.514
60	TH'K(mm)	24.59	-	-	-	-	-	-
	TIG	0.015	-	-	-	-	-	-
	ARC	0.753	-	-	-	-	-	-
	TOTAL	0.768	-	-	-	-	-	-
80	TH'K(mm)	30.94	-	-	-	-	-	-
	TIG	0.015	-	-	-	-	-	-
	ARC	1.093	-	-	-	-	-	-
	TOTAL	1.108	-	-	-	-	-	-
100	TH'K(mm)	38.89	-	-	-	-	-	-
	TIG	0.015	-	-	-	-	-	-
	ARC	1.626	-	-	-	-	-	-
	TOTAL	1.641	-	-	-	-	-	-
120	TH'K(mm)	46.02	-	-	-	-	-	-
	TIG	0.014	-	-	-	-	-	-
	ARC	2.179	-	-	-	-	-	-
	TOTAL	2.193	-	-	-	-	-	-
140	TH'K(mm)	52.37	19.10	-	19.10	19.10	-	-
	TIG	0.014	0.016	-	0.016	0.016	-	-
	ARC	2.755	0.492	-	0.492	0.492	-	-
	TOTAL	2.769	0.507	-	0.507	0.507	-	-
160	TH'K(mm)	59.51	-	25.40	25.40	25.40	25.40	25.40
	TIG	0.013	-	0.016	0.016	0.016	0.016	0.016
	ARC	3.527	-	0.781	0.750	0.781	0.781	0.856
	TOTAL	3.540	-	0.797	0.765	0.797	0.797	0.872
XS	TH'K(mm)	-	-	28.58	28.58	25.58	25.58	25.58
	TIG	-	-	0.015	0.015	0.015	0.016	0.016
	ARC	-	-	0.954	0.974	0.953	0.953	1.142
	TOTAL	-	-	0.969	0.990	0.969	0.969	1.158
XXS	TH'K(mm)	-	-	-	-	-	-	38.10
	TIG	-	-	-	-	-	-	0.015
	ARC	-	-	-	-	-	-	1.562
	TOTAL	-	-	-	-	-	-	1.577

Note : 현장 loss 분 55%를 감안하여 산출된 용접봉 소요량임.

Letter Designation	Welding and allied processes	Letter Designation	Welding and allied processes
AAC	air carbon arc cutting	IB	induction brazing
AAW	air acetylene welding	INS	iron soldering
ABD	adhesive bonding	IRB	infrared brazing
AB	arc brazing	IRS	infrared soldering
AC	arc cutting	IS	induction soldering
AHW	atomic hydrogen welding	IW	induction welding
AOC	oxygen arc cutting	LBC	laser beam cutting
AW	arc welding	LBW	laser beam welding
B	brazing	LOC	oxygen lance cutting
BB	block brazing	MAC	metal arc cutting
BMAW	bare metal arc welding	OAW	oxyacetylene welding
CAC	carbon arc cutting	OC	oxygen cutting
CAW	carbon arc welding	OFC	oxyfuel gas cutting
CAW-G	gas carbon arc welding	OFC-A	oxyacetylene cutting
CAW-S	shielded carbon arc welding	OFC-H	oxyhydrogen cutting
CAW-T	twin carbon arc welding	OFC-N	oxynatural gas cutting
CW	cold welding	OFC-P	oxypropane cutting
DB	dip brazing	OFW	oxyfuel gas welding
DFB	diffusion brazing	OHW	oxyhydrogen welding
DFW	diffusion welding	PAC	plasma arc cutting
DS	dip soldering	PAW	plasma arc welding
EASP	electric arc spraying	PEW	percussion welding
EBC	electron beam cutting	PGW	pressure gas welding
EBW	electron beam welding	POC	metal power cutting
ESW	electroslag welding	PSP	plasma spraying
EXB	explosion welding	RB	resistance soldering
FB	furnace brazing	RPW	projection welding
FCAW	flux cored arc welding	RS	resistance soldering
FCAW-EG	flux cored arc welding-electrogas	RSEW	resistance seam welding
FLB	flow brazing	RSW	resistance spot welding
FLOW	flow welding	ROW	roll welding
FLSP	flame spraying	RW	resistance welding
FOC	chemical flux cutting	S	soldering
FOW	forge welding	SAW	submerged arc welding
FRW	friction welding	SAW-S	series submerged arc welding
FS	furnace soldering	SMAC	shielded metal arc cutting
FW	flash welding	SMAW	shielded metal arc welding
GMAC	gas metal arc cutting	SSW	solid state welding
GMAW	gas metal arc welding	SW	stud arc welding
GMAW-EG	gas metal arc welding-electrogas	TB	torch brazing
GMAW-P	gas metal arc welding-pulsed arc	TC	thermal cutting
GMAW-S	gas metal arc welding-short circuiting arc	TCAB	twin carbon arc brazing
GTAC	gas tungsten arc cutting	THSP	thermal spraying
GTAW	gas tungsten arc welding	TS	torch soldering
GTAW-P	gas tungsten arc welding – pulsed arc	TW	thermit welding
HFRW	high frequency resistance welding	USW	ultrasonic welding
HPW	hot pressure welding	UW	upset welding
		WS	wave soldering

PIPING HANDBOOK

5. CONSTRUCTION

5.5 SPECIFICATION FOR ELECTRODE

1. All Welding shall be by a Metal-Arc Process

2. Welding Eletrodes shall be as follows :

1) Covered eletrodes shall be in accordance with the follows :

Material	Specification	Classification
Carbon Steel	AWS A-5.1, ASME SFA-5.1	E 70XX
Carbon - 1/2%Mo	AWS A-5.5, ASME SFA-5.5	E 7010-A1 or 701-A1
1%Cr - 1/2%Mo	AWS A-5.5, ASME SFA-5.5	E 80XX-B2 or B2L
1 1/4%Cr - 1/2%Mo	AWS A-5.5, ASME SFA-5.5	E 80XX-B2 or B2L
2 1/4%Cr - 1%Mo	AWS A-5.5, ASME SFA-5.5	E 90XX-B3 or B3L
3%Cr - 1%Mo	AWS A-5.4, ASME SFA-5.4	E 502XX
5%Cr - 1/2%Mo	AWS A-5.4, ASME SFA-5.4	E 502XX
7%Cr - 1/2%Mo	AWS A-5.4, ASME SFA-5.4	E 7 Cr XX
9%Cr - 1%Mo	AWS A-5.4, ASME SFA-5.4	E 505XX
2 1/4% Ni	AWS A-5.5, ASME SFA-5.5	E 80XX-C1
3 1/2% Ni	AWS A-5.5, ASME SFA-5.5	E 80XX-C2
Type 304 or 304H	AWS A-5.4, ASME SFA-5.4	E 308XX
Type 304L	AWS A-5.4, ASME SFA-5.4	E 308LXX
Type 309	AWS A-5.4, ASME SFA-5.4	E 309XX
Type 310	AWS A-5.4, ASME SFA-5.4	E 310XX
Type 316 or 316H	AWS A-5.4, ASME SFA-5.4	E 316XX
Type 316L	AWS A-5.4, ASME SFA-5.4	E 316LXX
Type 317	AWS A-5.4, ASME SFA-5.4	E 317XX
Type 317L	AWS A-5.4, ASME SFA-5.4	E 317XX (%Carbon shall be 0.04 max.)
Type 321 or 321H	AWS A-5.4, ASME SFA-5.4	E 347XX
Type 337 or 347H	AWS A-5.4, ASME SFA-5.4	E 347XX

* Elctrode coatings designed XX above may be 15, 16 or 18.

Coated electrodes shall be thoroughly dried prior to use.

2) Bare electrodes(for inert gas and submerged arc welding) shall be in accordance with the following.

Material	Specification	Classification
Carbon Steel	AWS A-5.17, ASME SFA-5.17	ER 502
3%Cr - 1%Mo	AWS A-5.9, ASME SFA-5.9	ER 502
5%Cr - 1/2%Mo	AWS A-5.9, ASME SFA-5.9	ER 308
Type 304 or 304H	AWS A-5.9, ASME SFA-5.9	ER 308L
Type 304L	AWS A-5.9, ASME SFA-5.9	ER 309
Type 309	AWS A-5.9, ASME SFA-5.9	ER 310
Type 310	AWS A-5.9, ASME SFA-5.9	ER 316
Type 316 or 316H	AWS A-5.9, ASME SFA-5.9	ER 316L
Type 316L	AWS A-5.9, ASME SFA-5.9	ER 317
Type 317	AWS A-5.9, ASME SFA-5.9	ER 317
Type 317L	AWS A-5.9, ASME SFA-5.9	ER 317 (%Carbon shall be 0.03 max.)
Type 321 or 321H	AWS A-5.9, ASME SFA-5.9	ER 321 or 327
Type 337 or 347H	AWS A-5.9, ASME SFA-5.9	ER 347

* Permanently welded-in back-up strips shall not be used.

3. References(Latest Edition)

- 1) Petroleum Refinery Piping Code(ANSI B 31.3), a section of the American National Standard Code for Pressure piping.
- 2) AWS A-5.1, ASME SFA-5.1, Specification for Mild steel Covered Arc-Welding Electrodes.
- 3) AWS A-5.4, ASME SFA-5.4, Specification for Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes.
- 4) AWS A-5.5, ASME SFA-5.5, Specification for Low-Alloy Steel Covered Arc-Welding electrodes.
- 5) AWS A-5.9, ASME SFA-5.9, Specification for Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes.
- 6) AWS A-5.17, ASME SFA-5.17, Specification for Bare Mild Steel Electrodes and Fluxes for Submerged Arc-Welding.
- 7) Pipe fabrication Institute Standard ES-24, Pipe Bending Tolerance Minimum Bending Radii-Minimum Tangents.

4. AWS Filler Metal Specifications and Related Documents

AWS Designation	Title
A 5.01	Filler Procurement Guidelines
A 5.1	Specification for Carbon Steel Electrodes for shielded Metal Arc Welding
A 5.2	Specification for Carbon and Low Alloy steel Rods for Oxyfuel Gas Welding
A 5.3	Specification for Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding
A 5.4	Specification for Stainless Steel Welding Electrodes for Shielded Metal Arc Welding
A 5.5	Specification for Low Alloy Steel Covered Arc Welding Electrodes
A 5.6	Specification for Covered Copper and Copper Alloy Arc Welding Electrodes
A 5.7	Specification for Copper and Copper Alloy Bare Welding Rods and Electrodes
A 5.8	Specification for Filler Metals for Brazing and Braze Welding
A 5.9	Specification for Bare Stainless Steel Welding Electrodes and Rods
A 5.10	Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
A 5.11	Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding
A 5.12	Specification for Tungsten and Tungsten Alloy Electrodes for Arc Welding and Cutting
A 5.13	Specification for Solid Surfacing Welding Rods and Electrodes
A 5.14	Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods
A 5.15	Specification for Welding Electrodes and Rods for Cast Iron
A 5.16	Specification for Titanium and Titanium Alloy Welding Electrodes and Rods
A 5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
A 5.18	Specification for Carbon Steel Filler Metals for Gas Shielded Arc Welding
A 5.19	Specification for Magnesium Alloy Welding Electrodes and Rods
A 5.20	Specification for Carbon Steel Electrodes for Flux Cored Arc welding
A 5.21	Specification for Composite Surfacing Welding Rods and Electrodes
A 5.22	Specification for Flux Cored Corrosion-Resisting Chromium and Chromium-Nickel Steel Electrodes
A 5.23	Specification for Low Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
A 5.24	Specification for Zirconium and Zirconium Alloy Welding Electrodes and Rods
A 5.25	Specification for Carbon and Low Alloy Steel Electrodes and Fluxes for Electrodes Welding
A 5.26	Specification for Carbon and Low Alloy Steel Electrodes and Electrogas Welding
A 5.27	Specification for Copper and Copper Alloy Rods for Oxyfuel Gas Welding
A 5.28	Specification for Low Alloy Steel Filler Metals for Gas Shielded Arc Welding
A 5.29	Specification for Low Alloy Steel Electrodes for Flux Cored Arc Welding
A 5.30	Specification for Consumable Inserts
A 5.31	Specification for Fluxes for Brazing and Braze Welding

1. 연강용접용

해 당 규 격			용 도
AWS	JIS	KS	
-	D4303	E4303	일반구조물 용접봉
-	D4303	E4303	전자세 고능률 용접봉
E6010	-	-	주강보수용 및 파이프 용접용
E6011	D4311	E4311	파이프 및 일반구조물 용접용
E6013	D4313	E4313	일반구조물 용접용 저흡(Low Fume) 용접용
E6013	D4313	E4313	박강판, 입향하진 용접용
E6019	D4301	E4301	조선전용, 강도부재용
E6027	D4327	E4327	고능률 필렛 용접 저흡(Low Fume) 용접용
E7014	D4313	E4313	박판, 고능률 용접용
E7016	D4316	E4316	일면 용접용
E7016	D4316	E4316	중강도부재, 후판용접용
E7024	D4324	E4324	고능률 필렛 용접용

2. 고장력강용

해 당 규 격			용 도
AWS	JIS	KS	
-	DA5026-W	-	50킬로급 내후성 고장력강용
E7016	D5016	D5016	50킬로급 고장력강용
E7016	D5016	D5016	50킬로급 고장력강용, 저흡(Low Fume) 용접봉
E7016	D5016	D5016	극저수소계 50킬로급 고장력 강용
E7016	D5316	D5316	55킬로급 고장력강용
E7016-G	DL5016-4AP0	-	50킬로급 고장력강용 및 저온 알루미늄킬드 강용
E7016-G	DL5016-6A1	-	50킬로급 고장력강용 및 저온 알루미늄킬드 강용
E7018	D5016	D5016	50킬로급 고장력강 고능률용
E7018-1	D5016	-	50킬로급 고장력강용
E7018-W1	-	-	50킬로급 내후성 고장력강용
E7028	D5026	D5026	50킬로급 저수소계 용접용(아래보기 및 수평필렛 용접용)
E7048	D5016	D5016	연강 및 50킬로급 고장력강의 입향하진 용접용
E8016-G	D5316	D5316	60킬로급 고장력 강용
E8018-G	D5826	-	60킬로급 고장력 강용
E8018-W2	-	-	60킬로급 내후성 고장력강용
E9016-G	D5816	D5816	60킬로급 고장력 강용
E9018-M	-	-	60킬로급 고장력 강용
E10016-G	D7016	-	70킬로급 고장력 강용
E11016-G	D8016	-	80킬로급 고장력 강용

3. 주철용

해 당 규 격			용 도
AWS	JIS	KS	
ENi-C I	DFC Ni	EGC Ni	Ni계 주철보수용
ENiFe-C I	DFC NiFe	EGC NiFe	Ni-Fe 주철보수용
Est	DFC Fe	EGC-Fe	주철보수용

4. 저합금강용(저온용, 내열강용)

해 당 규 격		용 도
AWS	JIS	
E7010-A1	-	0.5%Mo 강의 파이프 및 일반구조물 용접
E7016-A1	DT1216	0.5%Mo 내열강 및 주강용
E7018-A1	-	0.5%Mo 내열강 및 주강용
E8016-B1	-	0.5%Cr-0.5%Mo강용
E8016-B2	DT2316	1.25%Cr-0.5%Mo강용
E8016-B5	-	0.5%Cr-1%Mo강용
E8016-C1	DL5016-6AP2	2.5%Ni강 및 저온용강
E8016-C2	DL5016-6P3	3.25%Ni 강용
E8016-C3	DL5016-4A1	60킬로급 고장력강 및 1%Ni강용
E8018-B2	DT2318	1.25%Cr-0.5%Mo 내열강 및 주강용
E8018-C1	-	2.5%Ni강 및 저온용강
E8018-C3	DL5026-4A1	60킬로급 고장력강 및 1%Ni강용
E9016-B3	DT2416	2.25%Cr-1%Mo강용
E9018-B3	DT2418	2.25%Cr-1%Mo강용
E11018M	-	80킬로급 고장력 강용

5. 표면강화 육성용

해 당 규 격		용 도
AWS	JIS	
-	DF2A-250-R	금속간 경마모용(저합금페라이트계)
-	DF2A-350-R	금속간 경마모용
-	DF2A-300-B	금속간 경마모용
-	DF2A-400-B	금속간 마모용
-	DF2A-450-B	금속간 마모 및 경코사 마모용
-	DF2B-500-B	금속간 마모 및 경코사 마모용
-	DF2B-600-B	금속간 마모 및 경코사 마모용
-	DF3C-600-B	토사마모용
-	DFCrA-600-BR	토사마모용
-	DFMA-250-B	고충격 내마모용

6. Ni 합금강용

해 당 규 격			용 도
AWS	JIS	KS	
EniCrFe-4	DNiCrFe-2-16	DNiCrFe-4	인코넬계 합금, 9%Ni 강용

7. 불활성가스 용접용

해 당 규 격		용 도
AWS	JIS	
ER100S-1	-	70킬로급 저합금 고장력강용
ER308	Y308	18%Cr-12%Ni-2%Mo강용
ER308L	Y308L	
ER308	Y308	18%Cr-8%Ni 강용
ER308L	Y308L	극저탄소 18%Cr-8%Ni 강용
ER309	Y309	22%Cr-12%Ni 스테인레스강용
ER309L	Y309L	22%Cr-12%Ni 스테인레스강과 연강의 이중금속용접용, 18%Cr-8%Ni 크래드강의 크래드측의 용접용
ER309	Y309	22%Cr-12%Ni 스테인레스강과 연강의 이중금속용접용, 크래드강의 크래드측의 용접용
ER309L	Y309L	22%Cr-12%Ni 스테인레스강과 연강의 이중금속용접용, 18%Cr-8%Ni 크래드강의 크래드측의 용접용
ER310	Y310	25%Cr-20%Ni 스테인레스강용
ER310	Y310	25%Cr-20%Ni 강용
ER316	Y316	18%Cr-12%Ni-2%Mo 스테인레스 강용
ER316L	Y316L	
ER316	Y316	18%Cr-12%Ni-Mo 강용, 18%Cr-12%Ni-Mo 강 및 극저탄소, 18%Cr-12%Ni 강용
ER316L	Y316L	
ER70S-G	-	연강 및 50킬로급 고장력 강용
ER70S-6	-	연강 및 50킬로급 고장력 강용

8. CO₂ Wire 용접봉

해 당 규 격		용 도
AWS	JIS	
ER70S-6	YGW12	연강 및 50킬로급 고장력 강용
ER70S-G	YGW11	
ER70S-3	YGW16	
ER70S-G	YGW15	
ER80S-G	YGW21	55킬로급 고장력강 고능률 용접용

9. 산소-아세틸렌가스 용접봉

해 당 규 격			용 도
AWS	JIS	KS	
A5.2	Z3201	D7005	연강 및 저합금강의 산소, 아세틸렌가스 용접

10. 플렉스코어드 와이어 용접용

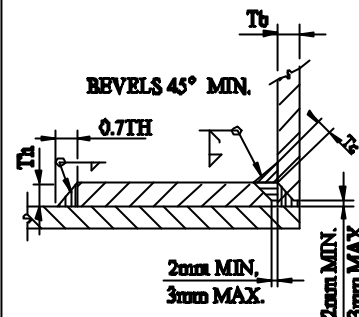
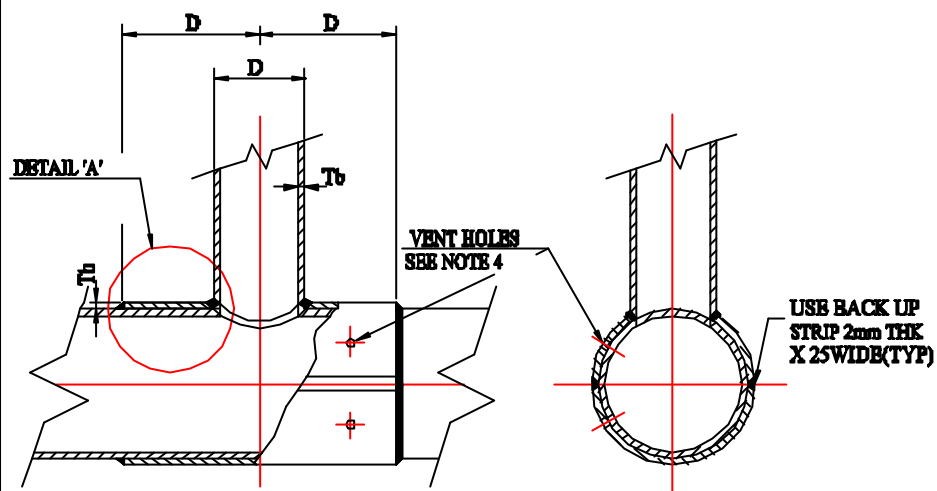
해 당 규 격		용 도
AWS	JIS	
E71T-1 E71T-1 E71T-1, E71T-9	YFW-C50DR YFW-C502R YFW-C502R	연강 및 50킬로급 고장력강의 전자세 용접용
E71T-1M	YFW-A502R	연강 및 50킬로급 혼합가스전용 전자세 용접용
E70T-1	YFW-C50DM	연강 및 50킬로급 고장력강의 고능률 용접용
E71T-5MJ	YFW-A502B	연강 및 50킬로급 저수소계 용접용
E70C-6M	YFW-A50DM	연강 및 50킬로급 고장력강 용접용(혼합가스용)
E70T-1	YFW-C50DM	연강 및 50킬로급 고장력강 용접용(Temdem용)
EG70T-2	YFEG-22C	연강 및 50킬로급 일렉트로드가스 용접용
E71T-5	YFW-C502B	연강 및 50킬로급 저수소계 용접용
E70C-3C	YFW-C50DM	연강 및 50킬로급 고장력강 용접용(박판용)
-	YFA-50W	연강 및 50킬로급 내후성 고장력강용
E81T1-W2	YFA-58W	60킬로급 내후성 고장력강용
E81T1-Ni1	YFW-C602R	60킬로급 고장력강용(전자세용)
E81T1-Ni1M	-	저온후열처리용(혼합가스용)
E81T1-K2	YFL-C506R	60킬로급 고장력강의 전자세용
E81T1-K2M	YFL-A506R	혼합가스용 저온용
E80C-G	YF1CM-G	1.25%Cr-0.5%Mo 내열강 용접용
E308LT1-1/-4	YF308LC	(저탄소) 18%Cr-8%Ni 스테인레스 강용
E309LT1-1/-4	YF309LC	(저탄소) 22%Cr-12%Ni 스테인레스 강용
E309LT0-G	YF309LG	(저탄소) 22%Cr-12%Ni 스테인레스 강용
E309LMoT1-1/-4	YF309MoLC	이종용접, Clad강 용접, Overlay용접용
E316LT1-1/-4	YF316LC	(저탄소) 18%Cr-12%Ni-2%Mo 스테인레스 강용
E317LT1-1/-4	YF317LC	19%Cr-13%Ni-3%Mo 스테인레스강용
E347T1-1/-4	YF347C	18%Cr-8%Ni-Nb 스테인레스강용
E308LT0-1/-4	YF308LC	18%Cr-8%Ni 스테인레스강용
E309LT0-1/-4	YF309LC	(저탄소) 22%Cr-12%Ni 스테인레스강(하향전용)
E309LMoT0-1/-4	YF309MoLC	이종용접, Clad강 용접, Overlay용접용
E316LT0-1/-4	YF316LC	18%Cr-12%Ni-2%Mo 스테인레스강용
E409T0-G	-	SUS409 용접용 스테인레스강
E430T0-G	YF430G	SUS430 용접용 스테인레스강
-	-	SUS436 용접용 스테인레스강
-	-	SUS409,430,436,439 자동차머플러용

11. 스테인레스강용

해 당 규 격			용 도
AWS	JIS	KS	
E308-16	D308-16	D308-16	18%Cr-8%Ni 스테인레스강용
E308L-16	D308L-16	D308L-16	극저탄소 18%Cr-8%Ni 스테인레스강용
E308Mo-16	-	D308Mo-16	18%Cr-8%Ni-2.5%Mo 스테인레스강용
E309-16	D309-16	D309-16	22%Cr-12%Ni 스테인레스강과 연강의 접합용접용
E309L-16	D309L-16	D309L-16	극저탄소 22%Cr-12%Ni 스테인레스강과 연강의 접합용접용
E309Mo-16	D309Mo-16	D309Mo-16	22%Cr-12%Ni-2.5%Mo 스테인레스강용
E309MoL-16	D309MoL-16	D309MoL-16	극저탄소 22%Cr-12%Ni-2.5%Mo 스테인레스강용
E310-15	D310-15	D310-15	25%Cr-20%Ni 스테인레스강용
E316-16	D316-16	D316-16	18%Cr-12%Ni-Mo 스테인레스강용
E317-16	D317-16	D317-16	18%Cr-12%Ni-3.5%Mo 스테인레스강용
E317L-16	D317L-16	D317L-16	극저탄소 18%Cr-12%Ni-3.5%Mo 스테인레스강용
E347-16	D347-16	D347-16	STS347, 321 스테인레스강용
D312-16	D312-16	D312-16	STS312 스테인레스강용, 이중금속의 접합용(만능봉)
D316L-16	D316L-16	D316L-16	극저탄소 18%Cr-12%Ni-Mo 스테인레스강용

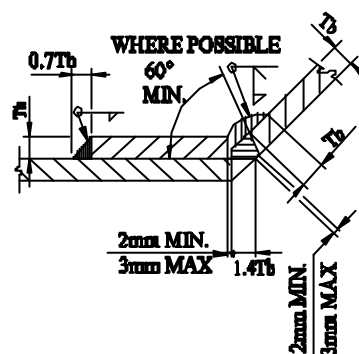
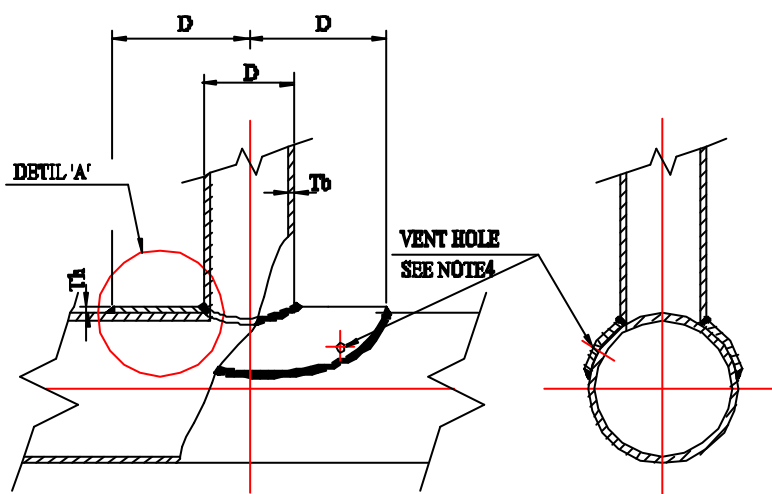
12. 서브머지드 용접용

해 당 규 격		용 도
AWS	JIS	
F7A(P)4-EL8	S502-H	단층용접용, 일면용접용
F7A(P)6-EM12K	S502-H	중,후판중요구조물의 단, 다층용접용
F7A(P)8-EH14	S502-H	저온용강의 다층용접용
F7A(P)2-EL8	S502-H	일반구조물의 단, 다층용접용, 필렛용접용
F7A(P)4-EH14	S502-H	중요구조물의 다층용접용, 횡향용접용
F7A(P)8-EH14	S502-H	저온용강의 단, 다층용접용
F7A(P)6-EH14	S502-H	중용구조물의 단, 다층용접용
F7A(P)Z-EH14	S502-H	일반구조물의 단, 다층용접용
-	-	일면용접용
F7A(P)0-EL8	S502-H	대전류 고능률 용접용
F7A(P)8-EH14	S502-H	저온용강의 다층용접용
F7A(P)2-EH14	S502-H	일반구조물의 단, 다층용접용, 횡향용접용
F8A(P)4-EH14	-	60킬로급 고장력강용
F8A(P)4-EA3-G	S501-H	일반구조물의 박판고속용접용
-	FSS-B1/YS308(L)	18%Cr-8%Ni 강용
-	FSS-B1/YS309(L)	22%Cr-12%Ni 강용
-	FSS-B1/YS316(L)	18%Cr-12%Ni-2%Mo 강용



DETAIL 'A'
SEE NOTE 5

FULL ENCIRCLEMENT REINFORCING PAD



DETAIL 'B'

REINFORCING PAD

GENERAL NOTES

1. REINFORCING PADS SHALL BE USED BY STRESS ANALYSIS REQUIREMENT.
2. REINFORCING PADS SHALL BE FABRICATED WITH THE SAME MATERIAL AND THICKNESS OF SERVICE PIPE (HEADER PIPE).
3. WELD PROCEDURE SHALL CONFORM TO LCS-L001. PIPE TO PIPE WELD TO BE COMPLETED BEFORE REIN. PAD WELD IS STARTED.

4. A VENT HOLE, TAPPED 3/8" N.P.T, SHALL BE PROVIDED IN EACH PAD, PRIOR TO INSTALLATION. HOLE TO BE AT THE SIDE AND NOT AT THE CROTCH, AFTER TIGHTNESS TESTING. THE VENT HOLE SHALL BE PLUGGED WITH STIFF GREASE.
5. THE NOTATION AND SYMBOLS USED ON THIS DWG ARE AS FOLLOWS ;
 - tc : 0.7Tb BUT NOT LESS THAN
 - Tb : ACTUAL THICKNESS OF BRANCH WALL LESS CORROSION ALLOWANCE. (mm)
 - Th : ACTUAL THICKNESS OF HEADER WALL ALSO NOMINAL THICKNESS OF PAD,



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

5. CONSTRUCTION

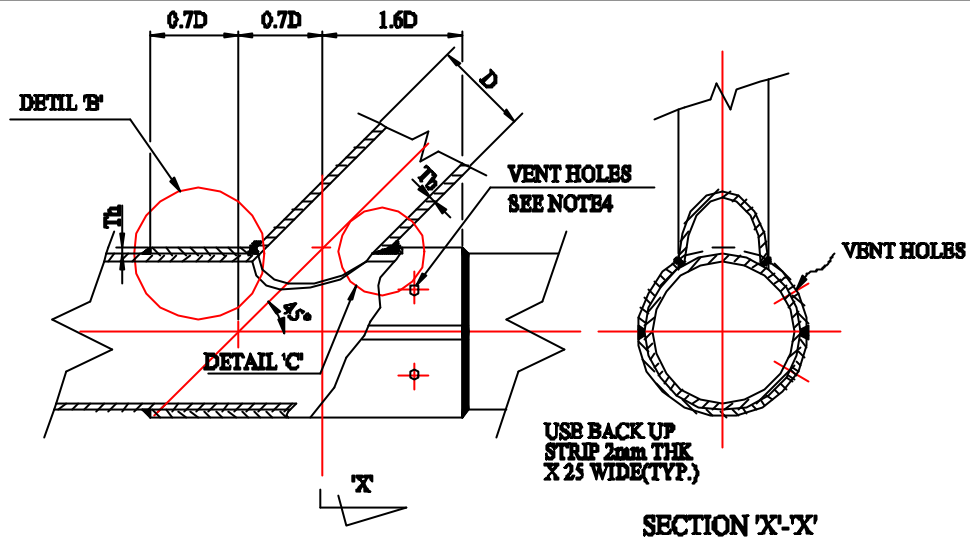
5.7 REINFORCING PAD DETAIL

LDP-L901

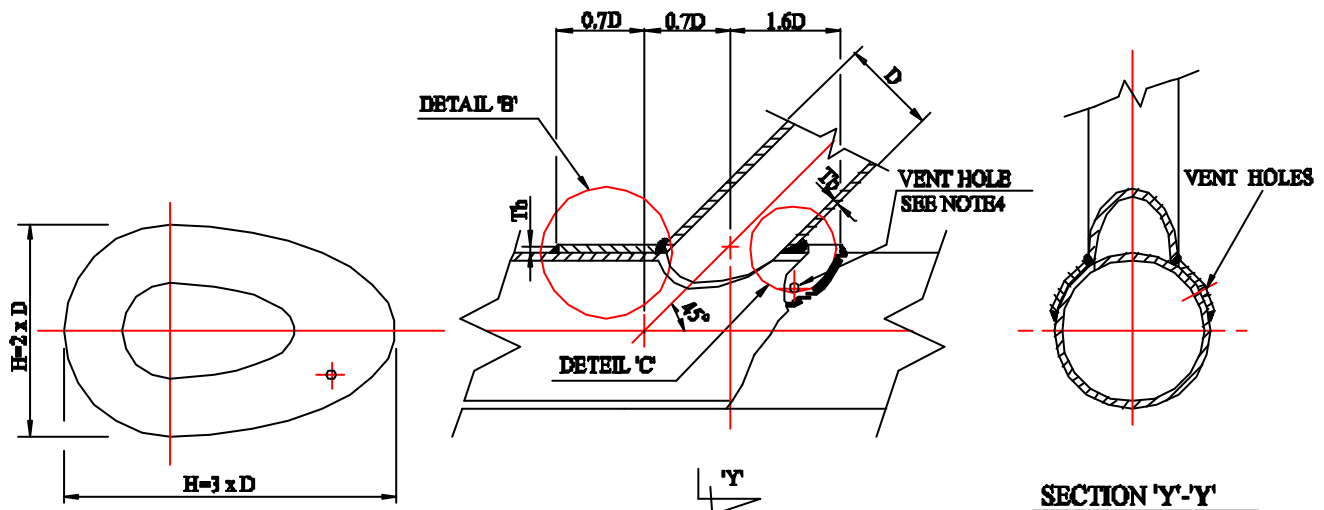
REV. 1 (OCT, 2002)

PAGE : 2 OF 2

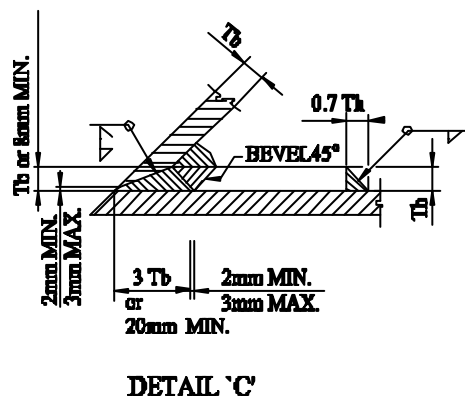
DATE : DEC. 1995



45° BRANCH FULL ENCIRCLEMENT REINFORCING PAD



45° BRANCH REINFORCING PAD



WHERE SHAPES OF CONTOUR
CAUSES FABRICATION PROBLEM
THE BRANCH STUB MAY BE
CUT AWAY AND BUILT UP
WITH WELD TO THE PROFILE
SHOWN.



LG E&C

**PIPING DISCIPLINE
PROCEDURE**

PIPING HANDBOOK

5. CONSTRUCTION

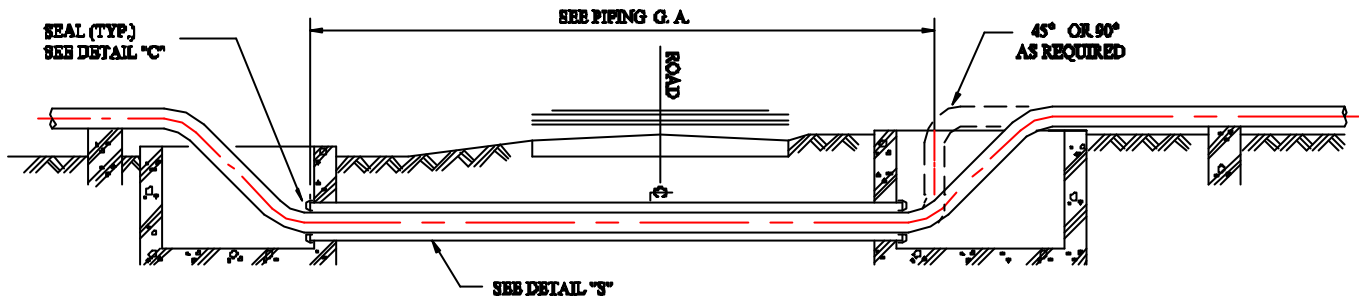
5.8 SLEEVED PIPING FOR ROAD CROSSING

LDP-L901

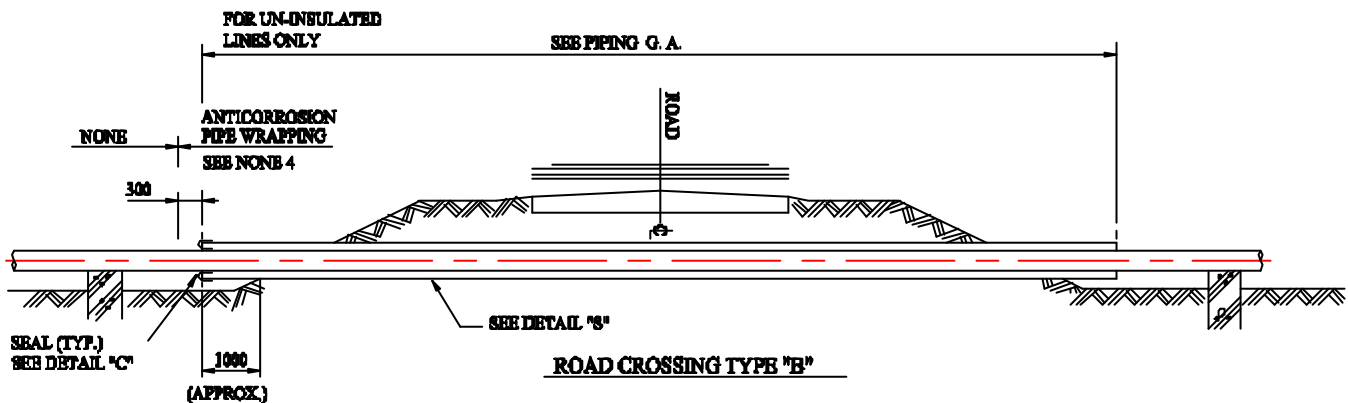
REV. 1 (OCT, 2002)

PAGE : 1 OF 2

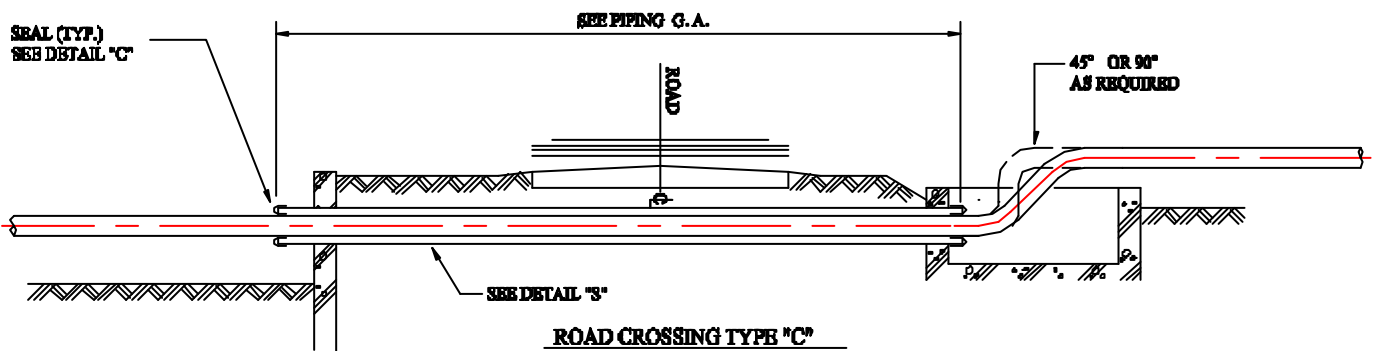
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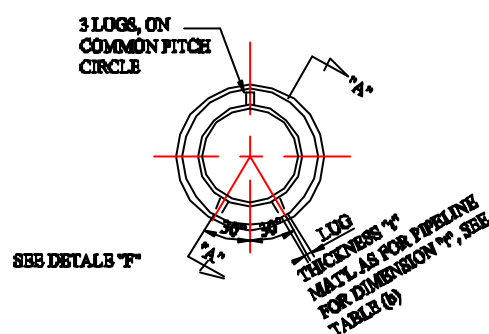
ROAD CROSSING TYPE "A"



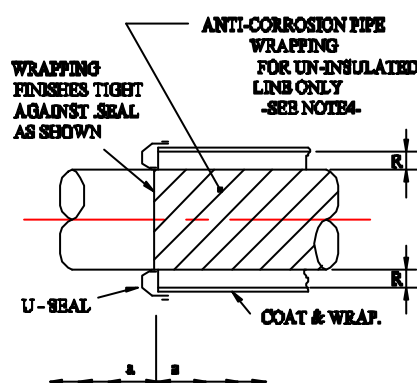
ROAD CROSSING TYPE "B"



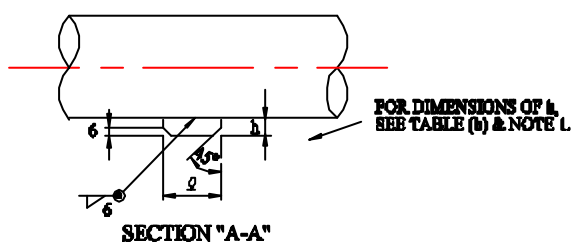
ROAD CROSSING TYPE "C"



END SECTION "E-E"
SEE ALSO DETAIL "F"

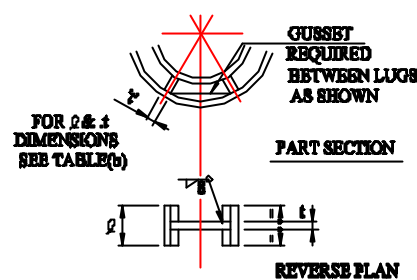
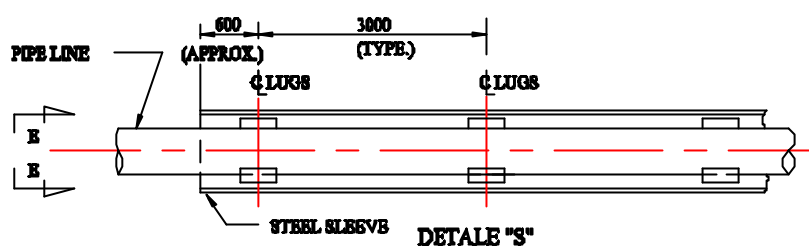


DETAIL "C"
SEE ALSO NOTE 6



NOTES

1. SPACER LUGS (REF. DETAIL "B"); - HEIGHT OF SUPPORT LUG(b) TO BE MADE TO GIVE RADIAL CLEARANCE BETWEEN I.D. OF SLEEVE & PITCH CIRCLE O.D. OF LUGS AS PER THE ABOVE TABLE.
2. U-SEALS FITTED TO INSULATED LINES; -
A) TO ACHIEVE A WATERTIGHT JOINT BETWEEN U-SEAL & THE OUTER SURFACE OF THE INSULATION SHEATHING WHICH IS OF CORRUGATED FORM, A NON SETTING MASTIC IS TO BE APPLIED.
B) WHERE THE O.D. OF THE INSULATION IS LESS THAN THE MINIMUM SIZE ACCEPTABLE TO MATE PROPERLY WITH THE U-SEAL, THE DIFFERENCE IS TO BE MADE UP WITH LAYERS OF HESSIAN REINFORCED BITUMEN FELT & MADE WATERTIGHT WITH THE APPLICATION OF A NON-SETTING MASTIC.
3. CASING SEALS TO BE ORDERED AS SPLIT & SCARFED TYPE. (THIS TYPE ALLOWS FOR FITTING AFTER PIPELINE HAS BEEN INSTALLED)
4. ANTI-CORROSION PIPE WRAPPING IS REFERRED TO SPECIFICATION. (LGS - L011).
5. BURIED PIPES TO BE DESIGNED & INSTALLED ACCORDING TO A.P.I.-R.P.1102 "RECOMMENDED PRACTICE FOR LIQUID PETROLEUM PIPELINES CROSSING RAILROADS & HIGHWAYS."
6. LONGITUDINAL MOVEMENT (a) OF PIPE LINE THROUGH SLEEVE SHOULD NOT EXCEED (R)-SEE DETAIL "C"-HOWEVER LINE MOVEMENTS OF UP TO 2 X R CAN BE ACCOMMODATED BY FITTING THE SEALS EXTENDED IN ONE DIRECTION IN THE COLD CONDITION.



DETAIL "F"

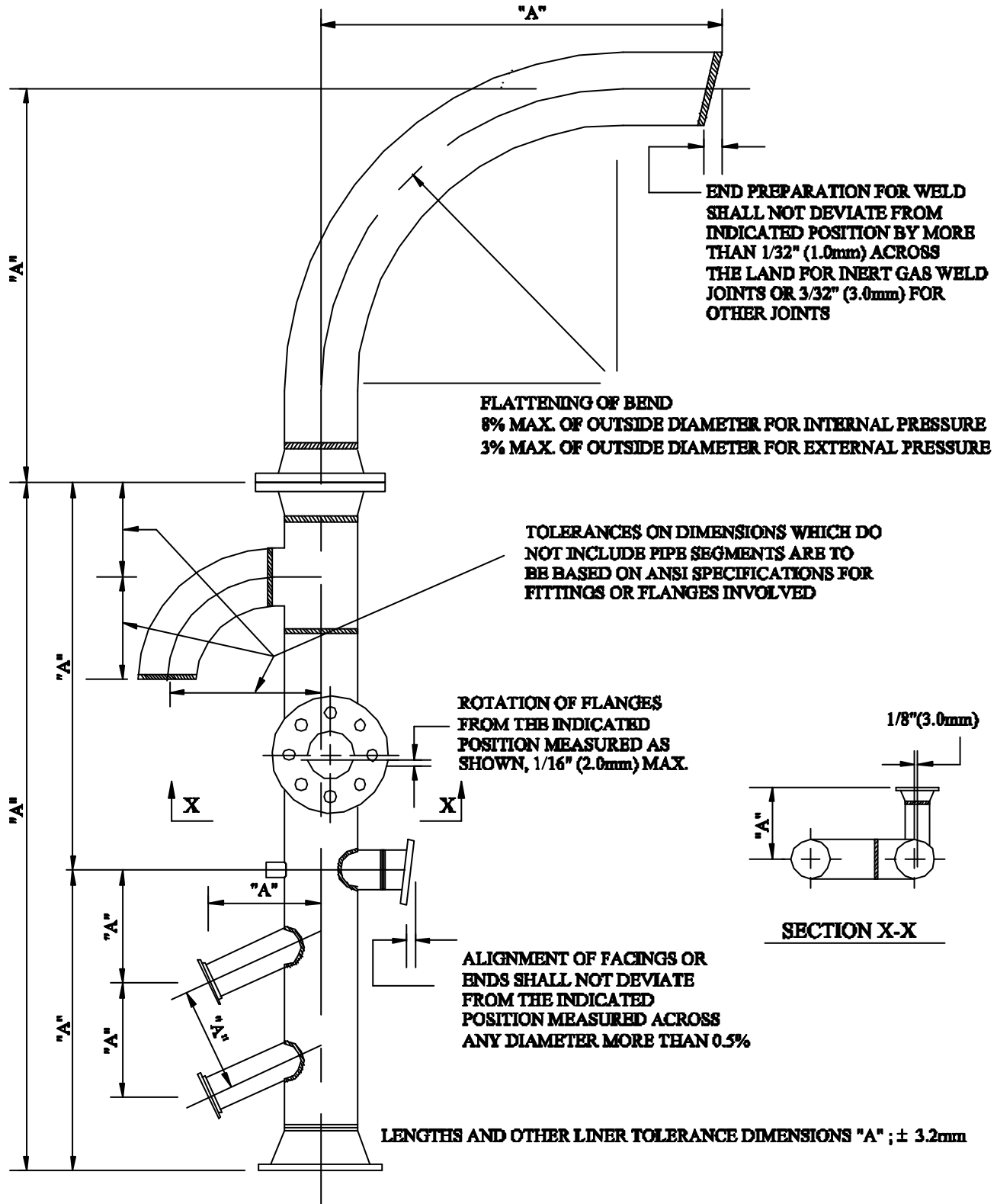
SPACER LUGS (REF. DETAIL "S" & NOTE 1.)

(a) CLEARANCE OF SPACER LUG

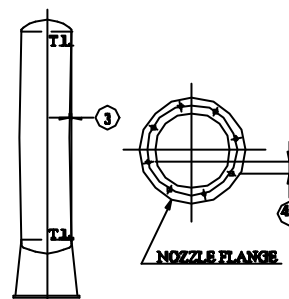
SLEEVE SIZE N.B.	RADIAL CLEARANCE
4" - 8"	6 mm
10" - 16"	10 mm
18" & OVER	15 mm

(b) THICKNESS / LENGTH OF SPACER LUG

LINE SIZE N.B.	UN-INSULATED LINE		INSULATED LINE	
	LUG THICKNESS t mm	LUG LENGTH l mm	LUG THICKNESS t mm	LUG LENGTH l mm
2" - 4"	6	50	8	100
6" - 10"	8	75	10	150
12" - 16"	10	100	15	175
18" - 42"	15	125	15	200



***REFER TO LCS-L015, ATTACHMENT #1.**





NOZZLES, MANHOLES AND OTHER ATTACHMENTS

SUPPORTS (SKIRT, LUGS, LEGS AND SADDLES)

- 4a. LOCATION OF NOZZLE FROM T.L. : ± 6
 4b. ORIENTATION OF NOZZLE FROM REFERENCE CENTERLINE : ± 6
 4c. NOZZLE FLANGE FACE FROM SHELL EXTERNAL SURFACE : ± 5
 4d. ALIGNMENT OF NOZZLE FLANGE FACE : $\pm 1/2^\circ$
 4e. ROTATIONAL ORIENTATION OF BOLT HOLE AT BOLT CIRCLE : MAX. 1.5
 4f. TOP (OR BOTTOM) FLANGE FACE FROM ADJACENT T.L. : ± 10
 4g. CENTER OF NOZZLE ON TOP HEAD FROM CENTER OF HEAD : ± 6
 4h. FLANGE FACE OF BOTTOM DRAW-OFF NOZZLE FROM REFERENCE CENTERLINE : ± 10
 5a. LOCATION OF MANHOLE FROM T.L. : ± 10
 5b. ORIENTATION OF MANHOLE FROM REFERENCE CENTERLINE. : ± 10
 5c. MANHOLE FLANGE FACE FROM SHELL EXTERNAL SURFACE. : ± 10
 5d. ALIGNMENT OF MANHOLE FLANGE FACE : ± 10
 6. LOCATION OF NOZZLE AND MANHOLE (RELATED TO TRAYS) FROM TRAY SUPPORT RING AS SHOWN ON VESSEL DRAWING. : ± 3
 7. ANY PAIR OF NOZZLE (I.E NOZZLE FOR LIQUID LEVEL GAUGE AND CONNECTED TO REBOILER)
 7a. DIFFERENCE IN NOZZLE LENGTH : MAX. 1
 7b. DISTANCE BETWEEN NOZZLES : ± 2
 7c. DIFFERENCE IN ORIENTATION : MAX. 2
 7d. ALIGNMENT OF FLANGE FACE : $\pm 1/4^\circ$
 8. CLIPS OR OTHER SIMILAR STRUCTURAL ATTACHMENT FOR PLATFORM LADDER OR PIPE SUPPORT
 8a. LOCATION FROM T.L. : ± 10
 8b. ORIENTATION FROM REFERENCE CENTERLINE : ± 10
 8c. DISTANCE BETWEEN ANY PAIR OF CLIPS : ± 3

- 9a. DISTANCE FROM T.L. TO BOTTOM OF BASE PLATE (HEIGHT OF SKIRT OR LEG) :

NOMINAL I.D. (D)	TOLERANCES
$D \leq 2100$	± 6
$D > 2100$	± 9

- 9b. OUT-OF-LEVEL OF BASEPLATE (DIFFERENCE BETWEEN MAX. AND MIN DISTANCE FROM T.L. TO BOTTOM OF BASEPLATE) : NOT EXCEED

NOMINAL I.D. (D)	TOLERANCES
$D \leq 2100$	3
$2100 < D \leq 4000$	6
$4000 < D \leq 6000$	7
$6000 < D \leq 8000$	8
$8000 < D \leq 10000$	10
$10000 < D$	15

10. DISTANCE FROM T.L. SUPPORT LUG : ± 6

11. BOLT CIRCLE DIAMETER AND PITCH BETWEEN BOLT HOLES :

NOMINAL I.D. (D)	TOLERANCES
$D \leq 2100$	± 3
$D > 2100$	± 6

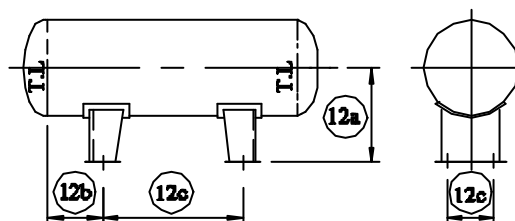
12. HORIZONTAL VESSELS

- 12a. DISTANCE FROM REFERENCE CENTERLINE TO BOTTOM OF SUPPORT SADDLE : ± 6

- 12b. DISTANCE FROM T.L. TO BOLT HOLE CENTER OF SUPPORT SADDLE : ± 6

- 12c. DISTANCE BETWEEN BOLT HOLES OF SUPPORT SADDLE ;

NOMINAL I.D. (D)	TOLERANCES
$D \leq 2100$	± 3
$D > 2100$	± 6



REMARKS :

- UNLESS OTHERWISE STATED, ALL DIMENSIONS AND TOLERANCES ARE GIVEN IN (MM).
- ABBREVIATIONS USED ARE :
T.L. : TANGENT LINE LD. : INSIDE DIAMETER
- TOLERANCES ARE NOT CUMULATIVE.
- TOLERANCES INDICATED ON VESSEL DRAWING SHALL GOVERN.
- TOLERANCES SHOWN ARE INTENDED TO APPLY TO BOTH VERTICAL AND HORIZONTAL VESSELS.

1. Spiral Wound Gasket

Size (inch)	ANSI 150#		ANSI 300#		ANSI 400#		ANSI 600#		ANSI 900#		ANSI 1500#		ANSI 2500#	
	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)	Bolt Stress (kgf/mm ²)	Bolt Torque (kgf-cm)
1/2	9.1	204	9.1	204	9.1	204	9.1	204	4.1	328	6.3	501	10.5	841
3/4	12.8	286	8.0	357	8.0	357	8.0	357	5.8	458	9.2	735	15.4	1232
1	16.1	360	10.1	450	10.1	450	10.1	450	5.0	640	8.3	1065	13.9	1777
1.1/4	20.6	460	12.9	575	12.9	575	12.9	575	7.9	1011	13.1	1675	16.5	3195
1.1/2	29.1	650	12.3	976	12.3	976	12.3	976	7.9	1517	13.1	2526	16.7	4743
2	23.3	1037	11.6	519	11.6	519	11.6	519	8.1	1032	13.4	1718	17.0	3278
2.1/2	28.0	1248	9.4	749	9.4	746	9.4	746	8.1	1561	13.5	2598	17.2	4878
3	34.3	1528	11.5	917	12.9	1022	12.9	1022	12.5	1508	13.8	3922	18.2	7275
3.1/2	21.4	954	14.4	1145	11.5	1472	11.5	1472	-	-	-	-	-	-
4	25.5	1136	17.2	1363	16.0	2047	16.0	2047	11.8	3353	16.5	6583	18.4	13187
5	23.9	1897	23.9	1897	21.6	2766	16.4	3159	13.1	5215	15.3	10975	18.2	21372
6	30.8	2447	20.5	1632	18.8	2414	14.3	2759	14.9	4237	16.6	9027	18.4	32876
8	39.4	3129	19.0	2433	20.6	3966	15.7	4461	14.6	7922	17.6	16361	18.8	33612
10	25.9	3317	14.8	2843	16.0	4528	12.9	5151	15.6	8501	18.2	26605	16.5	59213
12	34.1	4366	14.9	4210	16.8	6726	13.8	5814	16.8	9127	16.1	28887	18.3	88400
14	30.1	5786	13.8	3906	13.8	5496	13.0	7074	16.2	11613	14.6	37798	-	-
16	30.5	5872	14.7	5872	14.5	7908	13.8	9913	17.4	16160	14.8	53056	-	-
18	31.2	8501	15.8	6297	15.5	8453	14.6	13520	17.0	24840	15.7	75805	-	-
20	28.7	7827	18.1	7247	14.2	10169	14.6	13507	17.3	30985	15.3	96707	-	-
24	28.1	10846	15.1	10846	12.1	14203	14.4	20977	14.9	53655	15.3	156294	-	-
26	31.9	2538	15.4	6141	-	-	-	-	-	-	-	-	-	-
28	30.9	2456	14.6	5848	-	-	-	-	-	-	-	-	-	-
30	30.1	2389	12.7	6930	-	-	-	-	-	-	-	-	-	-
32	29.4	2332	13.0	9310	-	-	-	-	-	-	-	-	-	-
34	27.2	3489	12.8	9167	-	-	-	-	-	-	-	-	-	-
36	26.2	3354	13.4	12451	-	-	-	-	-	-	-	-	-	-
38	23.1	4441	13.1	12115	-	-	-	-	-	-	-	-	-	-
40	22.2	4273	13.0	12050	-	-	-	-	-	-	-	-	-	-
44	21.3	4104	13.3	15656	-	-	-	-	-	-	-	-	-	-
46	21.5	6086	13.6	19821	-	-	-	-	-	-	-	-	-	-
48	20.3	5766	13.2	19212	-	-	-	-	-	-	-	-	-	-
54	17.9	5079	13.5	19697	-	-	-	-	-	-	-	-	-	-
60	16.9	6763	13.4	34581	-	-	-	-	-	-	-	-	-	-

Gasket : Spiral Wound Type Gasket(K/#OSI Series)

Gasket Factor = 3

Minimum Design Seating Stress $y = 703 \text{ Kgf/mm}^2$

Gasket Dimension : KUKIL Standard Dimension

Pressure : Maximum Operating Pressure for Each Class

2. Ring Joint Gasket

Size (inch)	ANSI 600#		ANSI 900#		ANSI 1500#		ANSI 2500#	
	olt Stress (kgf/mm ²)	olt Torque (kgf-cm)	olt Stress (kgf/mm ²)	olt Torque (kgf-cm)	olt Stress (kgf/mm ²)	olt Torque (kgf-cm)	olt Stress (kgf/mm ²)	olt Torque (kgf-cm)
3/4	-	-	-	-	36.6	2420	36.6	2420
1	-	-	-	-	33.7	3526	33.7	3526
1.1/2	-	-	-	-	31.6	5116	29.9	4148
2	-	-	-	-	33.7	3526	30.2	5116
3	-	-	33.7	3111	29.9	6913	28.1	7812
4	-	-	29.9	6913	28.1	9194	25.7	13480
6	-	-	29.9	6913	25.3	11890	22.5	32491
8	-	-	26.7	11890	23.2	17766	22.5	32491
10	-	-	26.7	11890	23.2	30417	22.5	66365
12	28.1	9194	26.7	11890	22.5	32491	22.5	87104
14	26.7	11890	25.7	13480	22.5	48391	-	-
16	25.7	13480	24.6	17766	22.5	62217	-	-
18	24.6	17766	23.2	30417	22.5	87104	-	-
20	24.6	17766	22.5	32491	22.5	118904	-	-
24	23.2	30417	22.5	66365	21.8	193564	-	-

ABBREVIATIONS

CODE	DESCRIPTION
AGA	AMERICAN GAS ASSOCIATION
AISC	AMERICAN INSTITUTE STEEL CONSTRUCTION, INC.
AISI	AMERICAN IRON AND STEEL INSTITUTE
ANS	AMERICAN NUCLEAR SOCIETY
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
API	AMERICAN PETROLEUM INSTITUTE
ARI	AIR-CONDITIONING AND REFRIGERATION INSTITUTE (U.S.A)
ASA	AMERICAN STANDARDS ASSOCIATION
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASNT	AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING
ASQC	AMERICAN SOCIETY OF QUALITY CONTROL
ASSE	AMERICAN SOCIETY OF SANITARY ENGINEERING
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BS	BRITISH STANDARDS INSTITUTE (ENGLAND)
DIN	DEUTSCHER NORMENAUSSCHUSS (GERMAN STANDARD)
FS	FEDERAL SPECIFICATIONS (U.S.A)
IS	INDIAN STANDARDS INSTITUTE
ISA	INSTRUMENT SOCIETY OF AMERICA
ISEA	INDUSTRIAL SAFETY EQUIPMENT ASSOCIATION (U.S.A)
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
JIS	JAPAN INDUSTRIAL SOCIETY
JPI	JAPAN PETROLEUM INSTITUTE
KS	KOREAN STANDARDS
MIL	MILITARY STANDARD (U.S.A)
MSS	MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (U.S.A)
NACE	NATIONAL ASSOCIATION OF CORROSION ENGINEERS
NIST	NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
SAE	SOCIETY OF AUTOMOTIVE ENGINEERS (U.S.A.)
SPI	THE SOCIETY OF THER PLASTICS INDUSTRY, INC. (U.S.A.)
UL	UNDERWRITERS LABORATORIES (U.S.A)

Web Address for searching standard

ASTM : <http://www.astm.org/cgi-bin/SoftCart.exe/STORE/standardsearch.shtml?E+mystore>

MSS : <http://www.mss-hq.com/pricelist.htm>

ASME : <http://www.asmeny.org/catalog/html/catgcs2.htm>

ANSI : <http://www.ansi.org/>

API & etc : <http://www.cssinfo.com/>

INDEX FOR ASME

CODE	DESCRIPTION
ASME-B-1.1	UNIFIED INCH SCREW THREADS (ANSI/ASME)
ASME-B-1.2	GAGES AND GAGING FOR UNIFIED SCREW THREADS (ANSI/ASME)
ASME-B-1.3M	GAGING SYSTEMS FOR DIMENSIONAL ACCEPTABILITY, INCH AND METRIC SCREW THREADS (ANSI/ASME)
ASME-B-1.5	ACME SCREW THREADS (ANSI/ASME)
ASME-B-1.7M	SCREW THREADS, NOMENCLATURE, DEFINITIONS AND LETTER SYMBOLS (ANSI/ASME)
ASME-B-1.8	STUB ACME SCREW THREADS (ANSI/ASME)
ASME-B-1.12	SCREW THREADS-CLASS 5 INTERFERENCE-FIT THREADS (ANSI/ASME)
ASME-B-1.13M	METRIC SCREW THREADS-M PROFILE (ANSI/ASME)
ASME-B-1.16M	GAGES AND GAGING FOR METRIC M SCREW THREADS (ANSI/ASME)
ASME-B-1.20.1	PIPE THREADS-GENERAL PURPOSE (INCH) (ANSI/ASME)
ASME-B-1.20.3	DRYSEAL PIPE THREADS (INCH)
ASME-B-1.20.7	HOSE COUPLING SCREW THREADS (INCH) (ANSI/ASME)
ASME-B-1.21M	METRIC SCREW THREADS (ANSI/ASME)
ASME-B-16.1	CAST IRON PIPE FLANGES AND FLANGED FITTINGS-CLASS 25, 125, 250, AND 800 (ANSI/ASME)
ASME-B-16.3	MALLEABLE IRON-THREADED FITTINGS-CLASS 150 AND 300 (ANSI/ASME)
ASME-B-16.4	CAST IRON-THREADED FITTINGS-CLASS 125 AND 250 (ANSI/ASME)
ASME-B-16.5	PIPE FLANGES AND FLANGED FITTINGS (ANSI/ASME)
ASME-B-16.9	FACTORY-MADE WROUGHT STEEL BUTT-WELDING FITTINGS (ANSI/ASME)
ASME-B-16.10	FACE-TO-FACE AND END-TO-END DIMENSIONS OF VALVES (ANSI/ASME)
ASME-B-16.11	FORGED FITTINGS, SOCKET-WELDING AND TREADED (ANSI/ASME)
ASME-B-16.12	CAST IRON THREADED DRAINAGE FITTINGS (ANSI/ASME)
ASME-B-16.14	PERROUS PIPE PLUGS, BUSHING AND LOCKNUTS WITH PIPE THREADS (ANSI/ASME)
ASME-B-16.15	CAST BRONZE THREADED FITTINGS-CLASS 125 AND 250 (ANSI/ASME)
ASME-B-16.18	CAST COPPER ALLOY SOLDER JOINT PRESSURE FITTINGS
ASME-B-16.20	RING-JOINT GASKETS ANDGROOVES FOR STEEL PIPE FLANGES
ASME-B-16.21	NONMETALLIC FLAT GASKETS FOR PIPE FLANGES (ANSI/ASME)
ASME-B-16.22	WROUGHT COPPER AND COPPER ALLOY SOLDER JOINT PRESSURE FITTINGS (ANSI/ASME)
ASME-B-16.23	CAST COPPER ALLOY SOLDER JOINT DRAINAGE FITTINGS (ANSI/ASME)
ASME-B-16.24	CAST COPPER ALLOY PIPE FLANGES AND FLANGED FITTINGS (ANSI/ASME)
ASME-B-16.25	BUTT-WELDING ENDS (ANSI/ASME)
ASME-B-16.26	CAST COPPER ALLOY FITTINGS FOR FLANGED COPPER TUBES (ANSI/ASME)
ASME-B-16.28	WROUGHT STEEL BUTT-WELDING SHORT RADIUS ELBOWS AND RETURNS (ANSI/ASME)
ASME-B-16.29	WROUGHT COPPER AND WROUGHT COPPER ALLOY SOLDER JOINT DRAINAGE FITTING (ANSI/ASME)

INDEX FOR ASME

CODE	DESCRIPTION
ASME-B-16-32	CAST COPPER ALLOY SOLVENT JOINT FITTINGS FOR SOLVENT DRAINAGE SYSTEM (ANSI/ASME)
ASME-B-16-33	MANUALLY OPERATED METALLIC GAS VALVES FOR USE IN GAS PIPING SYSTEMS UP TO 125 PSIG (ANSI/ASME)
ASME-B-16-34	VALVES-FLANGED, THREADED AND WELDING END (ANSI/ASME)
ASME-B-16-36	ORIFICE FLANGES (ANSI/ASME)
ASME-B-16-38	LARGE METALLIC VALVES FOR GAS DISTRIBUTION-MANUALLY OPERATED, 2 1/2" TO 12", 125 PSIG MAXIMUM (ANSI/ASME)
ASME-B-16-39	PIPE UNIONS, MALLEABLE IRON THREADED (ANSI/ASME)
ASME-B-16-40	GAS SHUT-OFFS AND VALVES IN GAS DISTRIBUTION SYSTEMS-MANUALLY OPERATED THERMOPLASTIC (ANSI/ASME)
ASME-B-16-42	DUCTILE IRON PIPE FLANGES AND FLANGED FITTINGS (ANSI/ASME)
ASME-B-16-45	CAST IRON FITTINGS FOR SOLVENT DRAINAGE SYSTEMS (ANSI/ASME)
ASME-B-16-47	LARGE DIAMETER STEEL FLANGES (ANSI/ASME)
ASME-B-16-48	STEEL LINE BLANKS
ASME-B-18.2.1	SQUARE AND HEX BOLTS AND SCREW (ANSI/ASME)
ASME-B-18.2.2	SQUARE AND HEX NUTS (INCH SERIES) (ANSI/ASME)
ASME-B-18.3	SOCKET CAP, SHOULDER AND SET SCREW (ANSI/ASME)
ASME-B-18.5	ROUND HEAD BOLTS (INCH SERIES) (ANSI/ASME)
ASME-B-18.15	FORGED EYE-BOLTS (ANSI/ASME)
ASME-B-19.1	AIR COMPRESSOR SYSTEMS (ANSI/ASME)
ASME-B-19.3	COMPRESSOR FOR PROCESS INDUSTRIES, SAFETY STANDARD FOR (ANSI/ASME)
ASME-B-20.1	CONVEYORS AND RELATED EQUIPMENT, SAFETY STANDARD FOR (ANSI/ASME)
ASME-B-30.1	JACKS (ANSI/ASME)
ASME-B-31G	MANUAL FOR DETERMINING THE REMAINING STRENGTH OF CORRODED PIPE LINES (ANSI/ASME)
ASME-B-31.1	POWER PIPING (ANSI/ASME)
ASME-B-31.2	FUEL GAS PIPING
ASME-B-31.3	CHEMICAL PLANT AND PETROLEUM REFINERY PIPING (ANSI/ASME)
ASME-B-31.4	LIQUID TRANSPIRATION SYSTEMS FOR HYDROCARBONS, LIQUID PETROLE GAS, ANHYDROUS AMMONIA AND ALCOHOL (ANSI/ASME)
ASME-B-31.5	REFRIGERATION PIPING (ANSI/ASME)
ASME-B-31.8	GAS TRANSPIRATION AND DISTRIBUTION PIPING SYSTEMS (ANSI/ASME)
ASME-B-31.9	BUILDING SERVICES PIPING CODE (ANSI/ASME)
ASME-B-31.11	SLURRY TRANSPIRATION PIPING SYSTEMS (ANSI/ASME)
ASME-B-36.10M	WELDED AND SEAMLESS WROUGHT STEEL PIPE (ANSI/ASME)
ASME-B-36.19M	STAINLESS STEEL PIPE (ANSI/ASME)

INDEX FOR API

CODE	DESCRIPTION
<PIPELINE OPERATIONS>	
API-RP-500	RECOMMENDED PRACTICE FOR CLASSIFICATION OF LOCATIONS FOR ELECTRICAL INSTALLATIONS AT PETROLEUM FACILITIES
API-STD-1104	WELDING OF PIPELINES AND RELATED FACILITIES
API-RP-1107	PIPELINE MAINTENANCE WELDING PRACTICES
API-RP-1110	PRESSURE TESTING OF LIQUID PETROLEUM PIPELINES
API-RUBL-1113	PIPELINE SUPERVISORY CONTROL CENTER CHECKLIST
API-RP-1118	TRAINING AND QUALIFICATION OF LIQUID PIPELINE CONTROLLERS
API-RP-1119	TRAINING AND QUALIFICATION OF LIQUID PIPELINE OPERATORS
API-RP-1120	TRAINING AND QUALIFICATION OF LIQUID PIPELINE MAINTENANCE PERSONNEL
API-RP-1122	EMERGENCY PREPAREDNESS AND RESPONSE FOR HAZARDOUS LIQUID PIPELINE
API-RP-1123	DEVELOPMENT OF PUBLIC EDUCATION PROGRAMS BY HARDOUS LIQUID PIPELINE OPERATORS
<PIPELINE MAPS>	
API-PUBL-1108	API PETROLEUM PIPE LINE MAPS (MAPS COVER UNITED STATES)
<INSPECTION OF REFINERY EQUIPMENT>	
API-RP-572	INSPECTION OF PRESSURE VESSELS (ANSI/API STD. 572)
API-RP-573	INSPECTION OF FIRED BOILERS AND HEATERS (ANSI/API STD. 573)
API-RP-574	INSPECTION OF PIPING, TUBING, VALVES, AND FITTINGS (ANSI/API STD. 574)
API-RP-576	INSPECTION OF PRESSURE RELIEVING DEVICES (ANSI/API STD. 576)
<HEAT TRANSFER EQUIPMENT STANDARDS FOR REFINERY SERVICE>	
API-RP-530	CALCULATION OF HEATER TUBE THICKNESS IN PETROLEUM (ANSI/API STD. 530)
API-RP-531M	MEASUREMENT OF NOISE FROM FIRED PROCESS HEATERS
API-RP-533	AIR PREHEAT SYSTEMS FOR PROCESS HEATERS
API-STD-560	FIRED HEATERS FOR GENERAL REFINERY SERVICES (ANSI/API STD. 560)
API-RP-632	WINTERIZATION OF AIR-COOLED HEAT EXCHANGER
API-STD-660	SHELL AND TUBE HEAT EXCHANGERS FOR GENERAL REFINERY SERVICES
API-STD-661	AIR-COOLED HEAT EXCHANGERS FOR GENERAL REFINERY SERVICES (ANSI/API STD. 661)
<INSTRUMENTATION AND CONTROL MANUALS FOR REFINERY SERVICES>	
API-RP-550	INSTALLATION OF REFINERY INSTRUMENTS AND CONTROL SYSTEM
<MECHANICAL EQUIPMENT STANDARDS FOR REFINERY SERVICE>	
API-STD-610	CENTRIFUGAL PUMPS FOR GENERAL REFINERY SERVICE
API-STD-611	GENERAL-PURPOSE STEAM TURBINES FOR REFINERY SERVICE (ANSI/API STD. 611)
API-STD-612	SPECIAL-PURPOSE STEAM TURBINES FOR REFINERY SERVICE (ANSI/API STD. 612)
API-STD-613	SPECIAL-PURPOSE GEAR UNITS FOR REFINERY SERVICE
API-STD-614	LUBRICATION, SHAFT-SEALING AND CONTROL-OIL SYSTEM FOR SPECIAL-PURPOSE APPLICATIONS (ANSI/API STD. 614)
API-STD-615	SOUND CONTROL OF MECHANICAL EQUIPMENT FOR REFINERY SERVICE
API-STD-616	GAS TUBBINES FOR REFINERY SERVICE (ANSI/API STD. 616)
API-STD-617	CENTRIFUGAL COMPRESSORS FOR GENERAL REFINERY SERVICE
API-STD-618	RECIPROCATING COMPRESSORS FOR GENERAL REFINERY SERVICE (ANSI/API STD. 618)
API-STD-619	ROTARY-TYPE POSITIVE DISPLACEMENT COMPRESSORS FOR GENERAL REFINERY SERVICE (ANSI/API STD. 619)
API-STD-671	SPECIAL-PURPOSE COUPLINGS FOR REFINERY SERVICE
API-STD-672	PACKAGED INTEGRALLY GEARED CENTRIFUGAL AIR COMPRESSORS FOR GENERAL REFINERY SERVICE (ANSI/API STD. 672)
API-STD-674	POSITIVE DISPLACEMENT PUMPS-RECIPROCATING
API-STD-675	POSITIVE DISPLACEMENT PUMPS-CONTROLLED VOLUME
API-STD-676	POSITIVE DISPLACEMENT PUMPS-ROTARY (ANSI/API STD. 676)
API-STD-677	GENERAL-PURPOSE GEAR UNITS FOR REFINERY SERVICE

INDEX FOR API

CODE	DESCRIPTION
API-STD-678	ACCELEROMETER-BASED VIBRATION MONITORING SYSTEM
API-STD-680	PACKAGED RECIPROCATING PLANT AND INSTRUMENT, AIR-COMPRESSOR FOR GENERAL REFINERY SERVICE
<PIPING COMPONENT STANDARDS FOR REFINERY SERVICE>	
API-STD-5B	SPECIFICATION FOR THREADING, GAGING AND THREAD INSPECTION OF CASING, TUBING, AND LINE PIPE THREADS
API-SPEC-5L	SPECIFICATION FOR LINE PIPE
API-SPEC-6A	SPECIFICATION FOR WELLHEAD EQUIPMENT
API-SPEC-6D	SPECIFICATION FOR PIPELINE VALVES, ENC CLOSURES, CONNECTORS AND SWELDED
API-STD-590	STEEL LINE BLANKS
API-RP-591	USER ACCEPTANCE OF REFINERY VALVES
API-STD-593	DUCTILE IRON PLUG VALVES-FLANGED END
API-STD-594	WAFER CHECK VALVES
API-STD-595	CAST IRON GATE VALVES
API-STD-597	STEEL VENT GATE VALVES
API-STD-598	VALVE INSPECTION AND TESTING
API-STD-599	STEEL PLUG VALVES-FLANGED OR BUTT-WELDING ENDS
API-STD-600	STEEL GATE VALVES-FLANGED OR BUTT-WELDING ENDS
API-STD-601	METALLIC GASKETS FOR PIPING (DOUBLE-JACKETED CORRUGATED AND SPIRAL-WOUND)
API-STD-602	COMPACT STEEL GATE VALVES
API-STD-603	CLASS 150, CAST, CORROSION-RESISTANCE. FLANGED-END GATE VALVES
API-STD-604	DUCTILE IRON GATE VALVES
API-STD-605	LARGE DIAMETER CARBON STEEL FLANGES (SIZE 26"-60", CLASS 75, 150, 300, 400, 600, 900)
API-STD-606	COMPACT CARBON STEEL GATE VALVES-EXTENDED BODY
API-STD-607	FIRE TEST FOR SOFT-SEATED QUARTER-TURN VALVES
API-STD-608	METAL BALL VALVES-FLANGED AND BUTT-WELDING ENDS
API-STD-609	LUG AND WAFER TYPE BUTTERFLY VALVES
<PRESSURE-RELIEVING SYSTEMS FOR REFINERY SERVICE>	
API-RP-520	SIZING, SELECTION AND INSTALLATION OF PRESSURE-RELIEVING DEVICE IN REFINERIES (ANSI/API STD. 520)
API-RP-521	GUIDE FOR PRESSURE-RELIEVING AND DEPRESSING SYSTEMS (ANSI/API STD. 521)
API-RP-526	FLANGED STEEL SAFETY-RELIEF VALVES (ANSI/API STD. 526)
API-RP-527	SEAT TIGHTNESS OF PRESSURE RELIEF VALVES (ANSI/API STD. 527)
<PRESSURE-VESSELS AND TANKS AND MATERIALS ENGINEERING>	
API-STD-510	PRESSURE VESSEL INSPECTION CODE (MAINTENANCE INSPECTION, RATING, REPAIR AND ALTERATION (ANSI/API STD. 510)
API-STD-620	DESIGN AND CONSTRUCTION OF LARGE, WELDED, LOW PRESSURE STORAGE TANKS (ANSI/API STD. 620)
API-STD-650	WELDED STEEL TANKS FOR OIL STORAGE
API-STD-651	CATHODIC PROTECTION OF ABOVEGROUND PETROLEUM STORAGE TANKS (ANSI/API STD. 651)
API-STD-652	LINING OF ABOVEGROUND PETROLEUM STORAGE TANK BOTTOMS (ANSI/API STD. 652)
API-STD-653	TANK INSPECTION, REPAIR, ALTERATION AND RECONSTRUCTION
API-RP-920	PREVENTION OF BRITTLE FRACTURE OF PRESSURE VESSELS
API-RP-941	STEELS FOR HYDROGEN SERVICE AT ELEVATED TEMPERATURE AND PRESSURES IN PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS
API-RP-945	AVOIDING ENVIRONMENTAL CRACKING IN AMINE UNITS
API-RP-959	CHARACTERIZATION STUDY OF TEMPER EMBATTLEMENT OF CHROMIUM-MOLYBDENUM STEEL

INDEX FOR MSS

CODE	DESCRIPTION
MSS-SP-6	STANDARD FINISHES FOR CONTACT FACES OF FLANGES AND CONNECTING-END FLANGES OF VALVES AND FITTINGS
MSS-SP-9	SPOT FACING FOR BRONZE, IRON, AND STEEL FLANGES
MSS-SP-25	STANDARD MARKING SYSTEM FOR VALVES, FITTINGS, FLANGES, AND UNIONS
MSS-SP-42	CLASS 150 CORROSION RESISTANT GATE, GLOBE, ANGLE AND CHECK VALVES WITH FLANGED AND BUTT-WELD ENDS.
MSS-SP-43	WROUGHT STAINLESS STEEL BUTT-WELDING FITTINGS
MSS-SP-44	STEEL PIPE LINE FLANGES
MSS-SP-45	BYPASS AND DRAIN CONNECTION STANDARD
MSS-SP-51	CLASS 150LW CORROSION RESISTANT CAST FLANGES AND FLANGED FITTINGS
MSS-SP-53	QUALITY STANDARD FOR STEEL CASTINGS FOR VALVES, FLANGES AND FITTINGS AND OTHER PIPING COMPONENTS-MAGNETIC PARTICLE EXAMINATION METHOD
MSS-SP-54	QUALITY STANDARD FOR STEEL CASTINGS FOR VALVES, FLANGES, AND FITTINGS AND OTHER PIPING COMPONENTS-RADIOGRAPHIC EXAMINATION METHOD
MSS-SP-55	QUALITY STANDARD FOR STEEL CASTINGS FOR VALVES, FLANGES AND FITTINGS AND OTHER PIPING COMPONENTS-VISUAL METHOD
MSS-SP-58	PIPE HANGERS AND SUPPORTS-MATERIALS, DESIGN, AND MANUFACTURE
MSS-SP-60	CONNECTING FLANGE JOINT BETWEEN TAPPING SLEEVES AND TAPPING VALVES
MSS-SP-61	PRESSURE TESTING OF STEEL VALVES
MSS-SP-65	HIGH PRESSURE CHEMICAL INDUSTRY FLANGES AND THREADED STUBS FOR USE WITH GASKETS
MSS-SP-67	BUTTERFLY VALVES
MSS-SP-68	HIGH PRESSURE-OFFSET SEAT BUTTERFLY VALVES
MSS-SP-69	PIPE HANGERS AND SUPPORTS-SELECTION AND APPLICATION
MSS-SP-70	CAST IRON GATE VALVES-FLANGED AND THREADED ENDS
MSS-SP-71	CAST IRON SWING CHECK VALVES-FLANGED AND THREADED ENDS
MSS-SP-72	BALL VALVES WITH FLANGED OR BUTT-WELDING ENDS FOR GENERAL SERVICE
MSS-SP-73	SILVER BRAZING JOINTS FOR WROUGHT COPPER AND COPPER ALLOY AND CAST COPPER ALLOY SOLDER JOINT PRESSURE FITTINGS
MSS-SP-75	SPECIFICATION FOR HIGH TEST WROUGHT BUTT-WELDING FITTINGS
MSS-SP-77	GUIDELINES FOR PIPE SUPPORT CONTRACTUAL RELATIONSHIPS
MSS-SP-78	CAST IRON PLUG VALVES-FLANGED AND THREADED ENDS
MSS-SP-79	SOCKET-WELDING REDUCER INSERTS
MSS-SP-80	BRONZE GATE, GLOBE, ANGLE, AND CHECK VALVES
MSS-SP-81	STAINLESS, STEEL, BONNETLESS, FLANGED KNIFE GATE VALVES
MSS-SP-82	VALVE PRESSURE TESTING METHODS
MSS-SP-83	CARBON STEEL PIPE UNIONS-SOCKET-WELDING AND THREADED ENDS

INDEX FOR MSS

CODE	DESCRIPTION
MSS-SP-84	STEEL VALVES-SOCKET-WELDING AND THREADED ENDS
MSS-SP-85	CAST IRON GLOBE AND ANGLE VALVES-FLANGED AND THREADED ENDS
MSS-SP-86	GUIDELINES FOR METRIC DATA IN STANDARD FOR VALVES, FLANGES, AND FITTINGS
MSS-SP-87	FACTORY MADE BUTT-WELDING FITTINGS FOR CLASS INUCLEAR PIPING APPLICATIONS
MSS-SP-88	DIAPHRAGM TYPE VALVES
MSS-SP-89	PIPE HANGERS AND SUPPORTS-FABRICATION AND INSTALLATION PRACTICES
MSS-SP-90	GUIDELINES ON TERMINOLOGY FOR PIPE HANGERS AND SUPPORTS
MSS-SP-91	GUIDELINES FOR MANUAL OPERATION OF VALVES
MSS-SP-92	MSS VALVE USER GUIDE
MSS-SP-93	QUALITY STANDARD FOR STEEL CASTINGS AND FORGINGS FOR VALVES, FLANGES, AND FITTINGS AND OTHER PIPING COMPONENTS-LIQUID PENETRANT EXAMINATION METHOD
MSS-SP-94	QUALITY STANDARD FOR FERRITIC AND MARTENSITIC STEEL CASTINGS FOR VALVES, FLANGES, AND FITTINGS AND OTHER PIPING COMPONENTS-ULTRASONIC EXAMINATION METHOD
MSS-SP-95	SWAGE(D) NIPPLES AND BULL PLUGS
MSS-SP-97	INTEGRALLY REINFORCED FORGED BRANCH OUTLET FITTINGS-SOCKET WELDING, THREADED AND BUTTWELDING ENDS.

INDEX FOR NACE

CODE	DESCRIPTION
NACE-MR-0175	SULFIDE STRESS CRACKING RESISTANT METALLIC MATERIALS FOR OILFIELD EQUIPMENT
NACE-TM-0177	LABORATORY TESTING OF METALS FOR RESISTANCE TO SULFIDE STRESS CRACKING IN H ₂ S ENVIRONMENTS
NACE-RP-0296	GUIDELINES FOR DETECTION, REPAIR, AND MITIGATION OF CRACKING OF EXISTING PETROLEUM REFINERY PRESSURE VESSELS IN WET H ₂ S ENVIRONMENTS
NACE-RP-0472	METHODS AND CONTROLS TO PREVENT IN-SERVICE ENVIRONMENTAL CRACKING OF CARBON STEEL WELDMENTS IN CORROSIVE PETROLEUM REFINING ENVIRONMENTS
NACE-TM-0284	EVALUATION OF PIPELINE AND PRESSURE VESSEL STEELS FOR RESISTANCE TO HYDROGEN-INDUCED CRACKING
NACE-8X194	MATERIALS AND FABRICATION PRACTICES FOR NEW PRESSURE VESSELS USED IN WET H ₂ S REFINERY SERVICE

INDEX FOR AWWA

CODE	DESCRIPTION
AWWA-C207	STEEL PIPE FLANGES FOR WATERWORKS SERVICE-SIZE 4" THROUGH 144"
AWWA-C208	DIMENSIONS FOR STEEL WATER PIPE FITTINGS
AWWA-C500	GATE VALVES, 3" THROUGH 48" FOR WATER AND SEWAGE SYSTEMS
AWWA-C503	WET-BARREL FIRE HYDRANTS
AWWA-C504	RUBBER-SEATED BUTTERFLY VALVES
AWWA-C507	BALL VALVES 6" THROUGH 48"
AWWA-C508	SWING CHECK VALVES FOR WATERWORKS SERVICE-2" THROUGH 24"
AWWA-C509	RESILIENT-SEALTED GATE VALVES FOR WATER AND SEWAGE SYSTEMS-3" THROUGH 12"

INDEX FOR ASTM

CODE	DESCRIPTION
ASTM-A36	SPECIFICATION FOR STRUCTURAL STEEL
ASTM-A47	SPECIFICATION FOR FERRITIC MALLEABLE IRON CASTINGS
ASTM-A48	SPECIFICATION FOR GRAY IRON CASTINGS
ASTM-A53	SPECIFICATION FOR PIPE, STEEL, BLACK AND HOT-DIPPED, ZINC-COATED WELDED AND SEAMLESS
ASTM-A74	SPECIFICATION FOR CAST IRON SOIL PIPE AND FITTINGS
ASTM-A82	SPECIFICATION FOR STEEL WIRE, PLAIN, FOR CONCRETE REINFORCEMENT
ASTM-A90	TEST METHOD FOR WEIGHT OF COATING ON ZINC COATED IRON OR STEEL ARTICLES
ASTM-A105	SPECIFICATION FOR FORGINGS, CARBON STEEL, FOR PIPING COMPONENTS
ASTM-A106	SPECIFICATION FOR SEAMLESS CARBON STEEL PIPE FOR HIGH-TEMPERATURE SERVICE
ASTM-A123	SPECIFICATION FOR ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS
ASTM-A126	SPECIFICATION FOR GRAY IRON CASTINGS FOR VALVES, FLANGES AND PIPE FITTINGS
ASTM-A128	SPECIFICATION FOR STEEL CASTINGS, AUSTENITIC MANAGNESES
ASTM-A134	SPECIFICATION FOR PIPE, STEEL, ELECTRIC-FUSION (ARC)-WELDED-SIZE 16" AND OVER
ASTM-A135	SPECIFICATION FOR ELECTRIC-RESISTANCE-WELDED STEEL PIPE
ASTM-A139	SPECIFICATION FOR ELECTRIC-FUSION (ARC)-WELDED STEEL PIPE-SIZE 4" AND OVER
ASTM-A144	SPECIFICATION FOR FERROTUNGSTEN
ASTM-A178	SPECIFICATION FOR ELECTRIC-RESISTANCE-WELDED CARBON STEEL BOILER TUBES
ASTM-A179	SPECIFICATION FOR SEAMLESS COLD-DRAWN LOW-CARBON STEEL HEAT-EXCHANGER AND CONDENSER TUBES
ASTM-A181	SPECIFICATION FOR FORGINGS, CARBON STEEL, FOR GENERAL PURPOSE PIPING
ASTM-A182	SPECIFICATION FOR FORGED OR ROLLED ALLOY-STEEL PIPE FLANGES, FORGED FITTINGS, AND VALVES AND PARTS FOR HIGH-TEMPERATURE SERVICE
ASTM-A192	SPECIFICATION FOR SEAMLESS CARBON STEEL BOILER TUBES FOR HIGH-TEMPERATURE SERVICE
ASTM-A193	SPECIFICATION FOR ALLOY-STEEL AND STAINLESS STEEL BOLTING MATERIALS FOR HIGH-TEMPERATURE SERVICE
ASTM-A194	SPECIFICATION FOR CARBON AND ALLOY STEEL NUTS FOR BOLTS FOR HIGH-PRESSURE AND HIGH-TEMPERATURE SERVICE
ASTM-A197	SPECIFICATION FOR CUPOLA MALLEABLE IRON
ASTM-A210	SPECIFICATION FOR SEAMLESS MEDIUM-CARBON STEEL BOILER AND SUPER HEATER TUBES
ASTM-A211	SPECIFICATION FOR SPIRAL-WELDED STEEL OR IRON PIPE
ASTM-A216	SPECIFICATION FOR STEEL CASTINGS, CARBON SUITABLE FOR FUSION WELDING FOR HIGH-TEMPERATURE SERVICE
ASTM-A217	SPECIFICATION FOR STEEL CASTINGS, MARTENSITIC STAINLESS AND ALLOY FOR PRESSURE-CONTAINING PARTS SUITABLE FOR HIGH-TEMPERATURE SERVICE
ASTM-A220	SPECIFICATION FOR PEARLITIC MALLEABLE IRON CASTINGS
ASTM-A234	SPECIFICATION FOR PIPING FITTINGS OF WROUGHT CARBON STEEL AND ALLOY STEEL FOR MODERATE AND ELEVATED TEMPERATURE
ASTM-A240	SPECIFICATION FOR HEAT-RESISTING CHROMIUM-NICKEL STAINLESS STEEL PLATE, SHEET AND STRIP FOR PRESSURE VESSELS
ASTM-A312	SPECIFICATION FOR SEAMLESS AND WELDED AUSTENIC STAINLESS STEEL PIPE
ASTM-A333	SPECIFICATION FOR SEAMLESS AND WELDED STEEL PIPE FOR LOW TEMPERATURES SERVICE
ASTM-A334	SPECIFICATION FOR SEAMLESS AND WELDED CARBON AND ALLOY-STEEL TUBES FOR LOW-TEMPERATURES SERVICE
ASTM-A335	SPECIFICATION FOR SEAMLESS FERRITIC ALLOY STEEL PIPE FOR HIGH-TEMPERATURES SERVICE
ASTM-A338	SPECIFICATION FOR MALLEABLE IRON FLANGES PIPE FITTINGS, AND VALVES PARTS FOR RAILROAD MARINE AND OTHER HEAVY DUTY SERVICE AT TEMPERATURES UP TO 650°F(345°C)
ASTM-A350	SPECIFICATION FOR FORGINGS, CARBON AND LOW-ALLOY STEEL, REQUIRING NOTCH TOUGHNESS TESTING FOR PIPING COMPONENTS
ASTM-A351	SPECIFICATION FOR STEEL CASTINGS, AUSTENITIC, FOR HIGH-TEMPERATURE SERVICE

INDEX FOR ASTM

CODE	DESCRIPTION
ASTM-A352	SPECIFICATION FOR CASTINGS, FERRITIC AND MARTENSITIC, FOR PRESSURE CONTAINING PARTS SUITABLE FOR LOW-TEMPERATURE SERVICE
ASTM-A358	SPECIFICATION FOR ELECTRIC-FUSION-WELDED AUSTENITIC CHROMIUM-NICKEL ALLOY STEEL PIPE FOR HIGH-TEMPERATURE SERVICE
ASTM-A369	SPECIFICATION FOR CARBON AND FERRITIC ALLOYS STEEL FORGED AND BORED PIPE FOR HIGH-TEMPERATURE SERVICE
ASTM-A376	SPECIFICATION FOR SEAMLESS AUSTENITIC STEEL PIPE FOR HIGH-TEMPERATURE CENTRAL-STATION SERVICE
ASTM-A377	SPECIFICATION FOR DUCTILE IRON PRESSURE PIPE
ASTM-A381	SPECIFICATION FOR METAL-ARC-WELDED STEEL PIPE FOR USE WITH HIGH-TEMPERATURE TRANSMISSION SYSTEMS
ASTM-A403	SPECIFICATION FOR WROUGHT AUSTENITIC STAINLESS STEEL PIPING FITTINGS
ASTM-A405	SPECIFICATION FOR SEAMLESS FERRITIC ALLOYS-STEEL PIPE SPECIALLY HEAT TREATED FOR HIGH-TEMPERATURE SERVICE
ASTM-A409	SPECIFICATION FOR WELDED LARGE DIAMETER AUSTENITIC STEEL PIPE FOR CORROSIVE OR HIGH-TEMPERATURE SERVICE
ASTM-A420	SPECIFICATION FOR PIPING FITTINGS OF WROUGHT CARBON STEEL AND ALLOY STEEL FOR LOW-TEMPERATURE SERVICE
ASTM-A426	SPECIFICATION FOR CENTRIFUGALLY CAST FERRITIC ALLOY STEEL PIPE FOR HIGH-TEMPERATURE SERVICE
ASTM-A430	SPECIFICATION FOR AUSTENITIC STEEL FORGED AND BORED PIPE FOR HIGH-TEMPERATURES SERVICE
ASTM-A436	SPECIFICATION FOR AUSTENITIC GRAY IRON CASTINGS
ASTM-A439	SPECIFICATION FOR AUSTENITIC DUCTILE IRON CASTINGS
ASTM-A444	SPECIFICATION FOR STEEL SHEET ZINC-COATED (GALVANIZED) BY HOT-DIP PROCESS FOR STORM SEWER AND DRAINAGE PIPE
ASTM-A451	SPECIFICATION FOR CENTRIFUGALLY CAST AUSTENITIC STEEL PIPE FOR HIGH-TEMPERATURE SERVICE
ASTM-A452	SPECIFICATION FOR CENTRIFUGALLY CAST AUSTENITIC STEEL COLD-WROUGHT PIPE FOR HIGH-TEMPERATURE SERVICE
ASTM-A453	STANDARD SPECIFICATION FOR HIGH-TEMPERATURE BOLTING MATERIALS, WITH EXPANSION COEFFICIENTS COMPARABLE TO AUSTENITIC STAINLESS STEELS
ASTM-A530	SPECIFICATION FOR GENERAL REQUIREMENTS FOR SPECIALIZED CARBON AND ALLOY STEEL PIPE
ASTM-A671	STANDARD SPECIFICATION FOR ELECTRIC-FUSION-WELDED STEEL PIPE FOR ATMOSPHERIC AND LOWER TEMPERATURES
ASTM-A672	STANDARD SPECIFICATION FOR ELECTRIC-FUSION-WELDED STEEL PIPE FOR HIGH-PRESSURE SERVICE AT MODERATE TEMPERATURES
ASTM-A691	STANDARD SPECIFICATION FOR CARBON AND ALLOY STEEL PIPE, ELECTRIC-FUSION-WELDED FOR HIGH-PRESSURE SERVICE AT HIGH TEMPERATURES
ASTM-B36	STANDARD SPECIFICATION FOR BRASS PLATE, SHEET, STRIP AND ROLLED BRAS
ASTM-B42	STANDARD SPECIFICATION FOR SEAMLESS COPPER PIPES, STANDARD SIZE
ASTM-B43	STANDARD SPECIFICATION FOR SEAMLESS RED BRASS PIPE, STANDARD SIZE
ASTM-B61	STANDARD SPECIFICATION FOR STEAM OR VALVES BRONZE CASTINGS
ASTM-B62	STANDARD SPECIFICATION FOR COMPOSITION BRONZE OR OUNCE METAL CASTINGS
ASTM-B75	STANDARD SPECIFICATION FOR SEAMLESS COPPER TUBE
ASTM-B75M	STANDARD SPECIFICATION FOR SEAMLESS COPPER TUBE(METRIC)
ASTM-B148	STANDARD SPECIFICATION FOR ALUMINUM-BRONZE SAND CASTINGS
ASTM-B161	STANDARD SPECIFICATION FOR NICKEL SEAMLESS PIPE AND TUBE
ASTM-B188	STANDARD SPECIFICATION FOR SEAMLESS COPPER BUS PIPE AND TUBE
ASTM-B210	STANDARD SPECIFICATION FOR ALUMINUM-ALLOY DRAWN SEAMLESS TUBE
ASTM-B271	STANDARD SPECIFICATION FOR COPPER-BASE ALLOY CENTRIFUGAL CASTINGS

INDEX FOR ASTM

CODE	DESCRIPTION
ASTM-B283	STANDARD SPECIFICATION FOR COPPER AND COPPER-ALLOY DIE FORGINGS(HOT PRESSED)
ASTM-B302	STANDARD SPECIFICATION FOR THREADLESS COPPER PIPE
ASTM-B306	STANDARD SPECIFICATION FOR COPPER DRAINAGE TUBE
ASTM-B315	STANDARD SPECIFICATION FOR SEAMLESS COPPER ALLOY PIPE AND TUBE
ASTM-B337	STANDARD SPECIFICATION FOR SEAMLESS AND WELDED TITANIUM AND TITANIUM ALLOY PIPE
ASTM-B361	STANDARD SPECIFICATION FOR FACTORY-MADE WROUGHT ALUMINUM AND ALUMINUM-ALLOY WELDING FITTINGS
ASTM-B363	STANDARD SPECIFICATION FOR SEAMLESS AND WELDED UNALLOYED TITANIUM AND TITANIUM ALLOY WELDING FITTINGS
ASTM-B366	STANDARD SPECIFICATION FOR FACTORY-MADE WROUGHT NICKEL AND NICKEL ALLOY WELDING FITTINGS
ASTM-B367	STANDARD SPECIFICATION FOR TITANIUM AND TITANIUM ALLOY CASTINGS
ASTM-B369	STANDARD SPECIFICATION FOR COPPER-NICKEL CASTINGS

INDEX FOR JIS

CODE	DESCRIPTION
<TERMS AND SYMBOLS>	
JIS B 0100	GLOSSARY OF TERMS FOR VALVES
JIS-B 0116	GLOSSARY OF TERMS FOR PACKINGS AND GASKETS
JIS-B 0125	GRAPHIC SYMBOLS FOR FLUID POWER SYSTEMS
JIS-B 0151	GLOSSARY OF TERMS FOR IRON AND STEEL PIPE FITTINGS
JIS-Z 3001	WELDING TERMS
JIS-Z 3021	SYMBOLIC REPRESENTATION OF WELDS
JIS-Z 8204	INSTRUMENTATION SYMBOLS
JIS-Z 8205	SIMPLIFIED REPRESENTATION OF PIPE LINES
JIS-Z 8207	VACUUM TECHNOLOGY - GRAPHICAL SYMBOLS
JIS-Z 9102	IDENTIFICATION MARKING FOR PIPING SYSTEMS
<PIPES>	
JIS-G 3442	GALVANIZED STEEL PIPES FOR ORDINARY PIPING <SGPW>
JIS-G 3443	COATED STEEL PIPES FOR WATER SERVICE
JIS-G 3447	STAINLESS STEEL SANITARY PIPES <SUS-TBS>
JIS-G 3448	LIGHT GAUGE STAINLESS STEEL TUBES FOR ORDINARY PIPING <SUS-TPD>
JIS-G 3452	CARBON STEEL PIPES FOR ORDINARY PIPING <SGP>
JIS-G 3454	CARBON STEEL PIPES FOR PRESSURE SERVICE <STPG>
JIS-G 3455	CARBON STEEL PIPES FOR HIGH PRESSURE SERVICE <STS>
JIS-G 3456	CARBON STEEL PIPES FOR HIGH TEMPERATURE SERVICE <STPT>
JIS-G 3457	ARC WELDED CARBON STEEL PIPES <STPY>
JIS-G 3458	ALLOY STEEL PIPES <STPA>
JIS-G 3459	STAINLESS STEEL PIPES <SUS-TP>
JIS-G 3460	STEEL PIPES FOR LOW TEMPERATURE SERVICE <STPL>
JIS-G 3467	STEEL TUBES FOR FIRED HEATER
JIS-G 3468	LARGE DIAMETER WELDED STAINLESS STEEL PIPES <SUS-TPY>
JIS-G 3469	POLYETHYLENE COATED STEEL PIPES <P>
JIS-G 4903	SEAMLESS NICKEL-CHROMIUM-IRON ALLOY PIPES
JIS-G 5202	CENTRIFUGALLY CAST STEEL PIPES FOR HIGH TEMPERATURE AND HIGH PRESSURE SERVICE <SCPH-CF>
JIS-G 5525	CAST IRON SOIL PIPES AND FITTINGS
JIS-G 5526	DUCTILE IRON PIPES
JIS-H 3300	COPPER AND COPPER ALLOY-SEAMLESS PIPES AND TUBES
JIS-H 3320	COPPER AND COPPER ALLOY-WELDED PIPES AND TUBES
JIS-H 4080	ALUMINUM AND ALUMINUM ALLOYS EXTRUDED TUBE AND COLD-DRAWN TUBES <AXXXTE, TES, TD, TDS>
JIS-H 4090	ALUMINUM AND ALUMINUM ALLOY-WELDED PIPE AND TUBES <AXXXXTW, TWA, TWS, BAXXTW, TWS>
JIS-H 4202	MAGNESIUM ALLOY SEAMLESS PIPES AND TUBES <MT>
JIS-H 4311	LEAD AND LEAD ALLOY TUBES FOR COMMON INDUSTRIES <PBT, TPBT, HPBT>
JIS-H 4312	POLYETHYLENE LEAD COMPOSITE PIPES FOR WATER SUPPLY <PEPB-S,1,2>
JIS-H 4313	HARD LEAD PIPES
JIS-H 4552	NICKEL AND NICKEL ALLOY SEAMLESS PIPES AND TUBES
JIS-H 4630	TITANIUM AND TITANIUM ALLOY SEAMLESS PIPES <TPPXXXH, C,W, W.WC>
<PIPE FITTINGS>	
JIS-B 2301	SCREWED TYPE MALLEABLECAST IRON PIPE FITTINGS
JIS-B 2302	SCREWED TYPE STEEL PIPE FITTINGS

INDEX FOR JIS

CODE	DESCRIPTION
JIS-B 2303	SCREWED DRAINAGE FITTINGS
JIS-B 2311	STEEL BUTT-WELDING PIPE FITTINGS FOR ORDINARY USE
JIS-B 2312	STEEL BUTT-WELDING PIPE FITTINGS
JIS-B 2313	STEEL PLATE BUTT-WELDING PIPE FITTINGS
JIS-B 2316	STEEL SOCKET-WELDING PIPE FITTINGS
JIS-B 2321	ALUMINUM AND ALUMINUM ALLOY BUTT-WELDING PIPE FITTINGS
JIS-B 2351	210 KGF/CM BITE TYPE TUBE FITTINGS FOR HYDRAULIC USE
JIS-B 2352	BELLOWS TYPE EXPANSION JOINTS
JIS-B 8381	TUBE FITTINGS FOR PNEUMATIC USE (FOR FLEXIBLE TUBES)
JIS-H 3401	PIPE FITTINGS OF COPPER AND COPPER ALLOY
<PIPE FLANGES>	
JIS-B 2201	PRESSURE RATINGS FOR FERROUS MATERIAL PIPE FLANGES
JIS-B 2202	DIMENSIONS FOR PIPE FLANGE FACING
JIS-B 2203	TOLERANCES FOR PIPE FLANGES
JIS-B 2206	BASIS FOR CALCULATION OF ALUMINUM ALLOY PIPE FLANGES
JIS-B 2207	BASIS FOR CALCULATION OF ALUMINUM ALLOY PIPE FLANGES WITH FULL FACE GASKET
JIS-B 2210	BASIC DIMENSIONS OF FERROUS MATERIALS PIPE FLANGES
JIS-B 2220	STEEL WELDING PIPE FLANGES
JIS-B 2240	GENERAL RULES FOR COPPER ALLOY PIPE FLANGES
JIS-B 2241	BASIC DIMENSIONS OF ALUMINUM ALLOY PIPE FLANGES
JIS-B 2290	VACUUM TECHNOLOGY - FLANGE DIMENSIONS
JIS-B 2291	210 KGF/CM ² SLIP-ON WELDING PIPE FLANGES FOR HYDRAULIC USE
JIS-B 8602	PIPE FLANGES FOR REFRIGERATION
<VALVES>	
JIS-B 2001	NOMINAL SIZE AND BORE OF VALVES
JIS-B 2002	FACE-TO-FACE AND END-TO-END DIMENSIONS OF VALVES
JIS-B 2003	GENERAL RULES FOR INSPECTION OF VALVES
JIS-B 2011	BRONZE GATE, GLOBE, ANGLE AND CHECK VALVES
JIS-B 2031	GRAY CAST IRON VALVES
JIS-B 2032	WAFET-TYPE
JIS-B 2051	MALLEABLE IRON 10K SCREWED VALVES
JIS-B 2061	FAUCETS AND BALL TAPS AND FLUSH VALVES
JIS-B 2062	SLUICE VALVES FOR WATER WORKS
JIS-B 2063	AIR VENT VALVES FOR WATER WORKS
JIS-B 2071	CAST STEEL FLANGED VALVES
JIS-B 2191	SCREWED BRONZE PLUG COCKS
<VALVES>	
JIS-B 8210	STEAM BOILERS AND PRESSURE VESSELS - SPRING LOADED SAFETY VALVES
JIS-B 8245	VALVES FOR LIQUEFIED PETROLEUM GAS CYLINDER
JIS-B 8246	HIGH PRESSURE CYLINDER - VALVES
JIS-B 8372	PRESSURE REDUCING VALVES FOR PNEUMATIC USE
JIS-B 8273	2-PORT SOLENOID OPERATED VALVES FOR PNEUMATIC USE
JIS-B 8374	3-PORT SOLENOID OPERATED VALVES FOR PNEUMATIC USE
JIS-B 8375	4-PORT AND 5-PORT SOLENOID OPERATED VALVES FOR PNEUMATIC USE
JIS-B 8376	SPEED CONTROL VALVES FOR PNEUMATIC USE

INDEX FOR JIS

CODE	DESCRIPTION
JIS-B 8401	AUTOMATIC STEAM TRAPS
JIS-B 8402	RADIATOR TRAPS
JIS-B 8403	RADIATOR VALVES AND FITTINGS
JIS-B 8410	PRESSURE REDUCING VALVES FOR WATER WORKS
JIS-B 8471	WATER PIPE LINES - SOLENOID VALVES
JIS-B 8472	STEAM PIPE LINES - SOLENOID VALVES
JIS-B 8473	FUEL OIL PIPE LINES - SOLENOID VALVES
JIS-B 8605	STOP VALVES FOR REFRIGERATION
<SCREW THREADS>	
JIS-B 0202	PARALLEL PIPE THREADS
JIS-B 0203	TAPER PIPE THREADS
JIS-B 0216	METRIC TRAPEZOIDAL SCREW THREADS
JIS-B 0222	29 TRAPEZOIDAL SCREW THREADS
<GASKETS AND PACKINGS>	
JIS-B 2401	O-RINGS
JIS-B 2403	V-PACKINGS
JIS-B 2404	SPIRAL-WOUND GASKETS FOR PIPE FLANGES
JIS-B 2406	INSTALLATION AND GLAND DESIGN FOR O-RINGS
JIS-B 2407	BACK-UP RINGS FOR O-RINGS
JIS-R 3451	ASBESTOS CLOTHS
JIS-R 3452	ASBESTOS BRAIDED ROPES
JIS-R 3453	COMPRESSED ASBESTOS SHEETS
JIS-R 3454	ASBESTOS MILL BOARDS
<TEST METHODS AND OTHERS>	
JIS-H 0401	METHODS OF TEST FOR HOT-DIP GALVANIZED COATINGS
JIS-H 8641	ZINC HOT DIP GALVANIZING
JIS-Z 3104	METHODS OF RADIOGRAPHIC TEST AND CLASSIFICATION OF RADIOGRAPHIC FOR STEEL WELDS
JIS-Z 3106	METHODS OF RADIOGRAPHIC TEST AND CLASSIFICATION OF RADIOGRAPHIC FOR STAINLESS STEEL WELDS
JIS-Z 3700	METHODS OF POST WELD HEAT TREATMENT
<REFERENCES>	
JIS-A 9501	STANDARD PRACTICE THERMAL INSULATION WORKS
JIS-A 9503	DIATOMACEOUS EARTH HEAT INSULATING MATERIAL
JIS-A 9504	THERMAL INSULATION MATERIAL MADE OF ROCK WOOL
JIS-A 9505	THERMAL INSULATION MATERIAL MADE OF GLASS WOOL
JIS-A 9506	BASIC MAGNESIUM CARBONATE HEAT INSULATING MATERIAL
JIS-A 9507	CORK BOARDS
JIS-A 9508	HAIR FELT
JIS-A 9510	THERMAL INSULATION MATERIAL MADE OF CALCIUM SILICATE
JIS-A 9511	THERMAL INSULATION MATERIAL MADE OF POLYSTYRENE FOAM
JIS-A 9512	WATER REPELLENT THERMAL INSULATION MATERIAL MADE OF PERLITE
JIS-A 9513	RIGID FOAM RUBBER HEAT INSULATION MATERIAL
JIS-A 9514	THERMAL INSULATION MATERIAL MADE OF RIGID URETHANE FOAM
JIS-R 2611	INSULATING FIRE BRICK
JIS-Z 7401	RULES FOR ROUNDING OFF OF NUMERICAL VALUES
JIS-Z 8601	PREFERRED NUMBERS

 LGE & C DESIGN SPECIFICATION	PIPING SUPPORTS	LDM – L002 REV. 0 PAGE 2 OF 7 DATE Sep. 2002
---	-----------------	---

CONTENTS

- 1. Scope & Definitions**
- 2. References**
- 3. Material and Construction of Supports**
- 4. Marking of Supports**
- 5. Design Criteria for Piping Supports**
- 6. Attachments**

STATUS OF REVISION SUMMARY

<u>REV. NO.</u>	<u>REVISED DATE</u>	<u>DESCRIPTION</u>	<u>REVISED PAGES</u>
0	02. 10. 15	First Issue	All Pages

 LGE & C DESIGN SPECIFICATION	PIPING SUPPORTS	LDM – L002 REV. 0 PAGE 3 OF 7 DATE Sep. 2002
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1. Scope & Definitions

1.1 Scope

This specification covers the minimum technical engineering requirements for the design of piping supports. If not specified especially, the piping supports of package facilities shall be in accordance with manufacture standard.

1.2 Definitions

1.2.1 Standard Piping Supports; Piping supports specified in Attachments 1 & 2 are defined as “Standard Piping Supports”. Piping designer shall not develop any evaluations of engineering requirement for these supports.

1.2.2 Special Piping Supports; Supports other than “Standard Piping Supports” or piping supports which are required special engineering requirements not specified in “Standard Piping Supports” are defined “Special Piping Supports”. Details of “Special Piping Supports” shall be developed in “Special Piping Support Drawings” by piping designer.

2. References

The following codes, standards and specifications including applicable addenda shall form a part of this specification to the extent specified herein. The referenced edition of these documents shall be that which is in effect as the issue date of this specification.

2.1 Codes & Standard

ASCI American Institute of Steel Construction
Manual of Steel Construction

ASME American Society of Mechanical Engineering (ASME)
B31.3 Process Piping

MSS Manufacturers Standardization Society
SP-58 Pipe Hangers and Supports –Material, Design and Manufacture.

2.2 Engineering Specifications

LDM-L003 Spring Hangers and Supports

LDM-L004 Fabrication and Installation Detail Drawings for Standard Piping Supports

3. Material and Construction of Supports

3.1 A description of materials for standard piping supports shall be provided in LDM-L004 “Fabrication and Installation Detail Drawings for Standard Piping Supports” and “Special Piping Support Drawings” for special piping supports.

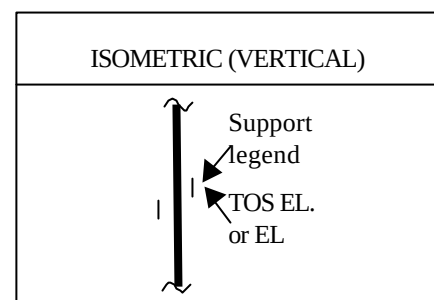
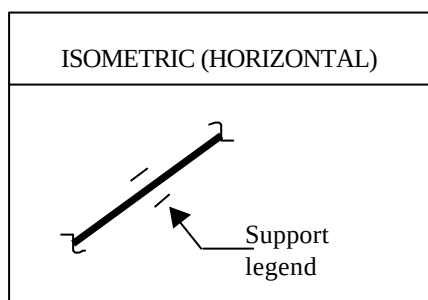
3.2 LDM-L004 “Fabrication and Installation Detail Drawings for Standard Piping Supports” and “Special Piping Support Drawings” shall be used to fabricate and install piping supports.

 LGE & C DESIGN SPECIFICATION	PIPING SUPPORTS	LDM – L002 REV. 0 PAGE 4 OF 7 DATE Sep. 2002
---	-----------------	---

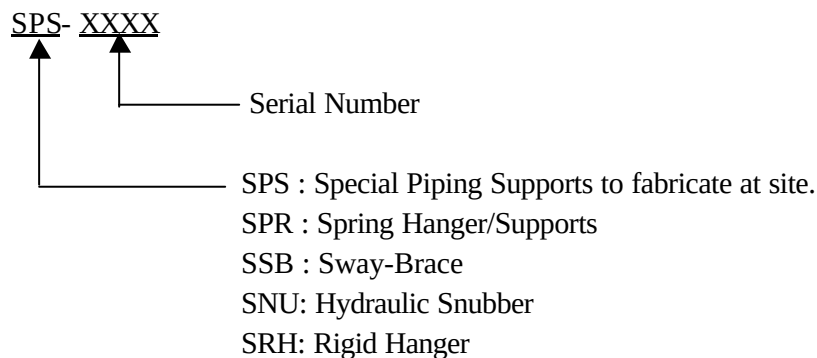
3.3 The installation and fabrication for piping supports including special elements such as spring hanger/support, sway-brace, rigid hanger and hydraulic snubber should be developed in “Special Piping Support Drawings” by piping designer.

4. Marking of Supports

4.1 The locations and legends of piping supports shall be shown as below on the isometric drawings on which the piping line appears. The legends of standard piping supports shall be described in accordance with those specified in attachment1 and 2.



4.2 The legends of special piping supports are as follows;



5. Design Criteria for Piping Supports

5.1 General Criteria

5.1.1 All dimensions on Attachments 1 & 2 are in mm. unless otherwise noted.

5.1.2 All components of piping supports except miscellaneous structural steel shall conform to ASME B31.3, “Process Piping” and MSS-SP-58, “Pipe Hangers and Supports –Material, Design and Manufacture”. If there are any deviations between ASME B31.3 and MSS-SP-58 the governing document shall be ASME B31.3.

5.1.3 Miscellaneous Structural-steel parts shall be designed in accordance with AISC “Manual of Steel Construction”.

 LGE & C DESIGN SPECIFICATION	PIPING SUPPORTS	LDM – L002 REV. 0 PAGE 5 OF 7 DATE Sep. 2002
---	-----------------	---

- 5.1.4 Piping supports shall be designed to satisfy all static and operational load conditions to which the piping and/or equipment may be subjected.
- 5.1.5 Support system shall provide for and control the free or intended movement due to thermal expansion or contraction of the piping and connected equipment.
- 5.1.6 The design of the support system shall take full advantage of commercially available load rated and tested components.
- 5.1.7 Be readily installable with usual field labor and equipment.
- 5.1.8 Stresses of support components must be kept within permissible values as per the applicable code(s). However, the stress evaluation for piping supports, which are specified in the attachments of this specification, is not necessary.
- 5.1.9 Piping supports for the heavy piping loads shall be checked by the Civil Engineer for the strength adequacy of associated civil components.
- 5.1.10 Design of piping supports shall include loads as a result of hydro-static testing. In certain cases temporary supporting may have to be specified on isometric drawing and applied.
- 5.1.11 Shims used in the field to achieve full bearing between piping and/or piping attachment and the structural steel and/or grade pier must have sufficient area to carry the load to the structural component.
- 5.1.12 Piping supports shall be designed to prevent the transmission of excessive heat to the steel structure or concrete beam. Bare piping may rest directly on support if the contact area temperature does not exceed 120°C on concrete beam supports or 400°C on structural steel beam supports. Otherwise, sufficient height/distance shall be provided such that the contact area temperature does not exceed the above limitations.
- 5.1.13 Design temperature of hanger components in direct contact with the pipe shall be the temperature of the contained fluid. For conventional high temperature piping installation, a reduction in temperature of 40°C (100°F) per 25 mm (1 in) as measured from the outer pipe surface may applied for strength calculations and material requirements.
- 5.1.14 Lines in the mixed flow condition of flow (boiler blow down lines, etc.) shall be supported on rigid supports, unless thermal movements dictate otherwise.
- 5.1.15 For stress relieved (PWHT) piping, the integral support attachments to piping should be welded prior to stress relief of piping.

5.2 Rests and Guides

Horizontal axial movement of pipe in excess of 125mm(5 in.) requires a check on the length of pipe shoe being used. It is imperative that the length of all shoes be such that they remain on the supporting steel during the full anticipated movement of the line.

 LGE & C DESIGN SPECIFICATION	PIPING SUPPORTS	LDM – L002 REV. 0 PAGE 6 OF 7 DATE Sep. 2002
---	-----------------	---

5.3 Elbow Stanchions

For “Low sections of ground or heavy duty”(Type: F, G, H, I, J), the locations & top elevations of concrete foundation (TOC) shall be informed civil engineer for the design & construction of piping support foundation.

5.4 Spring Hangers & Supports

5.4.1 Spring hanger shall be defined as a hanging support that includes spring element.

5.4.2 Spring support shall be defined as a piping support that includes spring element and supports piping like stanchion.

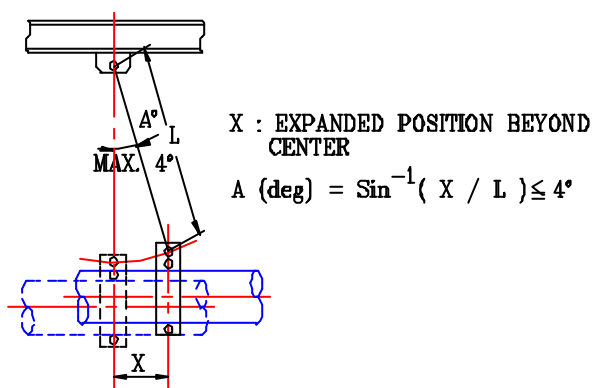
5.4.3 Refer to the specification of LDM-L003 “Spring Hangers and Supports” for details.

5.4.4 Spring hanger is more preferable than spring support.

5.4.5 Where horizontal movement of the spring support is over 15mm, spring hanger shall be preferred. If it is inevitable to use spring support, consider special device such as “Teflon” sliding pad, graphite or roller.

5.4.6 Refer to the Appendix 3 (Piping Support Component Data & Drawings) of LDM-L004 “Fabrication and Installation Detail Drawings for Standard Piping Supports” for support design if manufacturer’s drawing is not available.

5.4.7 The use of rod or spring hanger on lines shall be evaluated as follows.



5.4.8 The information of all rigid hangers shall be submitted to stress engineer. The stress engineer shall prepare the rigid hanger data sheet.

5.5 Piping Supports for Expansion Joints

5.5.1 Anchors required for expansion joint without hinged pin or gimbal devices shall have sufficient capacity to withstand internal pressure plus joint-spring force.

5.5.2 The internal pressure force shall be calculated as the product of the hydrostatic test pressure and the maximum internal area of the joint.

 LGE & C DESIGN SPECIFICATION	PIPING SUPPORTS	LDM – L002 REV. 0 PAGE 7 OF 7 DATE Sep. 2002
---	-----------------	---

5.5.3 Guides for expansion joints shall direct piping movement into the joint, within the joint manufacturer's allowable lateral and angular misalignment limits.

5.6 Piping Supports for Rotating Equipment

5.6.1 The first support of piping from rotating equipment shall be adjustable type support.

5.6.2 In outdoor installation, when differential settlement is anticipated, no rigid support shall be used in the vicinity of pumps, turbines, expanders or other sensitive equipment.

5.6.3 Reciprocating compressor or pump piping which is prone to vibration should be designed so that it can be supported from grade sleepers if possible.

5.7 Building Attachments

5.7.1 For piping routed inside of, or in vicinity of buildings, the use of existing structural steel and concrete shall be utilized with caution. Any additional loading to existing structures shall be checked to ensure the added load will not overstress the structure.

5.7.2 For attachment to concrete, the location and elevation of embedded plate shall be informed civil engineer, or if that is not feasible, Hawk-Anchor (Hilti' s HAS) bolts or equal may be used.

5.8 Sleepers and grade piers for Piping Supports

5.8.1 Where anchors or directional stops are specified at sleepers or base piers, the calculated reactions at these points are to be submitted to the Civil Engineer.

5.8.2 The location of sleepers and grade piers should be informed Civil Engineer for design and construction.

6. Attachments

6.1 Attachment 1: Standard Piping Supports (Bare / Hot Insulated Lines)

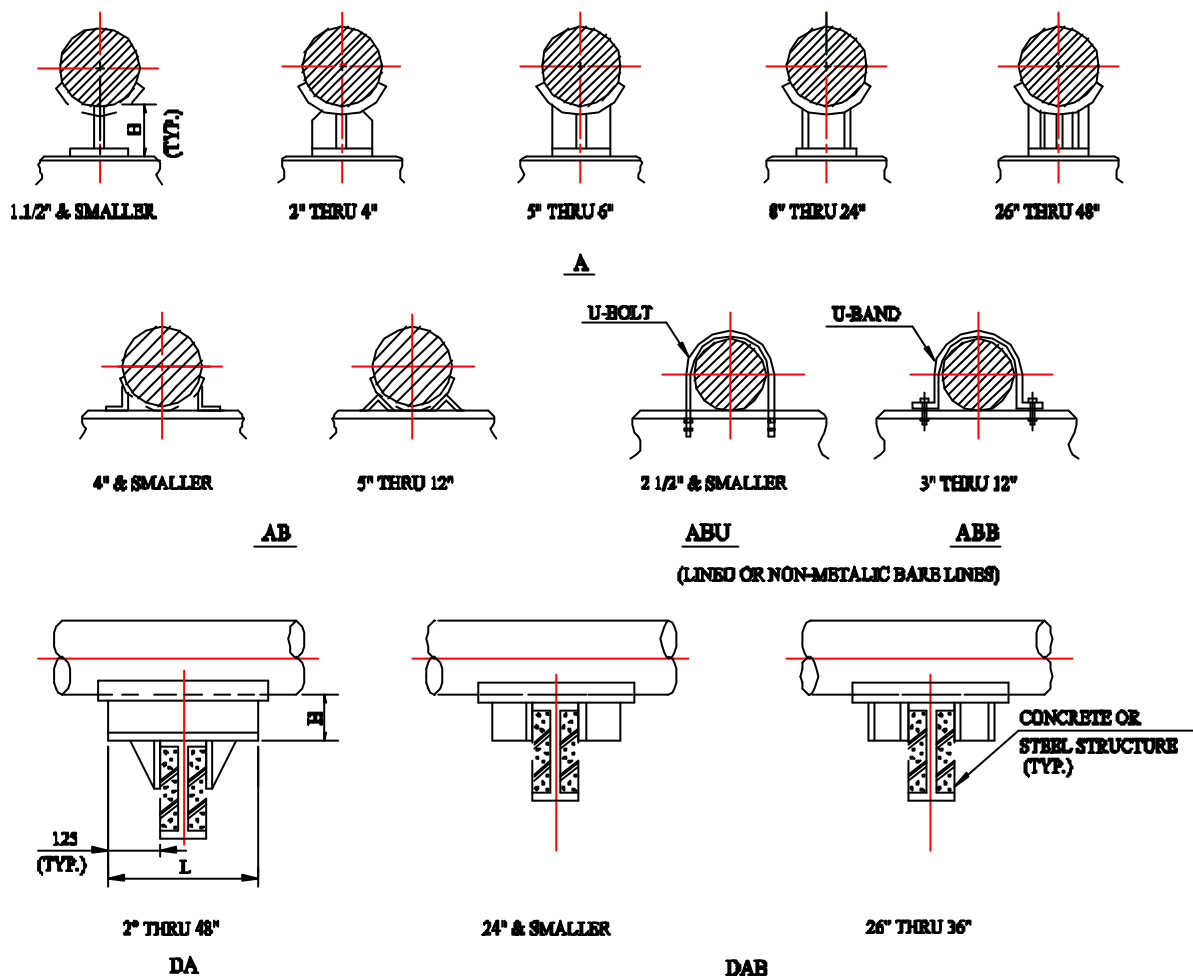
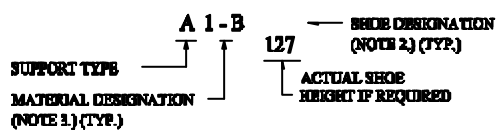
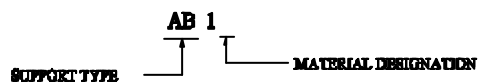
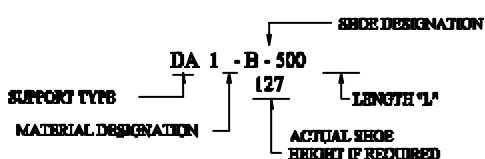
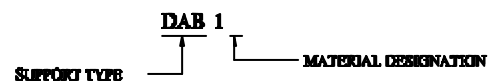
6.2 Attachment 2: Standard Piping Supports (Cold Insulated Lines)

 DESIGN SPECIFICATION	PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)	LDM-L002 REV. 0 PAGE : 1 OF 21 DATE : SEP., 2002
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CONTENTS

	PAGE
1. ANCHORS	2
2. GUIDES	3
3. RESTS	4
4. ELBOW STANCHIONS	5, 6
5. DUMMY SUPPORTS	7, 8
6. TRUNNIONS	9
7. VESSEL BRACKETS - GUIDE	10
8. VESSEL BRACKETS - REST	11
9. VESSEL BRACKETS - SPRING	12
10. SPRING HANGERS	13
11. SPRING SUPPORTS	14
12. RIGID HANGERS	15
13. HOLD - DOWNS	16
14. BRACKETS - SINGLE LINE SUPPORTING	17, 18, 19
15. BRACKETS - MULTI LINE SUPPORTING	20, 21

PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

1. ANCHORS

NOTES
1. ANCHOR SUPPORT LEGENDS ARE AS FOLLOWS.
1.1 FOR HOT INSULATED LINES

1.2 FOR BARE LINES

1.3 FOR DIRECTIONAL ANCHOR FOR HOT INSULATED LINES

1.4 DIRECTIONAL ANCHOR FOR BARE LINES

2. SIDE HEIGHTS ARE AS FOLLOWS.

INSUL. THK	SIDE HEIGHT (H)	DESIGNATION
BELOW 75	100	NONE
76 - 125	150	A
126 - 175	200	B
176 - 225	250	C

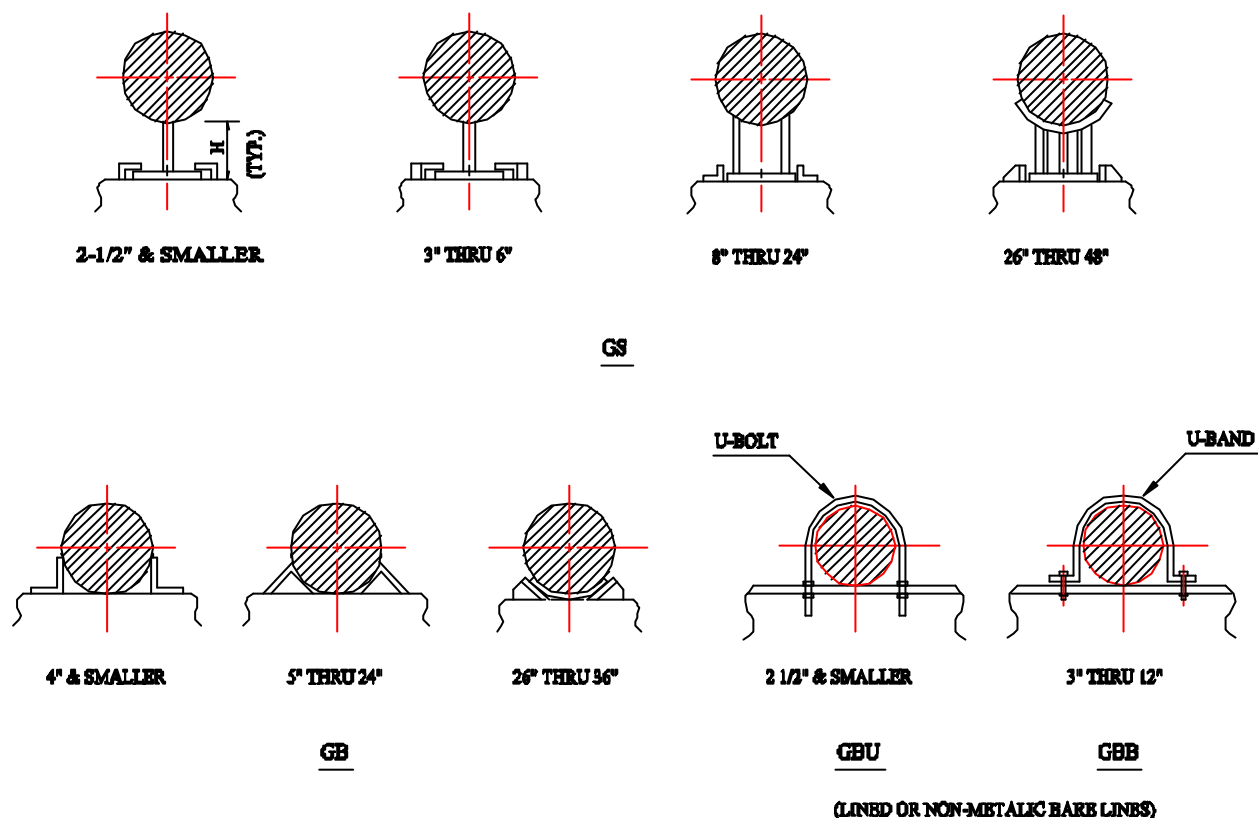
3. ANCHOR SELECTION GUIDE

PIPING		DESIGN TEMP.	ANCHOR TYPE			
MATERIAL	DESIGNATION		HOT INSULATED LINES		BARE LINES	
CARBON STEEL	1	BELOW 350° C	A1	DA1	AB1	DAB1
	2	350° C ~ 420° C	A2	DA2	NONE	NONE
STAINLESS STEEL	3	BELOW 350° C	A3	DA3	AB3	DAB3
	4	350° C ~ 420° C	A4	DA4	NONE	NONE
	NONE	420° C ~ 700° C	CONSULT WITH STRESS ENGINEER			
LOW ALLOY STEEL	5	BELOW 450° C	A5	DA5	NONE	
	NONE	450° C ~ 550° C	CONSULT WITH STRESS ENGINEER			
LINED/ NON-METALLIC	NONE	AMB ~ 150° C	NONE (NOTE 4)		ABU or ABB	

4. SPECIFY AS SPECIAL PIPING SUPPORT AND DEVELOP IN "SPECIAL PIPING SUPPORT DRAWINGS" OR PRE-FABRICATED TO PIPE BY MANUFACTURER.

PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

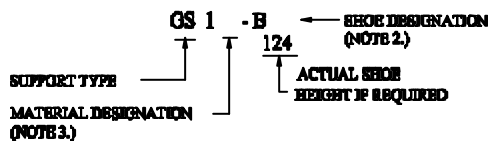
2. GUIDES



NOTES

1. GUIDE SUPPORT LEGENDS ARE AS FOLLOWS.

1.1 FOR HOT INSULATED LINES



1.2 FOR BARE LINES



2. SHOE HEIGHTS ARE AS FOLLOWS.

INSUL. THK	SHOE HEIGHT (H)	DESIGNATION
BELOW 75	100	NONE
76 ~ 125	150	A
126 ~ 175	200	B
176 ~ 225	250	C

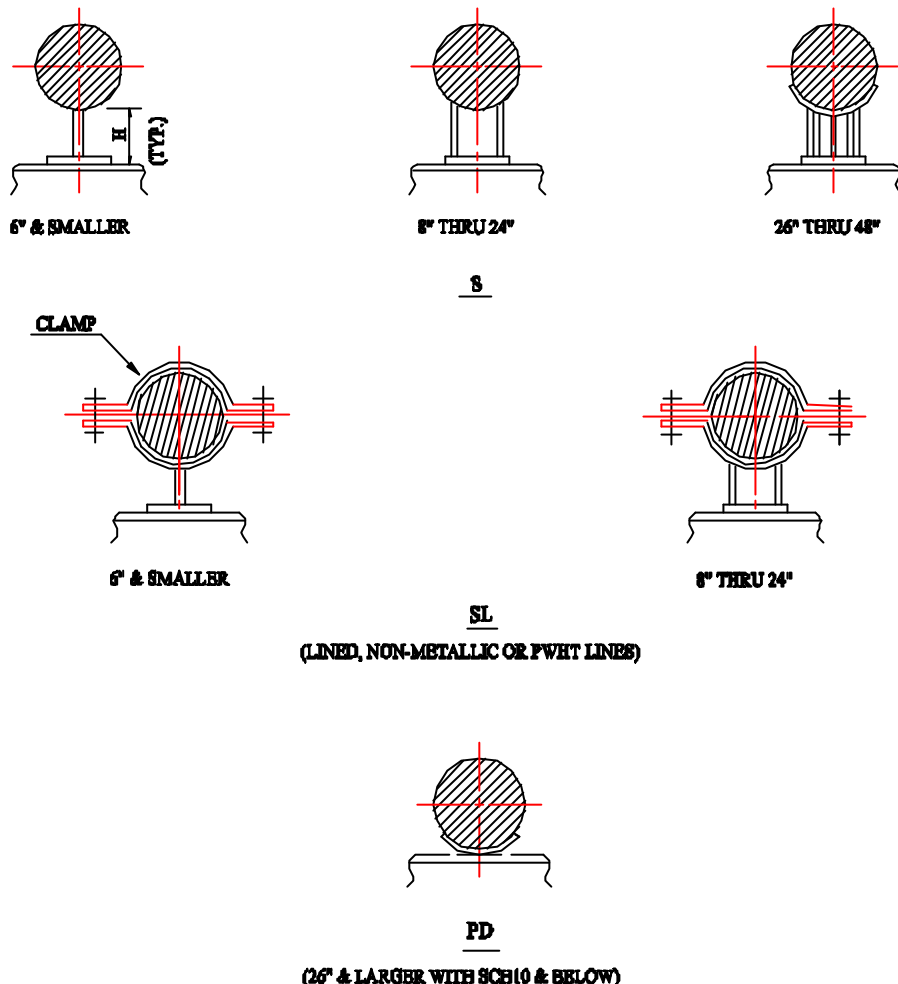
3. GUIDE SELECTION GUIDE

PIPING		DESIGN TEMP.	GUIDE TYPE	
MATERIAL	DESIGNATION		HOT INSULATED LINES	BARE LINES
CARBON STEEL	1	BELOW 350° C	GB1	GB
	2	350° C ~ 430° C	GB2	NONE
STAINLESS STEEL	3	BELOW 350° C	GB3	GB
	4	350° C ~ 430° C	GB4	NONE
	NONE	430° C ~ 700° C	CONSULT WITH STRESS ENGINEER	
LOW ALLOY STEEL	5	BELOW 450° C	GB5	NONE
	NONE	450° C ~ 550° C	CONSULT WITH STRESS ENGINEER	
LINED/ NON-METALLIC	NONE	AMB ~ 150° C	NONE (NOTE 4)	GBU OR GBB

4. SPECIFY AS SPECIAL PIPING SUPPORT AND DEVELOP IN "SPECIAL PIPING SUPPORT DRAWINGS".

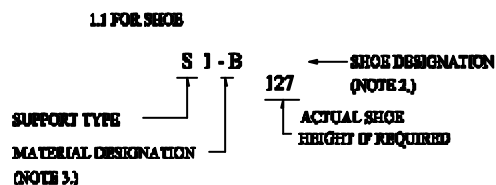
PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

3. RESTS



NOTES

1. REST SUPPORT LEGENDS ARE AS FOLLOWS.



2. SHOE HEIGHTS ARE AS FOLLOWS.

INSUL. THK	SHOE HEIGHT (H)	DESIGNATION
BELOW 75	100	NONE
76 ~ 125	150	A
126 ~ 175	200	B
176 ~ 225	250	C

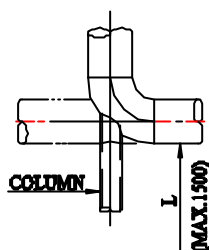
3. REST SELECTION GUIDE

PIPING		DESIGN TEMP.	REST TYPE	
MATERIAL	DESIGNATION		HOT INSULATED LINES	HOT INSULATED PWHT LINES
CARBON STEEL	1	BELOW 350° C	SL1	SL1
	2	350° C ~ 420° C	SL2	SL2
STAINLESS STEEL	3	BELOW 330° C	SL3	SL3
	4	330° C ~ 420° C	SL4	SL4
	NONE	420° C ~ 700° C	CONSULT WITH STRESS ENGINEER	
LOW ALLOY STEEL	5	BELOW 450° C	SL5	SL5
	NONE	450° C ~ 550° C	CONSULT WITH STRESS ENGINEER	
LINED/ NON-METALLIC	NONE	AMB ~ 150° C	SL6	NONE

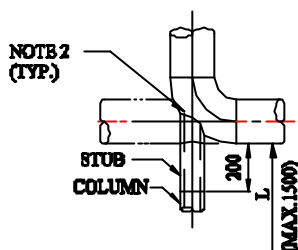
PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

4. ELBOW STANCHIONS (1 OF 2)

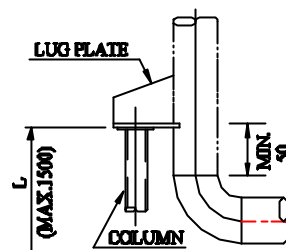
UPPER SECTION


E1

(POR C/S-NON HEAT TREATED)

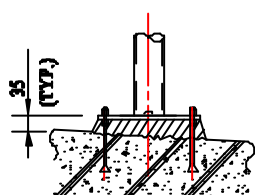

E2

(POR ALLOY, S/S, C/S-HEAT TREATED)

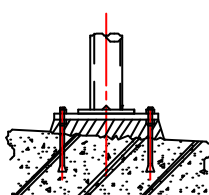

E3

(POR NPS 4" THRU 24")

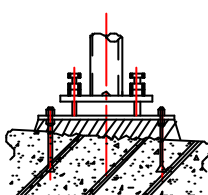
LOWER SECTION (PAVED AREA-LIGHT DUTY)


A

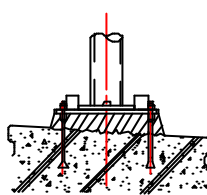
(ANCHOR)


B

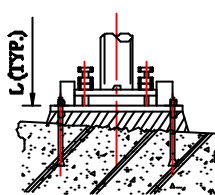
(REST)


C

(ADJUSTABLE REST)


D

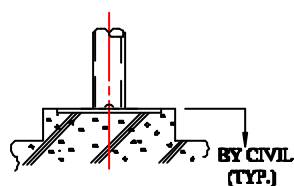
(GUIDE)


E

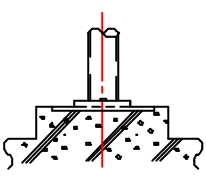
(GUIDE/ADJUSTABLE REST)

FOR NPS 16" & SMALLER AND PIPING LOAD 1000 Kgf & BELOW

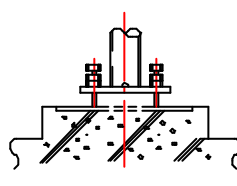
LOWER SECTION (GROUND OR HEAVY DUTY)


F

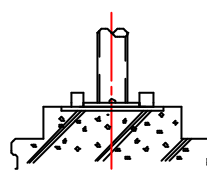
(ANCHOR)


G

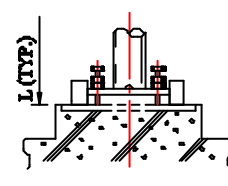
(SLIDE)


H

(ADJUSTABLE REST)

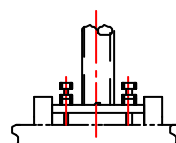

I

(GUIDE)

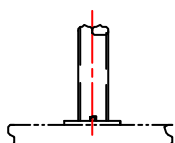

J

(GUIDE/ADJUSTABLE REST)

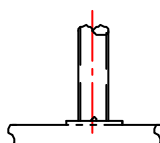
LOWER SECTION (STEEL SURFACE)


N

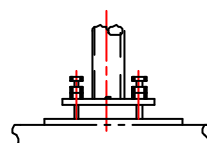
(GUIDE/ADJUSTABLE REST)


S

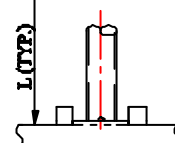
(ANCHOR)


T

(REST)


U

(ADJUSTABLE REST)


W

(GUIDE)

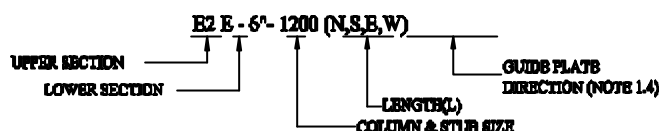
PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

4. ELBOW STANCHIONS (2 OF 2)

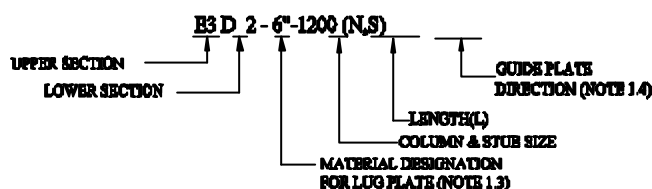
NOTES

1. ELBOW STANCHION SUPPORT LEGENDS ARE AS FOLLOWS.

1.1 FOR TYPE E1, E2 OF UPPER SECTION



1.2 FOR TYPE E3 OF UPPER SECTION



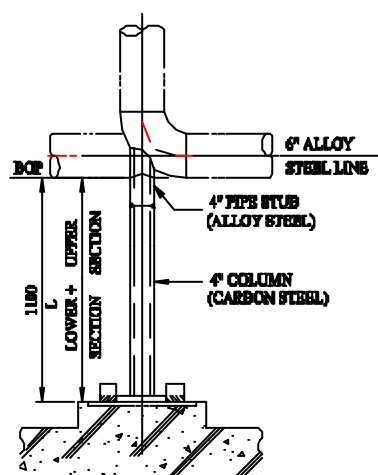
1.3 MATERIAL DESIGNATION FOR LUG PLATE

- 1: CARBON STEEL, PIPING TEMP. BELOW 350° C
- 2: CARBON STEEL, PIPING TEMP. 350° C ~ 420° C
- 3: STAINLESS STEEL, PIPING TEMP. BELOW 350° C
- 4: STAINLESS STEEL, PIPING TEMP. 350° C ~ 420° C
- 5: LOW ALLOY STEEL, PIPING TEMP. BELOW 450° C

1.4 GUIDE PLATE DIRECTIONS SHALL BE SPECIFIED ONLY AT REQUIRED DIRECTIONS FOR THE TYPE D, E, I, J, N, W OF LOWER SECTION AND OMITTED FOR THE OTHER TYPES.

DIRECTION DESIGNATION

N: NORTH, S: SOUTH, E: EAST, W: WEST



SAMPLE: E2L4"-1100 (N,S)

2. SPECIAL CONSIDERATION SHALL BE GIVEN TO ELBOW ATTACHMENT UNDER THE FOLLOWING CONDITIONS. CONSULT WITH PIPING STRESS ENGINEER.

2.1 DESIGN TEMPERATURES ABOVE 420° C FOR CARBON /STAINLESS STEEL PIPING, AND 450° C FOR ALLOY STEEL.

2.2 OPERATING PRESSURE 210 KG/CM² AND ABOVE.

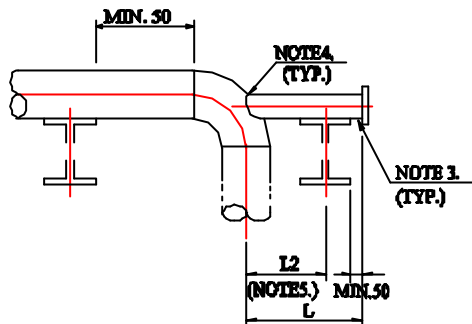
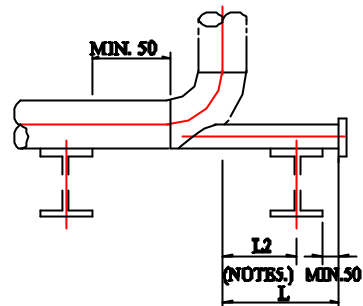
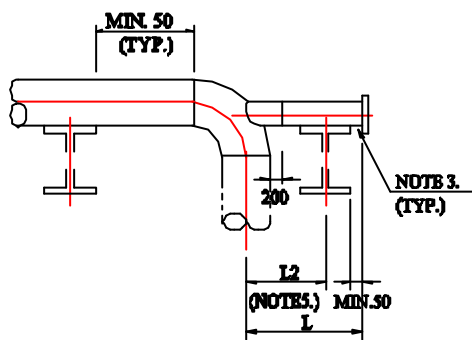
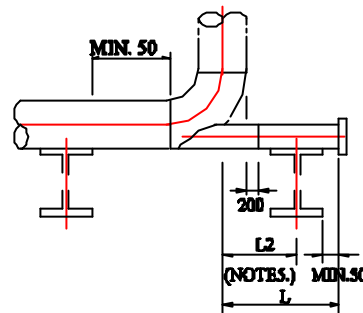
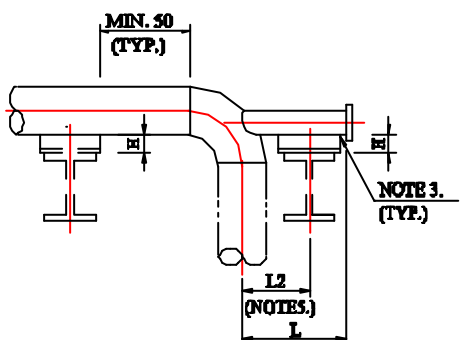
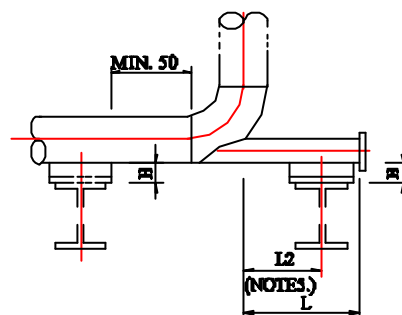
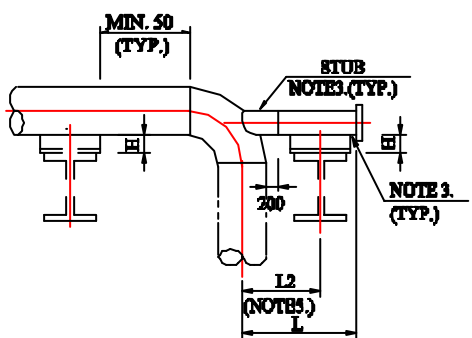
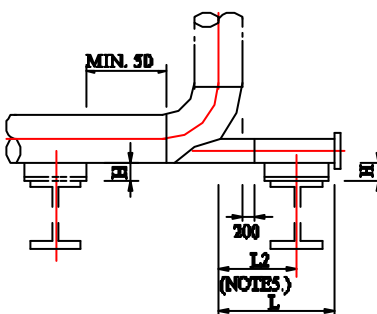
2.3 PIPING TO AND FROM RECIPROCATING OR POSITIVE DISPLACEMENT COMPRESSOR AND PUMP.

2.4 PIPING OPERATING IN A SEVERE CYCLIC CONDITION.

3. THE SIZE SELECTION FROM THE TABLE BELOW IS ONLY FOR REFERENCE. THE SIZE OF COLUMN & STUB MAY BE INCREASED OR REDUCED BY THE STRESS EVALUATION OF PIPING SUPPORTS.

ELBOW STANCHION SIZE SELECTION TABLE

NOMINAL PIPE SIZE	COLUMN & STUB SIZE	
	L ≥ 1000	1000 < L ≤ 500
2"	2"	NONE
2 1/2"	2"	NONE
3"	2"	3"
4"	3"	3"
5" - 6"	4"	4"
8" - 10"	6"	6"
12" - 16"	8"	8"
18" - 20"	10"	12"
22" - 24"	12"	14"
26" - 30"	14"	16"
32" - 36"	16"	18"
38" - 42"	18"	20"
44" - 48"	20"	20"

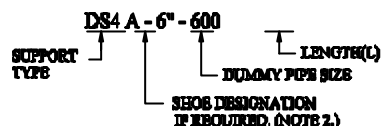
5. DUMMY SUPPORTS (1 OF 2)
CS - NON HEAT TREATED LINES : BARE LINES

DS1

ALLOY, S/S, CS - HEAT TREATED LINES : BARE LINES

DS2

CS - NON HEAT TREATED LINES : HOT INSULATED LINES

DS3

ALLOY, S/S, CS - HEAT TREATED LINES : HOT INSULATED LINES

DS4


PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

5. DUMMY SUPPORTS (2 OF 2)

NOTES

1. SUPPORT LEGEND IS AS FOLLOWS.



2. SHOE HEIGHT SHALL BE AS FOLLOWS.

INSUL. THK	SHOE HEIGHT (H)	DESIGNATION
BELOW 75	100	NONE
75 ~ 125	150	A
125 ~ 175	200	B
175 ~ 225	250	C

3. THE BOP ELEVATION OF HEADER & DUMMY PIPE SHALL BE SAME.

4. SPECIAL CONSIDERATION SHALL BE GIVEN TO ELBOW ATTACHMENT UNDER THE FOLLOWING CONDITIONS. CONSULT WITH PIPING STRESS ENGINEER.

2.1 DESIGN TEMPERATURES ABOVE 400° C FOR CARBON /STAINLESS STEEL PIPING, AND 450° C FOR ALLOY STEEL.

2.2 OPERATING PRESSURE 210 KG/CM² AND ABOVE.

2.3 PIPING TO AND FROM RECIPROCATING OR POSITIVE DISPLACEMENT COMPRESSOR AND PUMP.

2.4 PIPING OPERATING IN A SEVERE CYCLIC CONDITION.

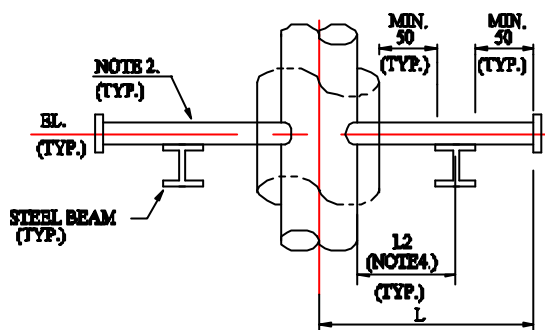
5. THE SIZE SELECTION FROM THE TABLE BELOW IS ONLY FOR REFERENCE. IN CASE "L2" LENGTH IS LONGER THAN MAX, DUMMY PIPE SIZE SHALL BE CALCULATED.

DUMMY SIZE SELECTION TABLE

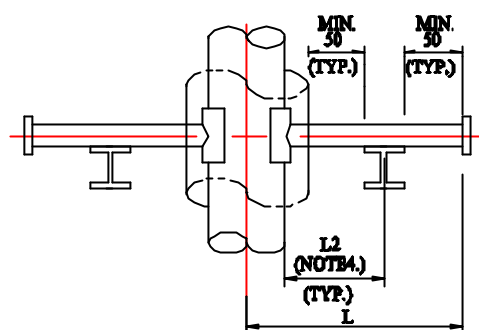
PIPE SIZE	DUMMY SIZE	MAX "L2" LENGTH
2"	1 1/2"	1000
2 1/2"-3"	2"	1000
4"	3"	1000
5"-6"	4"	1500
8"-10"	6"	1500
12"-16"	8"	1500
18"-20"	10"	2000
22"-24"	12"	2000
26"-30"	14"	2000
32"-36"	16"	2000
38"-42"	18"	2000
44"-48"	20"	2000

PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

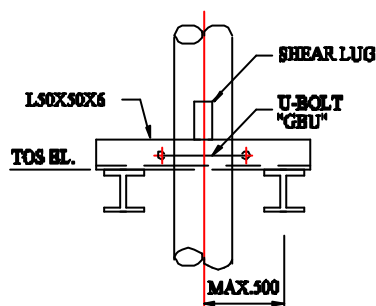
6. TRUNNIONS



TR1



TR2



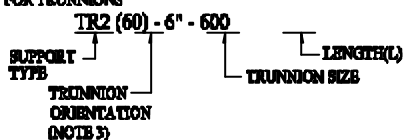
TR5

LUG W/ U-BOLT (1 1/2" & SMALLER)

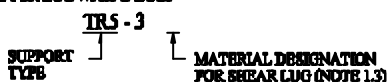
NOTES

1. SUPPORT LEGENDS ARE AS FOLLOWS.

1.1 FOR TRUNNIONS



1.2 FOR LUG WITH U-BOLT

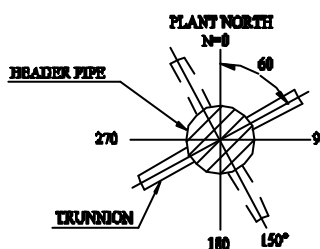


1.3 MATERIAL DESIGNATION FOR SHEAR LUG

- 1: CARBON STEEL, PIPING TEMP. BELOW 350° C
- 2: CARBON STEEL, PIPING TEMP. 350° C ~ 425° C
- 3: STAINLESS STEEL, PIPING TEMP. BELOW 350° C
- 4: STAINLESS STEEL, PIPING TEMP. 350° C ~ 425° C
- 5: LOW ALLOY STEEL, PIPING TEMP. BELOW 450° C

2. IN CASE OF THE DESIGN TEMPERATURES OF PIPING ABOVE 450° C, CONSULT WITH STRESS ENGINEER.

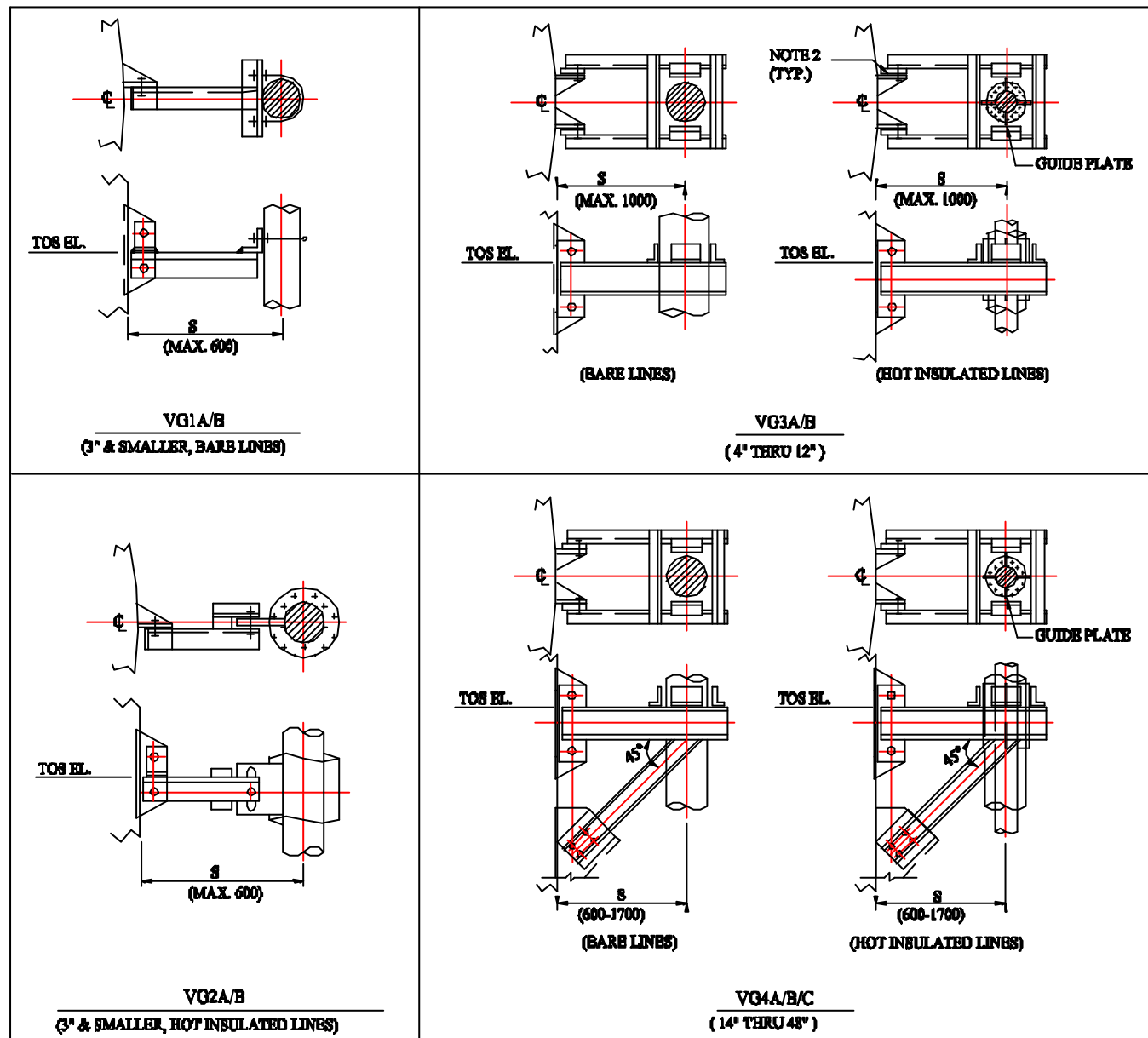
3. TRUNNION ORIENTATION



4. THE SIZE SELECTION FROM THE TABLE BELOW IS ONLY REFERENCE. IN CASE "L2" LENGTH IS LONGER THAN MAX., TRUNNION PIPE SIZE SHALL BE CALCULATED.

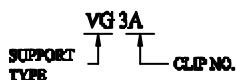
TRUNNION SIZE SELECTION TABLE

PIPE SIZE	TRUNNION SIZE	MAX. "L2" LENGTH
2"	1 1/2"	500
2 1/2"-3"	2"	
4"	3"	
5"-6"	4"	
8"-10"	6"	
12"-16"	8"	
18"-20"	10"	
22"-24"	12"	
26"-30"	14"	
32"-36"	16"	
38"-42"	18"	
44"-48"	20"	500

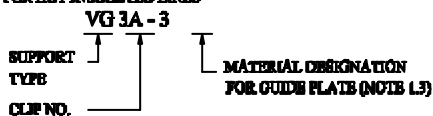
7. VESSEL BRACKETS - GUIDE

NOTES

1. GUIDE SUPPORT LEGENDS ARE AS FOLLOWS.

1.1 FOR BARE LINES



1.2 FOR HOT INSULATED LINES



1.3 MATERIAL DESIGNATION FOR GUIDE PLATE

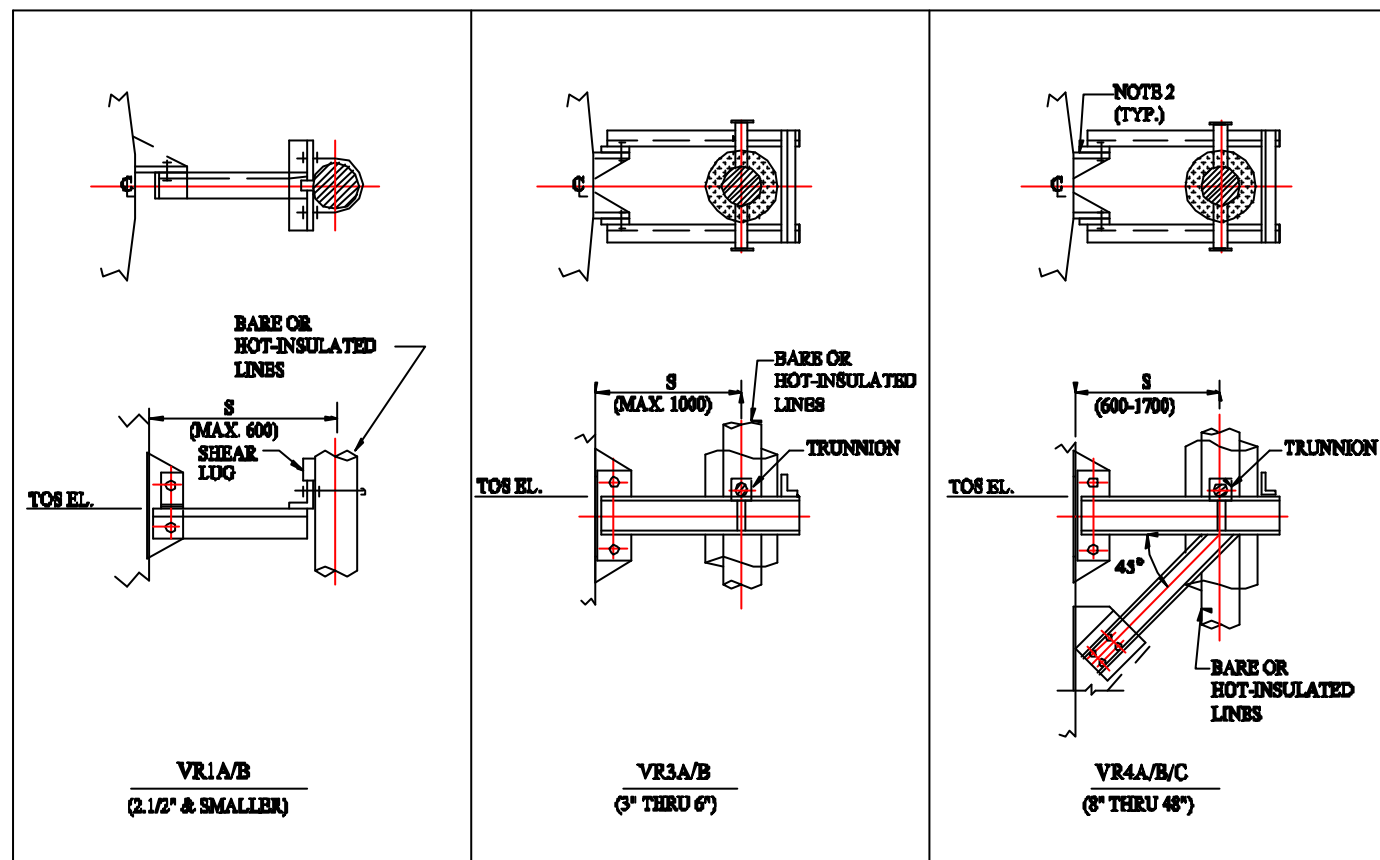
- 1: CARBON STEEL, PIPING TEMP. BELOW 350° C
- 2: CARBON STEEL, PIPING TEMP. 350° C ~ 420° C
- 3: STAINLESS STEEL, PIPING TEMP. BELOW 350° C
- 4: STAINLESS STEEL, PIPING TEMP. 350° C ~ 420° C
- 5: LOW ALLOY STEEL, PIPING TEMP. BELOW 450° C

2. WHEN THE VESSEL TEMPERATURE IS OVER 450° C, TEMPERATURE ISOLATION BETWEEN CLIP AND BRACKET SHOULD BE CONSIDERED.

3. THE TYPE FOR VESSEL BRACKET-GUIDES SHALL BE SELECTED FROM TABLE BELOW (UNLESS OTHERWISE NOTED BY STRESS ENGINEER).

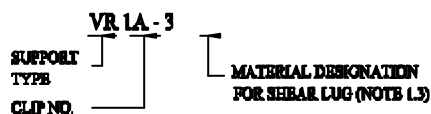
**TYPE SELECTION TABLE
FOR VESSEL BRACKET-GUIDES**

TYPE	LINE SIZE	MEMBER SIZE
VG1A	2" & SMALLER	1.50x50x6
1B	2.1/2" - 3"	1.75x75x9
VG2A	1 1/2" & SMALLER	1.50x50x6
2B	2" - 3"	1.75x75x9
3A	4" - 8"	[100x50x5x7.5]
3B	10" - 12"	[150x75x9x12.5]
4A	14" - 24"	[150x75x9x12.5]
4B	26" - 36"	[200x90x9x13.5]
4C	38" - 48"	[300x90x9x13]

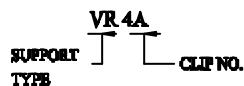
8. VESSEL BRACKETS - REST

NOTES

1. RESTING SUPPORT LEGENDS ARE AS FOLLOWS.

1.1 FOR VR1A/B



1.2 OTHERS



1.3 MATERIAL DESIGNATION FOR SHEAR LUG

- 1: CARBON STEEL, PIPING TEMP. BELOW 350° C
- 2: CARBON STEEL, PIPING TEMP. 350° C - 420° C
- 3: STAINLESS STEEL, PIPING TEMP. BELOW 350° C
- 4: STAINLESS STEEL, PIPING TEMP. 350° C - 420° C
- 5: LOW ALLOY STEEL, PIPING TEMP. BELOW 450° C

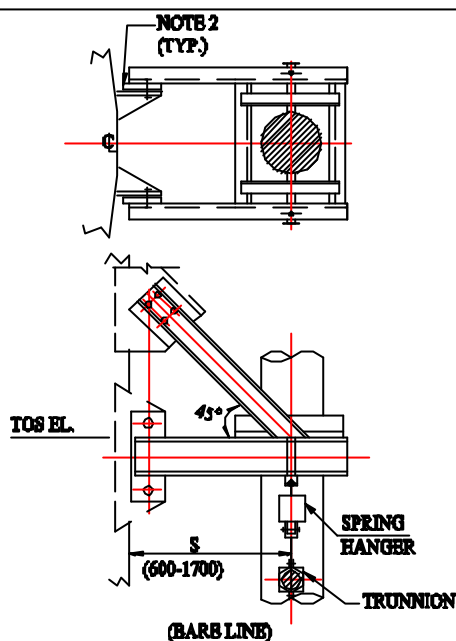
2. WHEN THE VESSEL TEMPERATURE IS OVER 450° C, TEMPERATURE ISOLATION BETWEEN CLIP AND BRACKET SHOULD BE CONSIDERED.

3. THE TYPE FOR VESSEL BRACKET-RESTS SHALL BE SELECTED FROM TABLE BELOW UNLESS OTHERWISE NOTED BY STRESS ENGINEER.

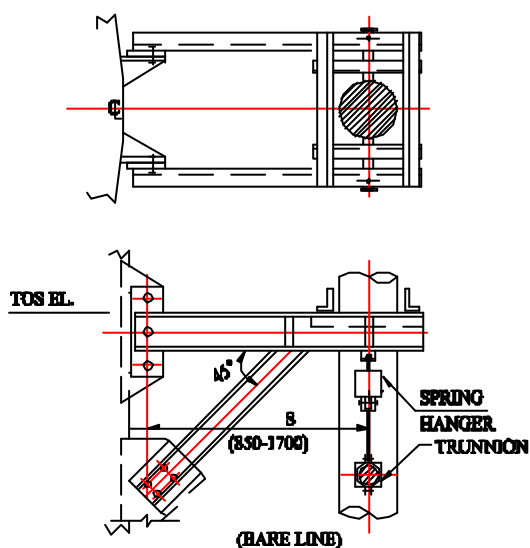
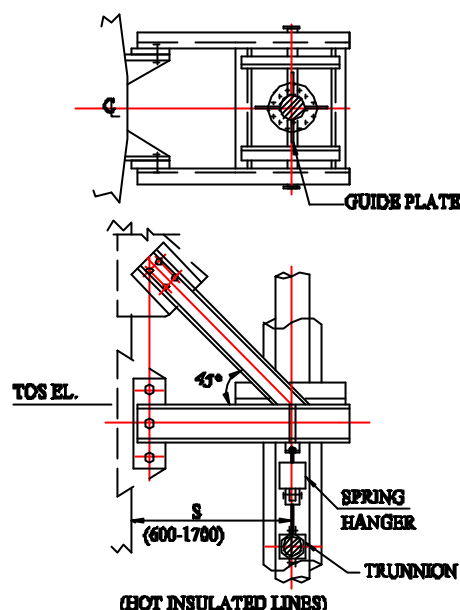
**TYPE SELECTION TABLE
FOR VESSEL BRACKET-RESTS**

TYPE	LINE SIZE	MEMBER SIZE
VR1A	1/2"-3/4"	L5X5X6
1B	1"-2.1/2"	L7SX7SX9
3A	3"-4"	[100x50x5x7.5
5B	6"	[150x75x9x12.5
4A	8"-16"	[150x75x9x12.5
4B	18"-28"	[200x90x8x13.5
4C	30"-48"	[300x90x9x13

9. VESSEL BRACKETS - SPRING

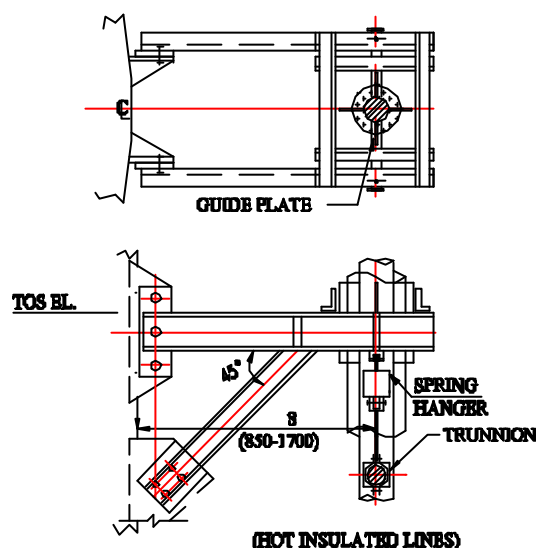


VS5A/B/C



VS4A/B/C

(DO NOT USE IN PRINCIPLE, SUBSTITUTE WITH VS5)

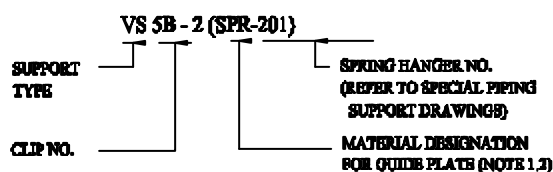


(HOT INSULATED LINES)

NOTES

1. SPRING HANGER LEGEND IS AS FOLLOWS.

1.1 SPRING HANGER



1.2 MATERIAL DESIGNATION FOR GUIDE PLATE

- 1: CARBON STEEL, PIPING TEMP. BELOW 350° C
- 2: CARBON STEEL, PIPING TEMP. 350° C ~ 420° C
- 3: STAINLESS STEEL, PIPING TEMP. BELOW 350° C
- 4: STAINLESS STEEL, PIPING TEMP. 350° C ~ 420° C
- 5: LOW ALLOY STEEL, PIPING TEMP. BELOW 450° C

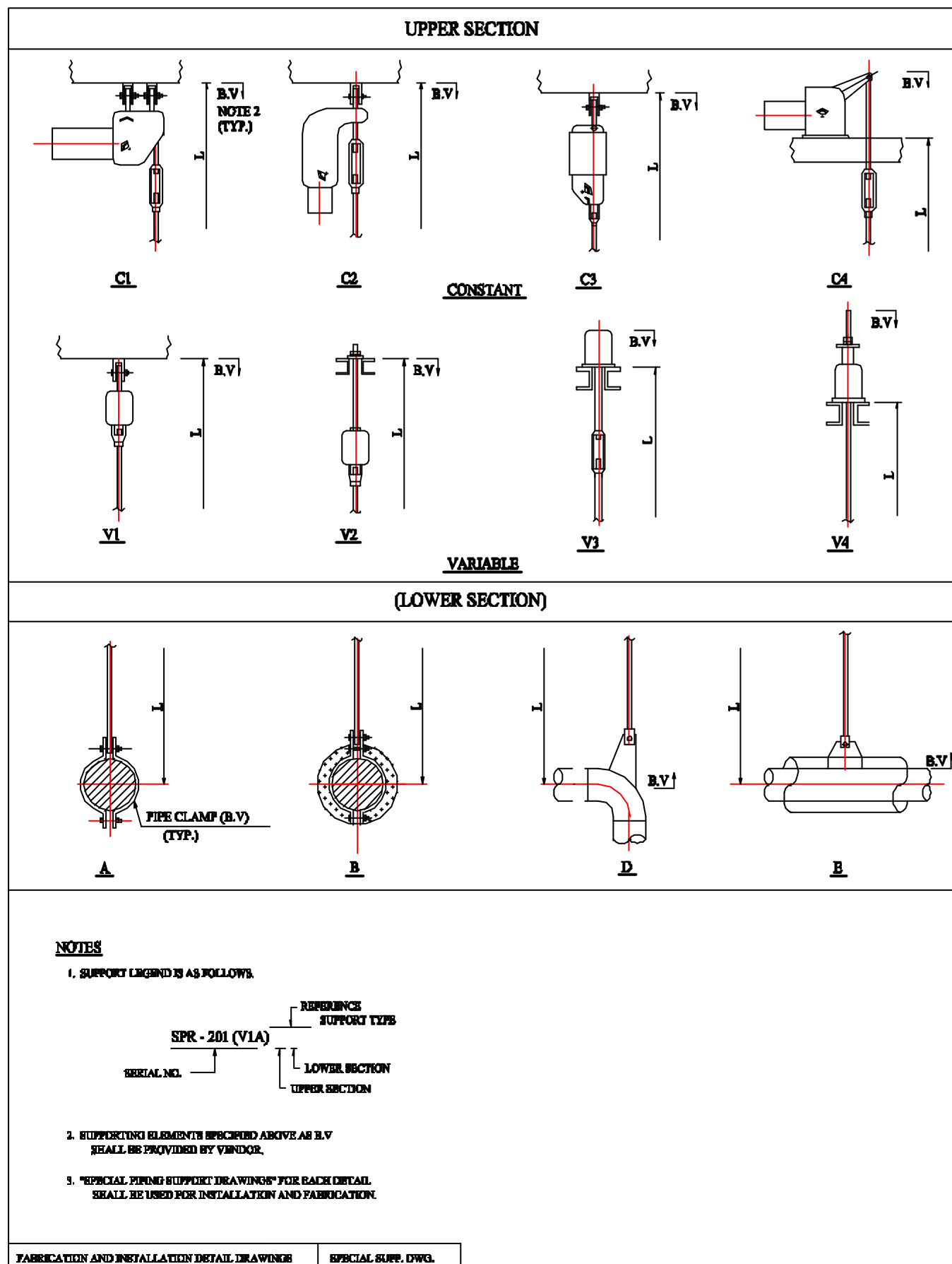
2. WHEN THE VESSEL TEMPERATURE IS OVER 450° C, TEMPERATURE ISOLATION BETWEEN CLIP AND BRACKET SHOULD BE CONSIDERED.

3. THE TYPE FOR VESSEL BRACKET-SPRING SUPPORTS SHALL BE SELECTED FROM TABLE BELOW UNLESS OTHERWISE NOTED BY STRESS ENGINEER.

**TYPE SELECTION TABLE
FOR VESSEL BRACKET-SPRING SUPPORTS**

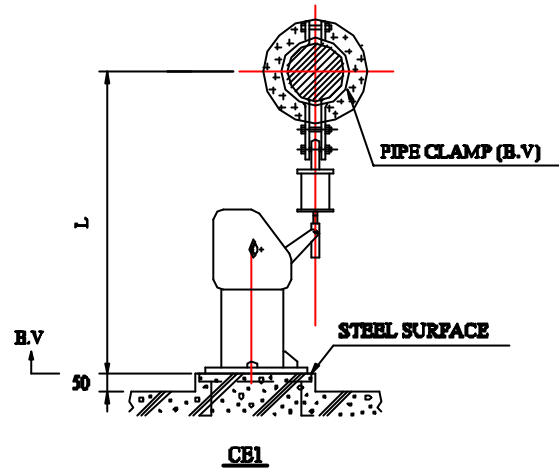
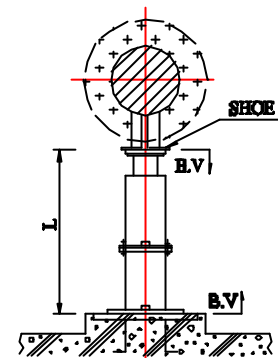
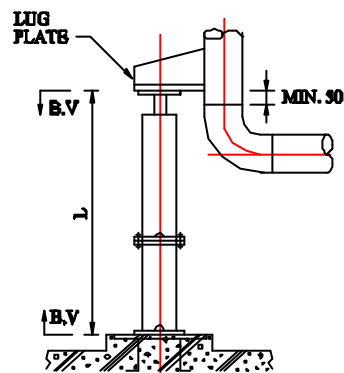
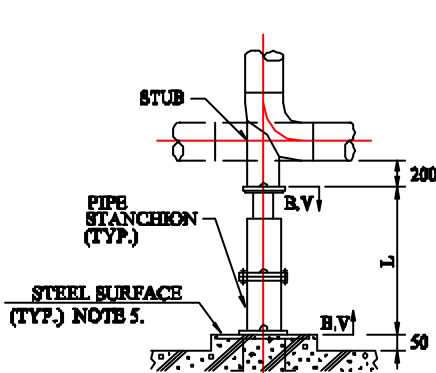
TYPE	LINE SIZE	MEMBER SIZE
VS4A	16" & SMALLER	[150x75x9x12.5]
5A		
4B	18" - 28"	[200x90x8x13.5]
5B		
4C	30" - 48"	[300x90x9x13]
5C		

PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

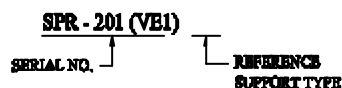
10. SPRING HANGERS


**LG E&C****DESIGN
SPECIFICATION**

**PIPING SUPPORTS
ATTACHMENT 1
STANDARD PIPING SUPPORTS
(FOR BARE / HOT INSULATED LINES)**

LDM-L002**REV. 0****PAGE : 14 OF 21****DATE : SEP. 2002****11. SPRING SUPPORTS****CONSTANT SPRING SUPPORT****VARIABLE SPRING SUPPORT****NOTES**

1. SUPPORT LEGEND IS AS FOLLOWS

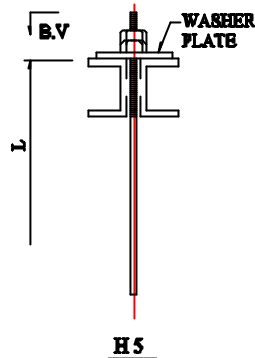
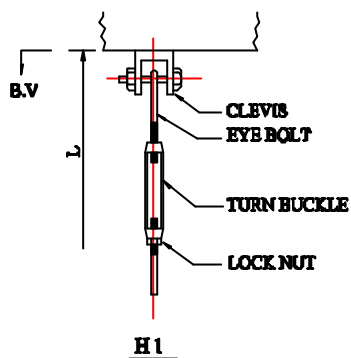
2. SUPPORTING ELEMENTS SPECIFIED ABOVE AS B.V
SHALL BE PROVIDED BY VENDOR.3. "SPECIAL PIPING SUPPORT DRAWINGS" FOR EACH DETAIL
SHALL BE USED FOR INSTALLATION AND FABRICATION.4. CONCRETE FOUNDATION AND STEEL SURFACE FOR EACH PIPE
SUPPORT SHALL BE PROVIDED BY CIVIL ENGINEER.

FABRICATION AND INSTALLATION DETAIL DRAWINGS

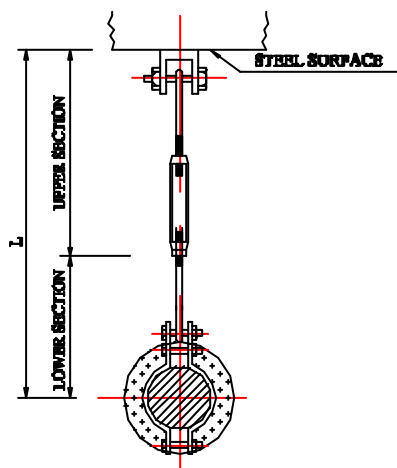
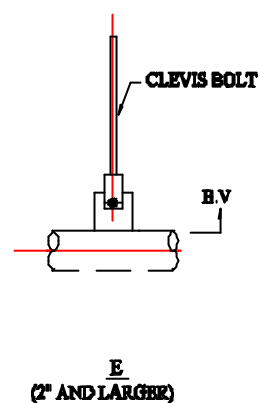
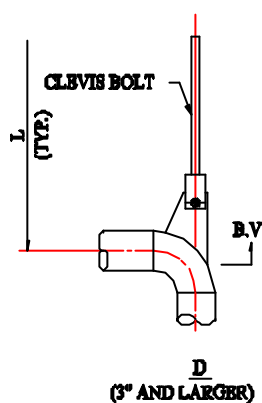
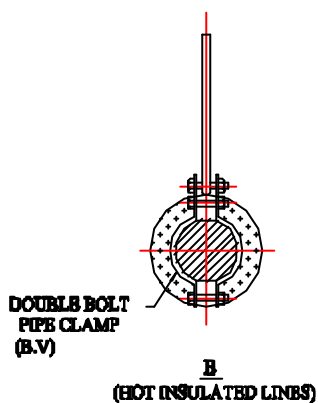
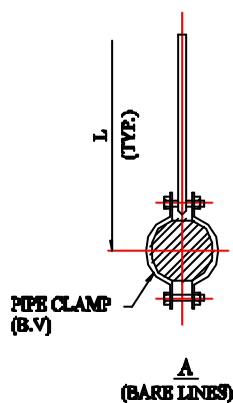
SPECIAL SUPP. DWG.

12. RIGID HANGERS

UPPER SECTION



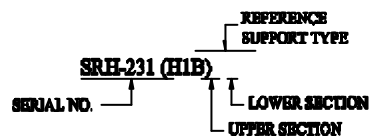
LOWER SECTION



SAMPLE : SRH-231(H1B)

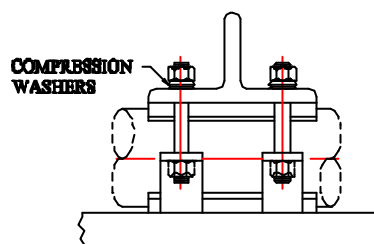
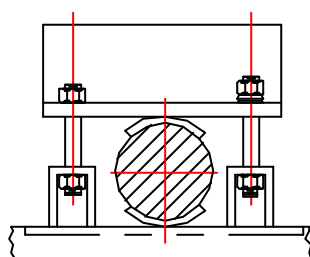
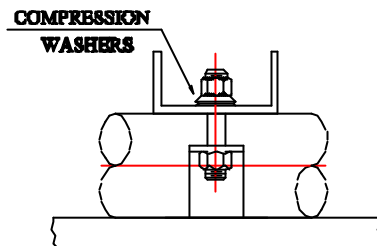
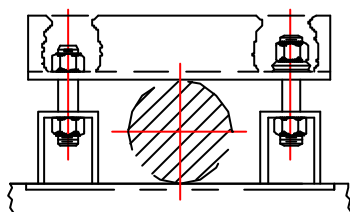
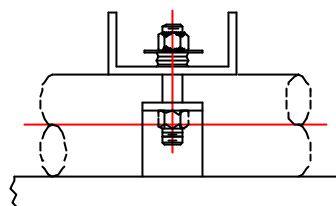
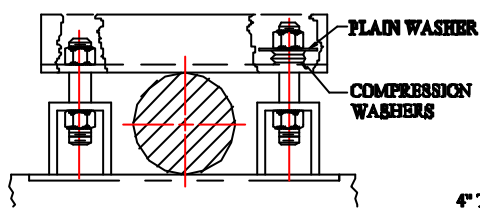
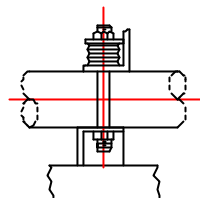
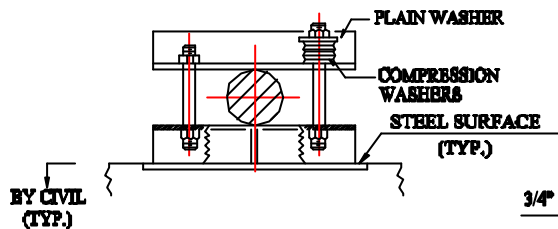
NOTES

1. RIGID HANGER SUPPORT LEGEND IS AS FOLLOWS.



2. SUPPORTING ELEMENTS SPECIFIED ABOVE AS B.V. SHALL BE PROVIDED BY VENDOR.

13. HOLD-DOWNS



HDH
(UP TO 330° C)

NOTES

1. HOLD-DOWN SUPPORT LEGEND IS AS FOLLOW.

HDH
SUPPORT TYPE

2. THE HOLD-DOWN SHALL BE INSTALLED WHERE REQUIRED BY VIBRATION ANALYSIS, ESPECIALLY ON RECIPROCATING PUMP AND COMPRESSOR LINES.

PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

LDM-L002

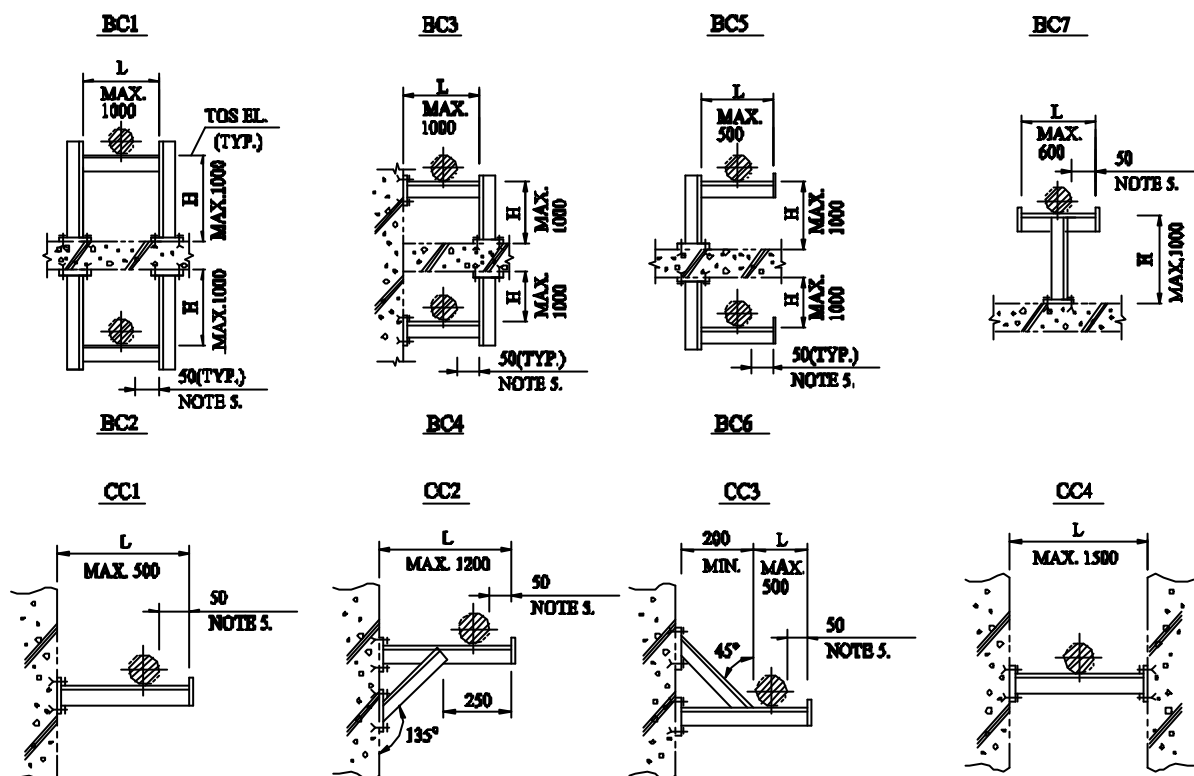
REV. 0

PAGE : 17 OF 21

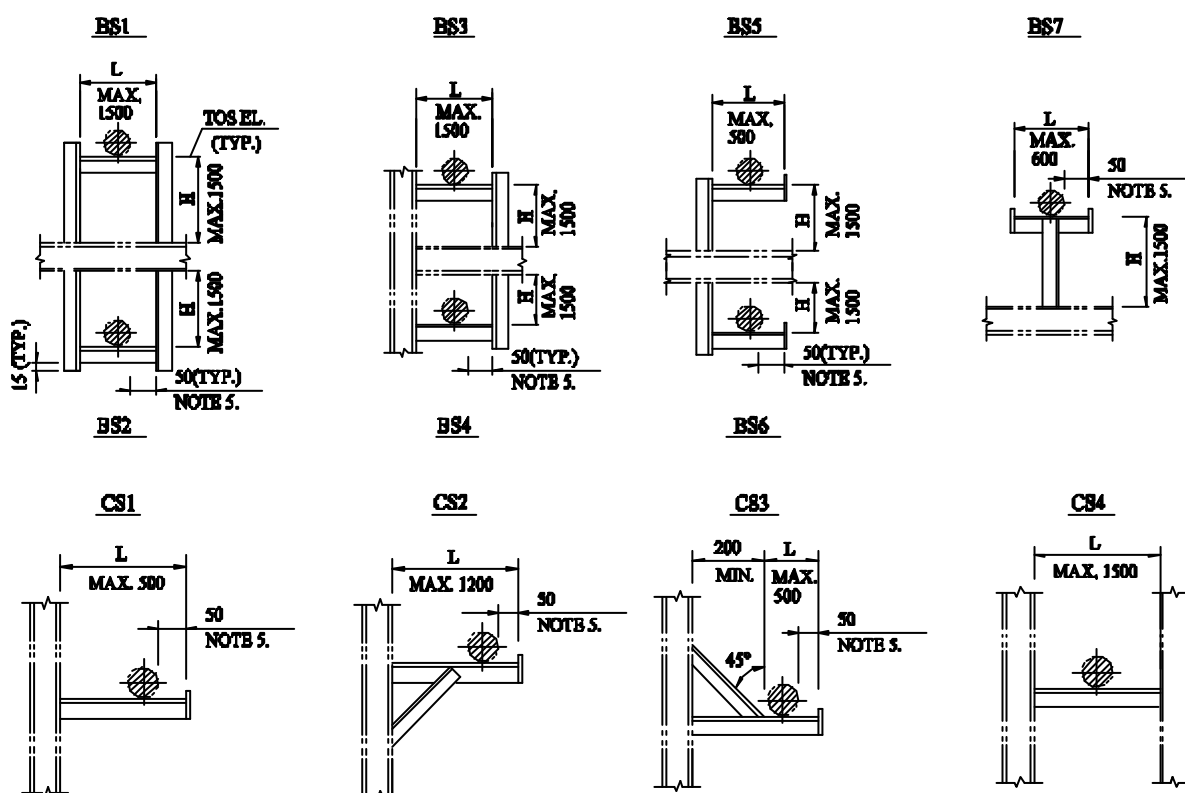
DATE : SEP. 2002

14. BRACKETS-SINGLE LINE SUPPORTING (1 OF 3)

FOR CONCRETE BEAM OR FLOOR (LOOKING ORIENTATION VIEW)

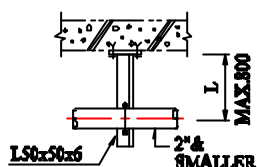


FOR STEEL COLUMN OR BEAM (LOOKING ORIENTATION VIEW)

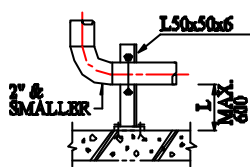


14. BRACKETS-SINGLE LINE SUPPORTING (2 OF 3)

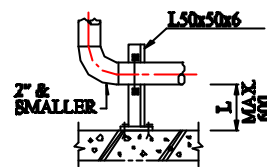
FOR CONCRETE BEAM OR FLOOR



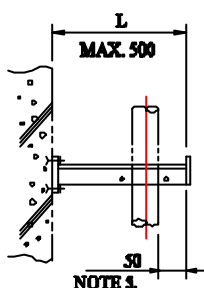
**BC8
(W/GBU)**



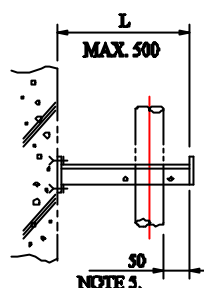
**BC9
(W/GBU)**



**BC10
(W/ABU)**

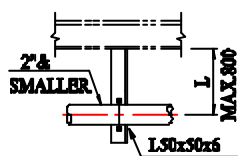


**CC5 (W/GBU)
(LOOKING ORIENTATION VIEW)**

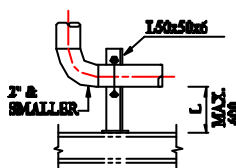


**CC6 (W/ABU)
(LOOKING ORIENTATION VIEW)**

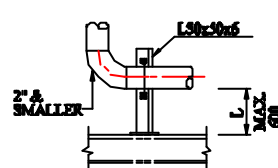
FOR STEEL COLUMN OR BEAM



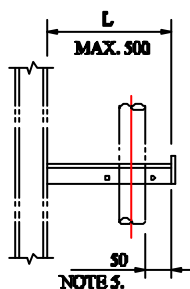
**BS8
(W/GBU)**



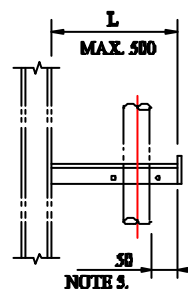
**BS9
(W/GBU)**



**BS10
(W/ABU)**



**CS5 (W/GBU)
(LOOKING ORIENTATION VIEW)**



**CS6 (W/ABU)
(LOOKING ORIENTATION VIEW)**

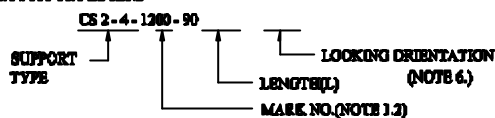
PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

14. BRACKETS - SINGLE LINE SUPPORTING (3 OF 3)

NOTES

1. BRACKET SUPPORT LEGEND IS AS FOLLOWS.

1.1 SUPPORT LEGEND



1.2 MEMBER SIZE MARK NO.

MARK NO.	MEMBER SIZE
1	L50x50x6
2	L65x65x6
3	L75x75x9
4	[100x50x6x7.5]
5	[150x75x6.5x10]

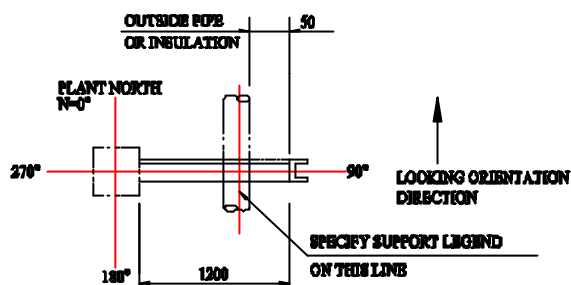
2. ANY ANCHOR ON THE BRACKET SUPPORTS EXCEPT BC(S)10, CC(S)6 SHALL NOT BE USED. HOWEVER, GUIDE CAN BE USED ONLY ON BC(S)1,2,3,4 FOR 6" AND BELOW.

3. SUPPLEMENTARY SUPPORT SUCH AS U-BOLT(SBU), C-BAND(CBS), GUIDES OR PIPE SHOES TO EACH OF THE LINES SHALL BE CALLED-OUT SEPARATELY EXCEPT BC(S)8,9,10 AND CC(S)5,6.

4. THE MEMBER SIZE OF BRACKETS SHALL BE SELECTED ACCORDING TO THE TABLES BELOW DEPENDING ON THE VERTICAL PIPING LOAD.

5. THE LENGTH FROM PIPE OUTSIDE (OR INSULATION) TO BRACKET'S EDGE SHALL BE 50MM.

6. LOOKING ORIENTATION & SAMPLE



SAMPLE : BS3-4-1200-0

BRACKET SELECTION TABLES

FOR TYPE : BS(C) 1 - 4

BRACKET DIMENSION		MAX. ALLOWABLE VERTICAL LOAD (kg)								
LENGTH(L)	HEIGHT(H)	100	200	300	400	500	600	700	800	1000
500	300	③	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③	③
1000	300	③	③	③	③	④	④	④	④	④
	1000	③	③	③	③	④	④	④	④	④
	1500	③	③	③	③	④	④	④	④	④
1500	300	④	④	④	④	④	④	④	④	④
	1000	④	④	④	④	④	④	④	④	④
	1500	④	④	④	④	④	④	④	④	④

FOR TYPE : BS(C)5-7, CS(C) 1, CS(C) 3, CS(C) 5,6

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)			
	100	200	300	400
200				
400	③	③	③	③
500				

FOR TYPE : CS(C) 2

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)									
	100	200	300	400	500	600	700	800	900	1000
500										
800	③	③	③	③	③	③	③	③	③	③
1000										
1200	④	④	④	④	④	④	④	④	④	④

FOR TYPE : CS(C) 4

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)				
	200	400	600	800	1000
500					
800	③	③	③	③	③
1000					
1200	④	④	④	④	④
1500					

**LG E&C****DESIGN
SPECIFICATION**

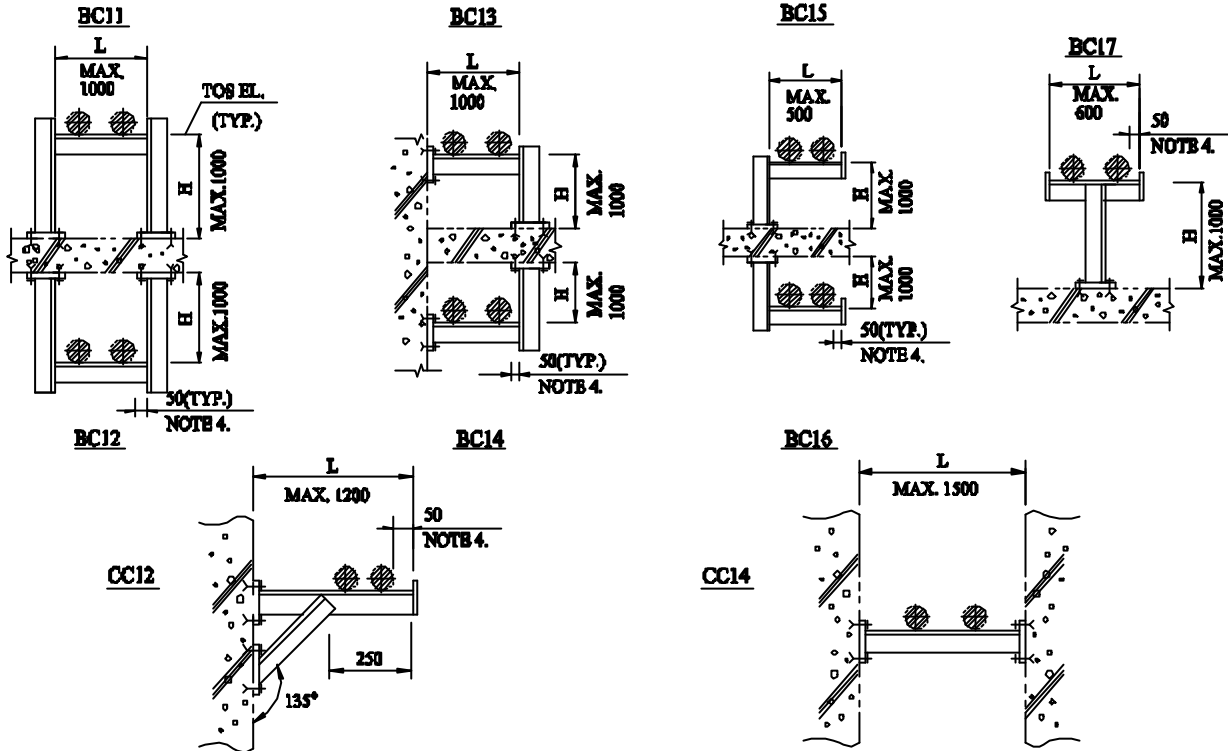
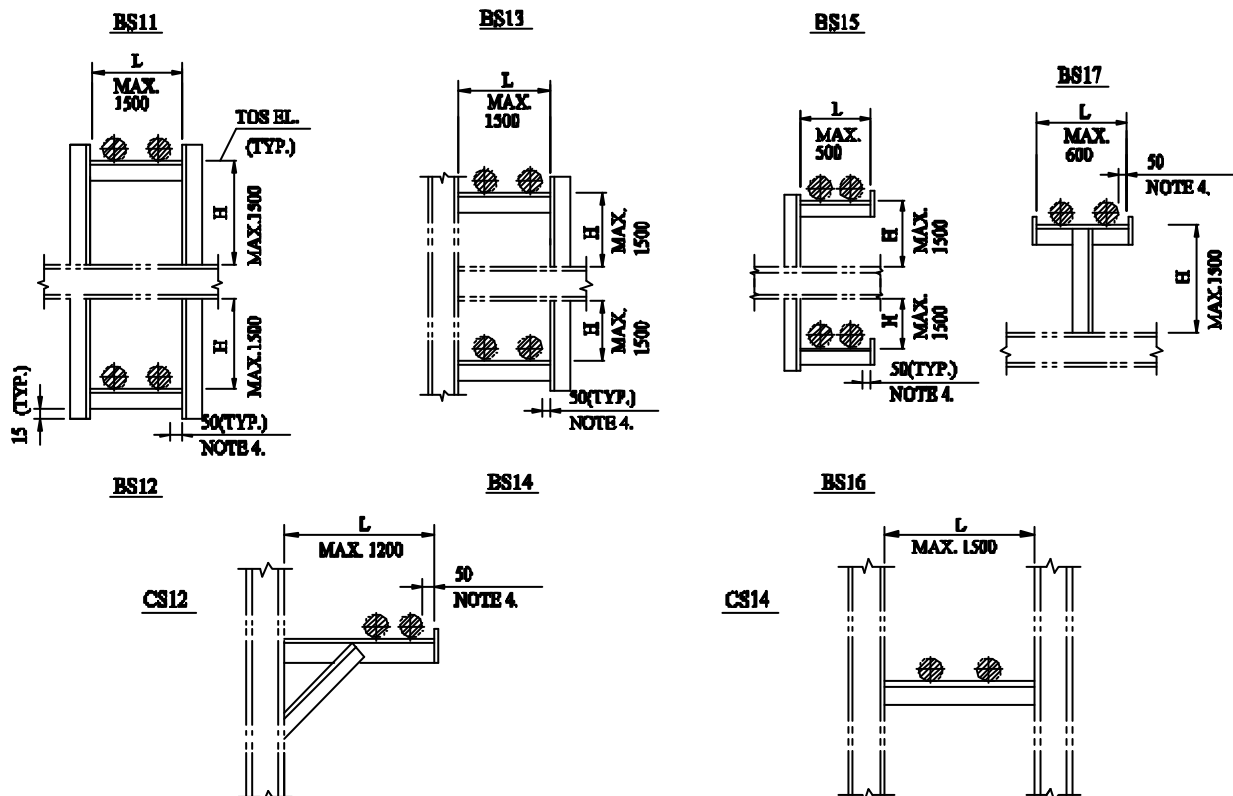
**PIPING SUPPORTS
ATTACHMENT 1
STANDARD PIPING SUPPORTS
(FOR BARE / HOT INSULATED LINES)**

LDM-L002

REV. 0

PAGE : 20 OF 21

DATE : SEP. 2002

15. BRACKETS-MULTI LINES SUPPORTING (1 OF 2)**FOR CONCRETE BEAM OR FLOOR (LOOKING ORIENTATION VIEW)****FOR STEEL COLUMN OR BEAM (LOOKING ORIENTATION VIEW)**

PIPING SUPPORTS ATTACHMENT 1 STANDARD PIPING SUPPORTS (FOR BARE / HOT INSULATED LINES)

15. BRACKETS - MULTI LINES SUPPORTING (2 OF 2)

NOTES

1. BRACKET SUPPORT LEGEND IS AS FOLLOWS.

1.1 SUPPORT LEGEND



1.2 MEMBER SIZE MARK NO.

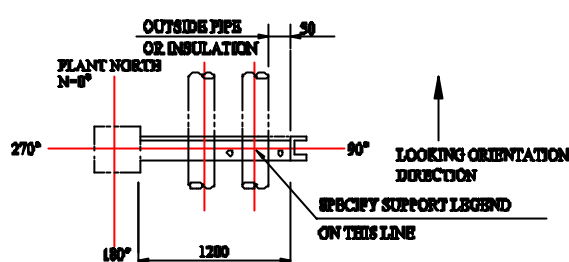
MARK NO.	MEMBER SIZE
2	L69x63x6
3	L75x75x8
4	[100x50x7.5
5	[150x75x6.5x10

2. ANY ANCHOR ON THE BRACKET SUPPORTS SHALL NOT BE USED. HOWEVER, GUNDS CAN BE USED ONLY ON BS(C)11,12,13,14 FOR 6" AND BELOW.

3. THE MEMBER SIZE OF BRACKETS SHALL BE SELECTED ACCORDING TO THE TABLES BELOW DEPENDING ON THE VERTICAL PIPING LOAD.

4. THE LENGTH FROM PIPE OUTSIDE (OR INSULATION) TO BRACKET'S EDGE SHALL BE 50MM.

5. LOOKING ORIENTATION & SAMPLE



SAMPLE : BS13-4-1200-0

BRACKET SELECTION TABLES

FOR TYPE : BS(C) 11 - 14

SPAN LIMITATION		MAX. ALLOWABLE VERTICAL LOAD (kg)							
LENGTH(L)	HEIGHT(H)	100	200	300	400	500	600	700	1000
500	500	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③
1000	500	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③
1500	500	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③

FOR TYPE : BS(C)15-17

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)			
	100	200	300	400
500				
1000	③	③	③	③
1500				

FOR TYPE : CS(C) 12

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)									
	100	200	300	400	500	600	700	800	900	1000
500										
1000	③	③	③	③	③	③	③	③	③	③
1500	③	③	③	③	③	③	③	③	③	③

FOR TYPE : CS(C) 14

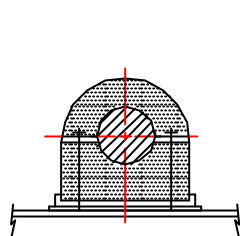
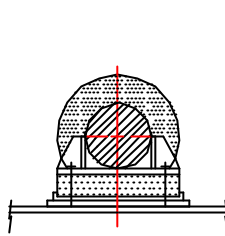
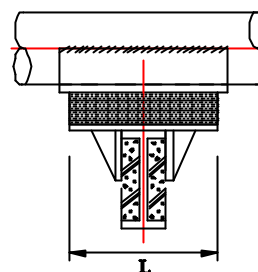
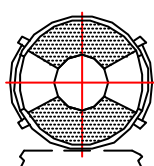
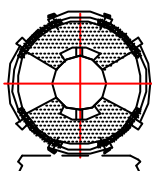
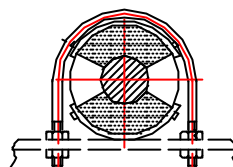
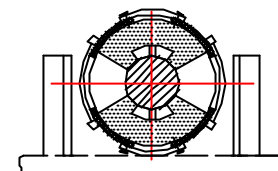
LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)				
	200	400	600	800	1000
500					
1000	③	③	③	③	③
1500	③	③	③	③	③

 DESIGN SPECIFICATION	PIPING SUPPORTS ATTACHMENT 2 STANDARD PIPING SUPPORTS (FOR COLD INSULATED LINES)	LDM-L002 REV. 0 PAGE : 1 OF 17 DATE : SEP., 2002
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CONTENTS

	PAGE
1. ANCHORS, RESTS, GUIDES	2
2. ELBOW STANCHIONS	3, 4
3. DUMMY SUPPORTS & TRUNNIONS	5
4. VESSEL BRACKETS - GUIDE	6
5. VESSEL BRACKETS - REST	7
6. VESSEL BRACKETS - SPRING	8
7. SPRING HANGERS	9
8. SPRING SUPPORTS	10
9. RIGID HANGERS	11
10. HOLD - DOWNS	12
11. BRACKETS – SINGLE LINE SUPPORTING	13, 14, 15
12. BRACKETS – MULTI LINE SUPPORTING	16, 17

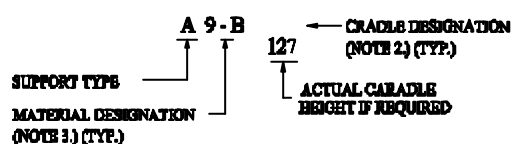
1. ANCHORS, RESTS & GUIDES


2 1/2" & SMALLER

3" THRU 48"

48" & SMALLER
A
DA

3" & SMALLER

4" THRU 48"
S9

3" & SMALLER

4" THRU 48"
GS9

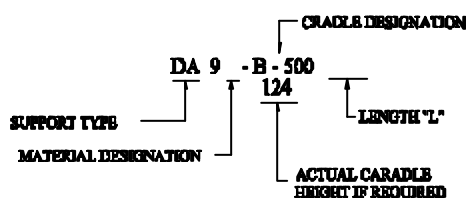
NOTES

1. ANCHOR, REST & GUIDE SUPPORT LEGENDS ARE AS FOLLOWS.

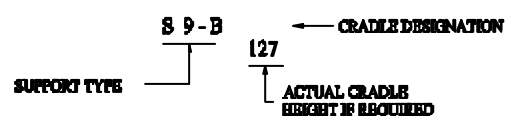
1.1 FOR ANCHOR



1.2 FOR DIRECTIONAL ANCHOR



1.3 FOR REST & GUIDE



2. CRADLE HEIGHTS ARE AS FOLLOWS.

INSUL. THK	CRADLE HEIGHT (H)	DESIGNATION
BELOW 30	50	NONE
31 - 75	100	A
76 - 125	150	B
126 - 175	200	C
176 - 225	250	D
226 - 275	300	E

3. ANCHOR SELECTION GUIDE

PIPING		DESIGN TEMP.	SUPPORT TYPE			
MATERIAL	DESIGNATION		ANCHOR		REST	GUIDE
CARBON STEEL	7	-29° C ~AMB	A7	DA7	S9	GS9
	8	-45° C ~-30° C	A8	DA8		
STAINLESS STEEL	9	-196° C ~AMB	A9	DA9		



LG E&C

**DESIGN
SPECIFICATION**

**PIPING SUPPORTS
ATTACHMENT 2
STANDARD PIPING SUPPORTS
(FOR COLD INSULATED LINES)**

LDM-L002

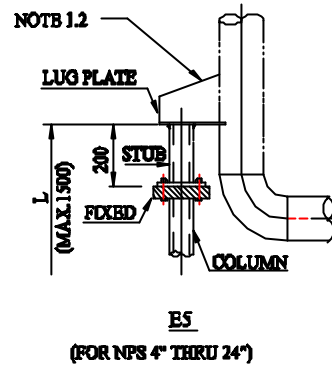
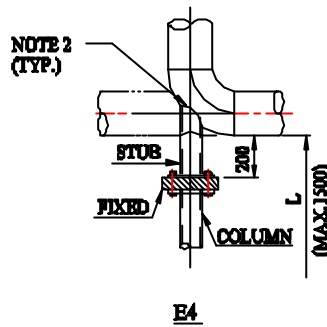
REV. 0

PAGE : 3 OF 17

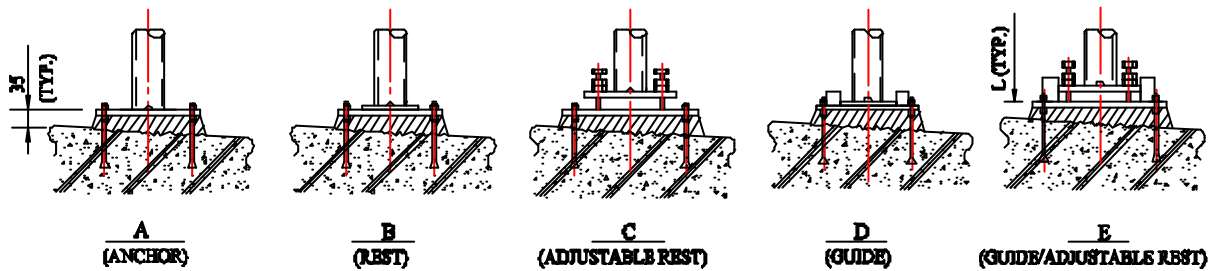
DATE : SEP. 2002

2. ELBOW STANCHIONS (1 OF 2)

UPPER SECTION

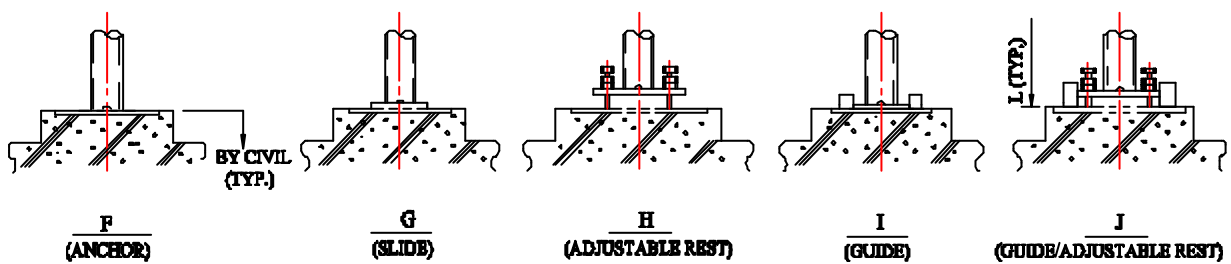


LOWER SECTION (PAVED AREA-LIGHT DUTY)

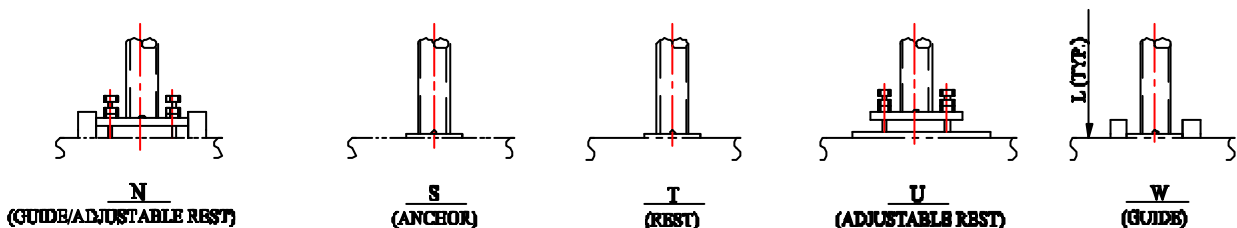


FOR NPS 16" & SMALLER AND PIPING LOAD 1000 Kgf & BELOW

LOWER SECTION (GROUND-HEAVY DUTY)



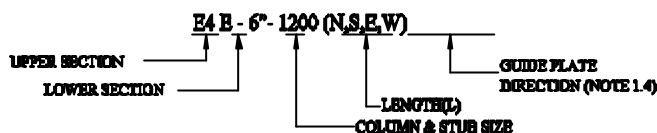
LOWER SECTION (STEEL SURFACE)



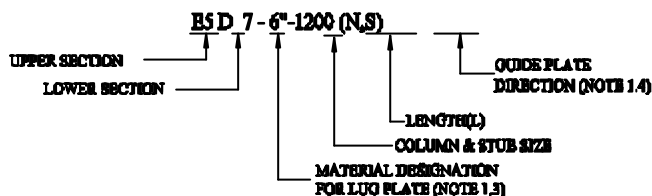
2. ELBOW STANCHIONS (2 OF 2)
NOTES

1. ELBOW STANCHION SUPPORT LEGENDS ARE AS FOLLOWS.

1.1 FOR TYPE E4 OF UPPER SECTION



1.2 FOR TYPE E5 OF UPPER SECTION



1.3 MATERIAL DESIGNATION

7 : CARBON STEEL, PIPING TEMP. -35° C ~ AMB.

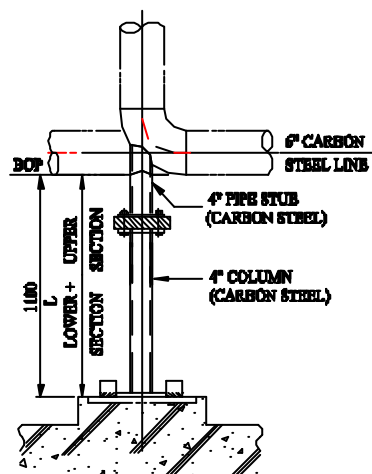
8 : CARBON STEEL, PIPING TEMP. -45° C ~ -30° C

9 : STAINLESS STEEL, PIPING TEMP. -196° C ~ AMB.

1.4 GUIDE PLATE DIRECTIONS SHALL BE SPECIFIED ONLY AT REQUIRED DIRECTIONS FOR THE TYPE D, E, (I, J, N, W OF LOWER SECTION AND OMITTED FOR THE OTHER TYPE.

DIRECTION DESIGNATION

N: NORTH, S: SOUTH, E: EAST, W: WEST



SAMPLE : E4I-4" - 1100 (N,S)

2. SPECIAL CONSIDERATION SHALL BE GIVEN TO ELBOW ATTACHMENT UNDER THE FOLLOWING CONDITIONS. CONSULT WITH PIPING STRESS ENGINEER.

2.1 DESIGN TEMPERATURES BELOW -29° C FOR CARBON STEEL PIPING.

2.2 OPERATING PRESSURE 210 KG/CM AND ABOVE.

2.3 PIPING TO AND FROM RECIPROCATING OR POSITIVE DISPLACEMENT COMPRESSOR AND PUMP.

2.4 PIPING OPERATING IN A SEVERE CYCLIC CONDITION.

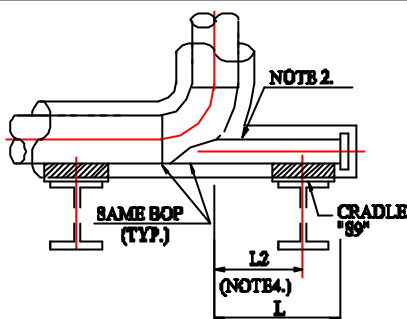
3. THE SIZE SELECTION FROM THE TABLE BELOW IS ONLY FOR REFERENCE. THE SIZE OF COLUMN & STUB MAY BE INCREASED OR REDUCED BY THE STRESS EVALUATION OF PIPING SUPPORTS.

ELBOW STANCHION SIZE SELECTION TABLE

NOMINAL PIPE SIZE	COLUMN & STUB SIZE	
	1 ≤ 1000	1000 < L ≤ 3000
2"	2"	NONE
2 1/2"	2"	NONE
3"	2"	3"
4"	3"	3"
5" - 6"	4"	4"
8" - 10"	6"	6"
12" - 16"	8"	8"
18" - 20"	10"	12"
22" - 24"	12"	14"
26" - 30"	14"	16"
32" - 36"	16"	18"
38" - 42"	18"	20"
44" - 48"	20"	20"

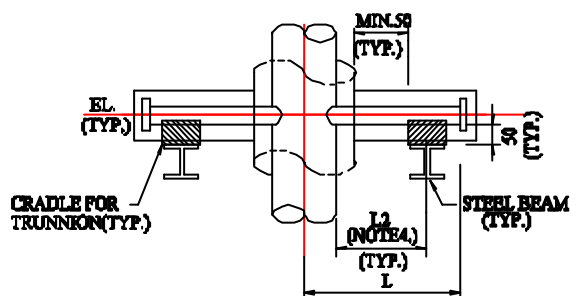
3. DUMMY SUPPORTS & TRUNNIONS

DUMMY SUPPORT

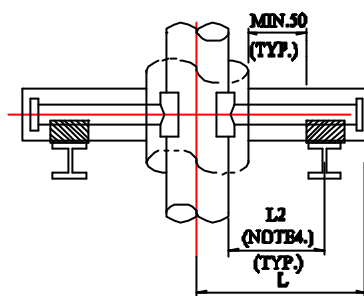


DS5

TRUNNIONS



TR3

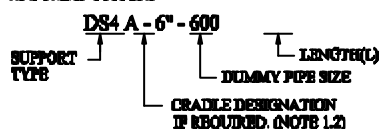


TR4

NOTES

1. DUMMY & TRUNNION SUPPORT LEGENDS ARE AS FOLLOWS.

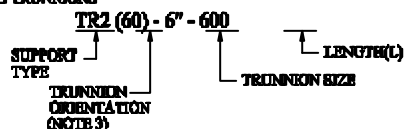
1.1 DUMMY SUPPORT



1.2 CRADLE HEIGHT SHALL BE AS FOLLOWS.

INSUL. THK	CRADLE HEIGHT (H)	DESIGNATION
BELOW 30	50	NONE
31 ~ 75	100	A
76 ~ 125	150	B
126 ~ 175	200	C
176 ~ 225	250	D
226 ~ 275	300	E

1.3 TRUNNIONS



2. SPECIAL CONSIDERATION SHALL BE GIVEN TO ELBOW ATTACHMENT UNDER THE FOLLOWING CONDITIONS. CONSULT WITH PIPING STRESS ENGINEER.

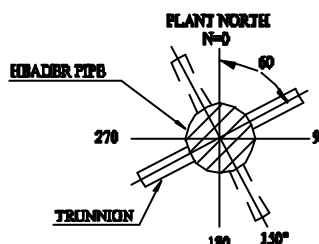
2.1 DESIGN TEMPERATURES BELOW -35° C FOR CARBON STEEL PIPING.

2.2 OPERATING PRESSURE 210 KG/CM² AND ABOVE.

2.3 PIPING TO AND FROM RECIPROCATING OR POSITIVE DISPLACEMENT COMPRESSOR AND PUMP.

2.4 PIPING OPERATING IN A SEVERE CYCLIC CONDITION.

3. TRUNNION ORIENTATION

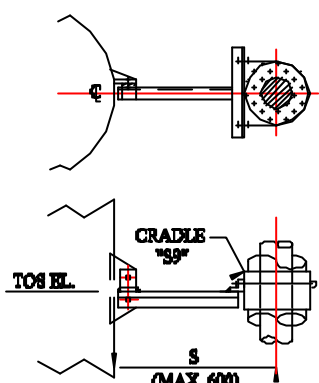
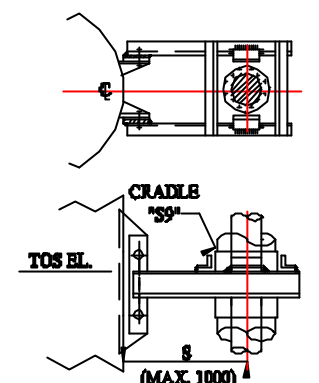
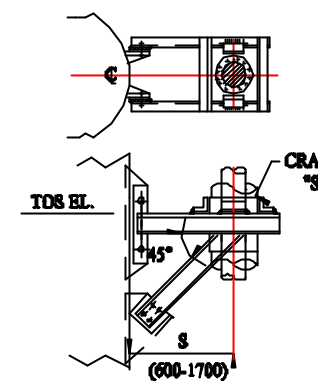
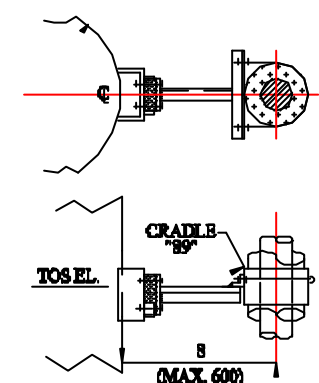
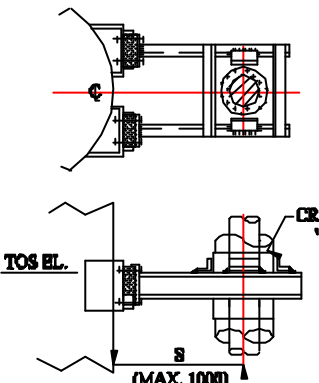
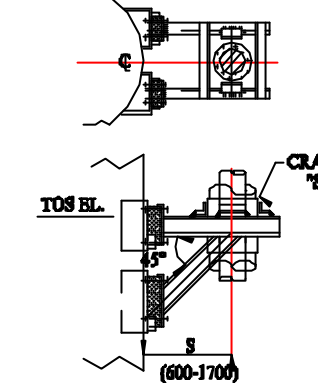


4. THE SIZE SELECTION FROM THE TABLE BELOW IS ONLY REFERENCE. IN CASE "L2" LENGTH IS LONGER THAN MAX, TRUNNION/DUMMY PIPE SIZE SHALL BE CALCULATED.

DUMMY / TRUNNION SIZE SELECTION TABLE

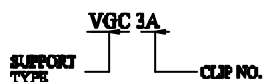
PIPE SIZE	TRUNNION SIZE	MAX. "L2"	
		DUM.	TRU.
2"	1 1/2"	1000	500
2 1/2"-3"	2"	1000	
4"	3"	1000	
5"-6"	4"	1500	
8"-10"	6"	1500	
12"-16"	8"	1500	
18"-20"	10"	2000	
22"-24"	12"	2000	
26"-30"	14"	2000	
32"-36"	16"	2000	
38"-42"	18"	2000	
44"-48"	20"	2000	500

4. VESSEL BRACKETS - GUIDE

-45° C AND ABOVE		
 VGC1A/B (3" & SMALLER)	 VGC3A/B (4" THRU 12")	 VGC4A/B/C (14" THRU 48")
-46° C AND BELOW		
 VGC6A/B (3" & SMALLER)	 VGC7A/B (4" THRU 12")	 VGC8A/B/C (14" THRU 48")

NOTES

1. GUIDE SUPPORT LEGEND IS AS FOLLOWS.



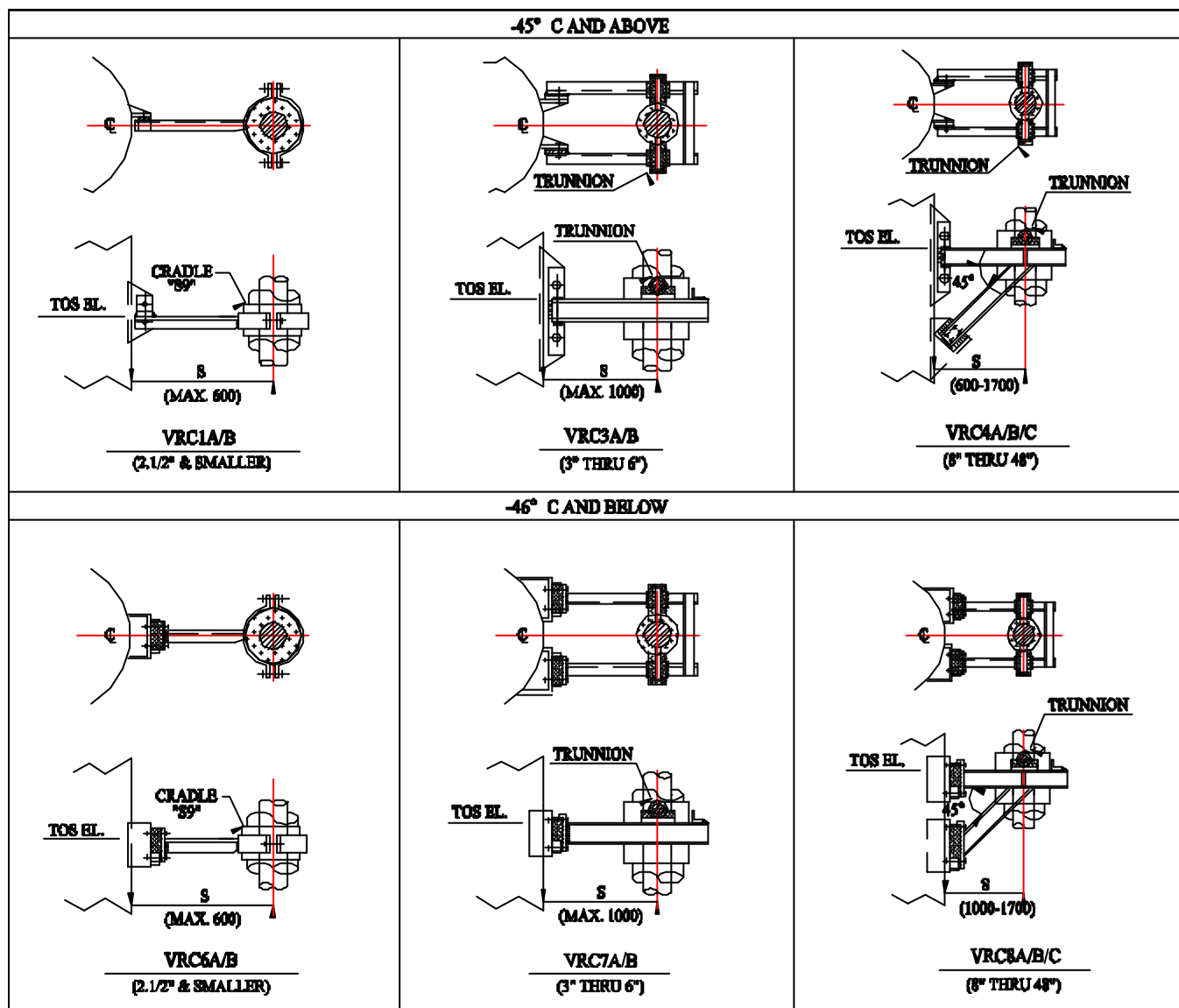
2. SPECIAL CONSIDERATION SHALL BE GIVEN WHERE THE TEMPERATURE OF VESSEL AND LINE ARE DIFFERENT.
SELECT SUPPORT TYPE WITH LINE DESIGN TEMPERATURE INSTEAD OF VESSEL TEMPERATURE.

3. THE TYPE FOR VESSEL BRACKET-GUIDES SHALL BE SELECTED FROM TABLE BELOW UNLESS OTHERWISE NOTED BY STRESS ENGINEER.

**TYPE SELECTION TABLE
FOR VESSEL BRACKET-GUIDES**

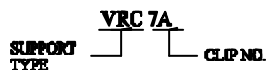
TYPE	LINE SIZE	MEMBER SIZE
VGC1A	1 1/2" & SMALLER	150x50x6
1B	2" - 3"	175x75x9
3A	4" - 8"	[100x50x7.5
3B	10" - 12"	[150x75x9x12.5
4A	14" - 24"	[150x75x9x12.5
4B	26" - 36"	[200x90x9x13.5
4C	38" - 48"	[300x90x9x13
6A	1 1/2" & SMALLER	150x50x6
6B	2" - 3"	175x75x9
7A	4" - 8"	[100x50x7.5
7B	10" - 12"	[150x75x9x12.5
8A	14" - 24"	[150x75x9x12.5
8B	26" - 36"	[200x90x9x13.5
8C	38" - 48"	[300x90x9x13

5. VESSEL BRACKETS - REST



NOTES

1. RESTING SUPPORT LEGEND IS AS FOLLOWS.



2. SPECIAL CONSIDERATION SHALL BE GIVEN WHERE THE TEMPERATURE OF VESSEL AND LINE ARE DIFFERENT.
- SELECT SUPPORT TYPE WITH LINE DESIGN TEMPERATURE INSTEAD OF VESSEL TEMPERATURE

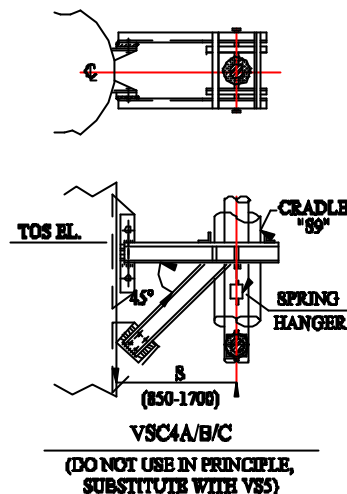
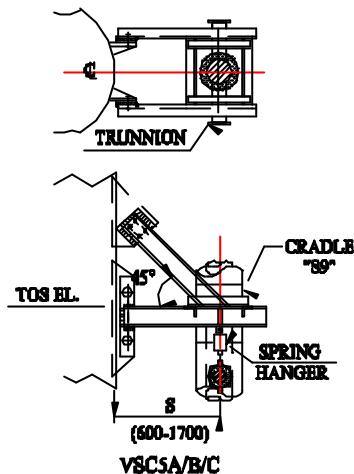
- 3. THE TYPE FOR VESSEL BRACKET-NESTS SHALL BE SELECTED FROM TABLE BELOW UNLESS OTHERWISE NOTED BY STEEL ENGINEER.**

TYPE SELECTION TABLE
FOR VESSEL BRACKET-TESTS

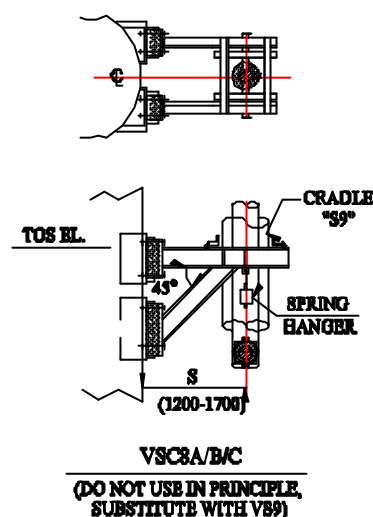
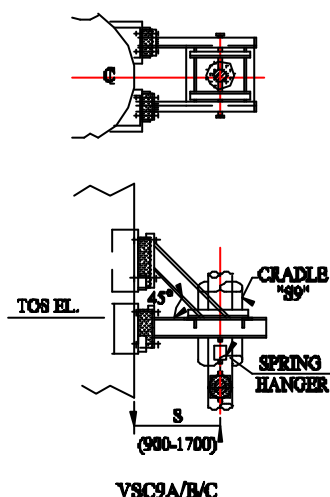
TYPE	LINE SIZE	MEMBER SIZE
VEHA	1/2"-3/4"	150x30x6
1B	1"-2 1/2"	175x75x9
3A	3"-4"	(100x50)x7.5
3B	6"	(150x75)x12.5
4A	8"-16"	(150x75)x12.5
4B	18"-28"	(200x90)x13.5
4C	30"-48"	(300x90)x13
6A	1/2"-3/4"	150x30x6
6B	1"-2 1/2"	175x75x9
7A	3"-4"	(100x50)x7.5
7B	6"	(150x75)x12.5
8A	8"-16"	(150x75)x12.5
8B	18"-28"	(200x90)x13.5
8C	30"-48"	(300x90)x13

6. VESSEL BRACKETS - SPRING

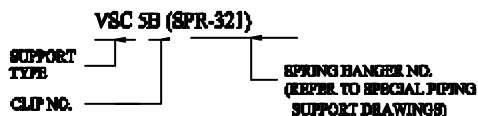
-45° C AND ABOVE



-46° C AND BELOW


NOTES

1. SPRING HANGER LEGEND IS AS FOLLOW.



2. SPECIAL CONSIDERATION SHALL BE GIVEN WHEN THE TEMPERATURE OF VESSEL AND LINE ARE DIFFERENT.

SELECT SUPPORT TYPE WITH LINE DESIGN TEMPERATURE INSTEAD OF VESSEL TEMPERATURE.

3. THE TYPE FOR VESSEL BRACKET-SPRING SUPPORTS SHALL BE SELECTED FROM TABLE BELOW UNLESS OTHERWISE NOTED BY STRESS ENGINEER.

**TYPE SELECTION TABLE
FOR VESSEL BRACKET-SPRING SUPPORTS**

TYPE	LINE SIZE	MEMBER SIZE
VSC4A		
5A	8"-16"	[150x75x9x12.5
4B		
5B	18"-28"	[200x90x9x13.5
4C		
5C	30"-48"	[300x90x9x13
8A		
9A	8"-16"	[150x75x9x12.5
8B		
9B	18"-28"	[200x90x9x13.5
8C		
9C	30"-48"	[300x90x9x13



LG E&C

**DESIGN
SPECIFICATION**

**PIPING SUPPORTS
ATTACHMENT 2
STANDARD PIPING SUPPORTS
(FOR COLD INSULATED LINES)**

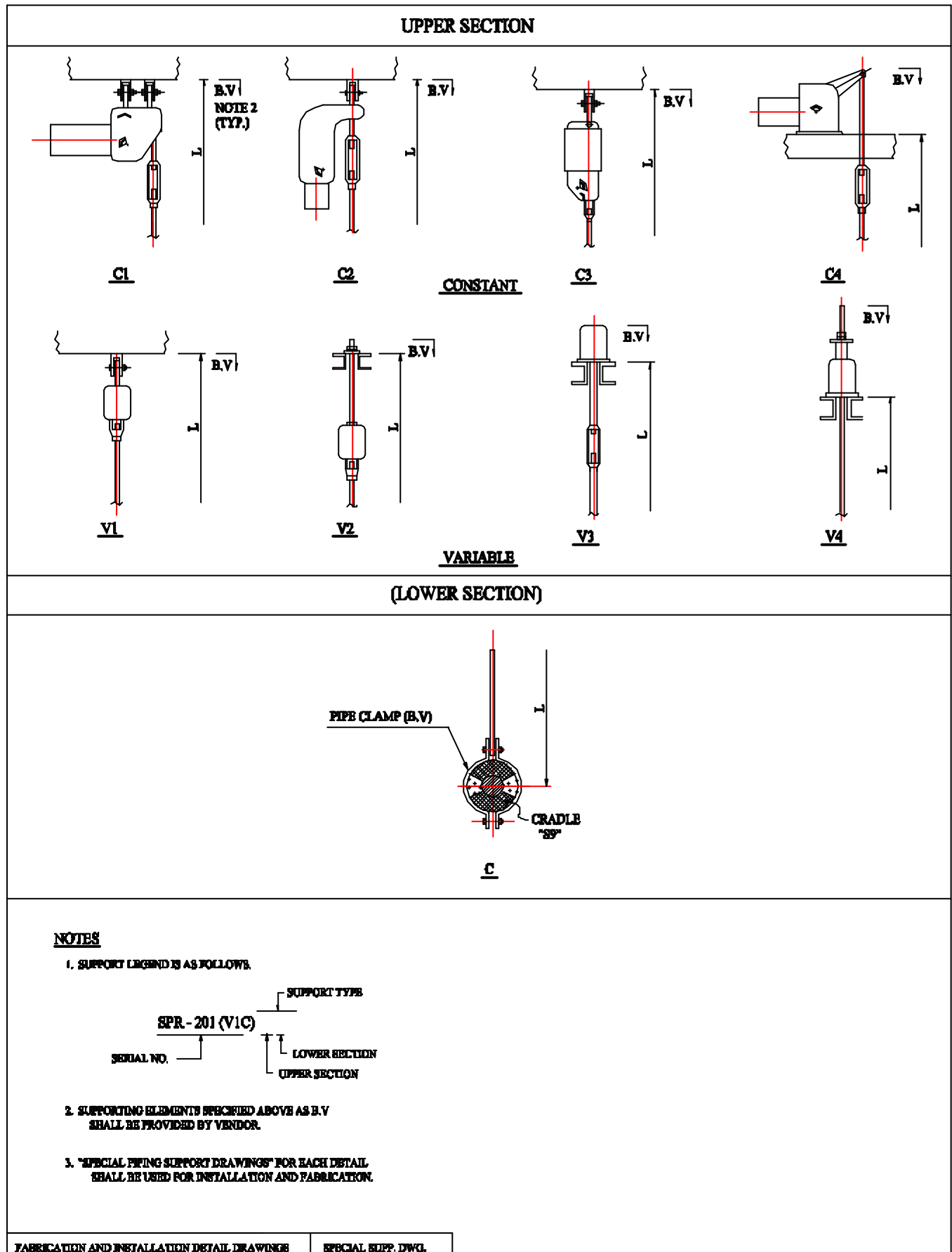
LDM-L002

REV. 0

PAGE : 9 OF 17

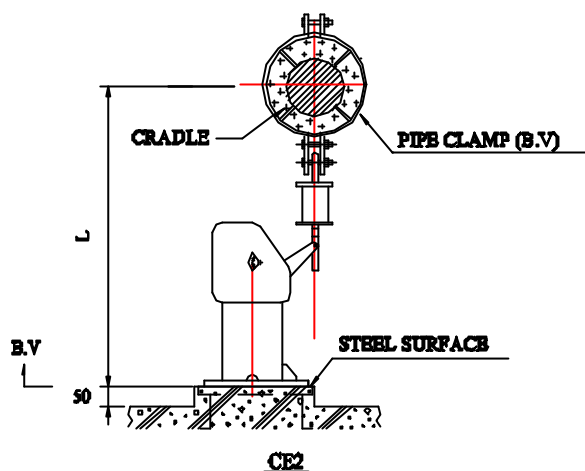
DATE : SEP. 2002

7. SPRING HANGERS

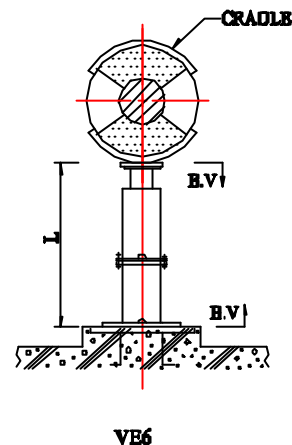
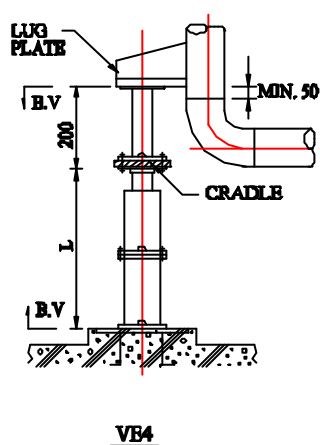
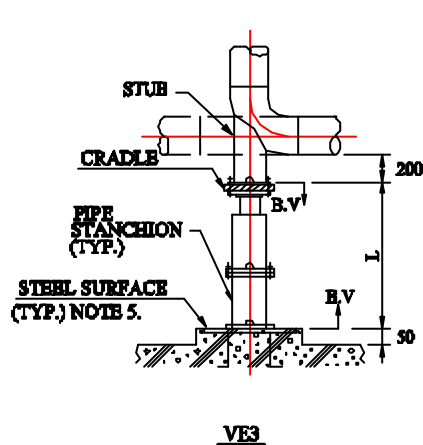


8. SPRING SUPPORTS

CONSTANT SPRING SUPPORT

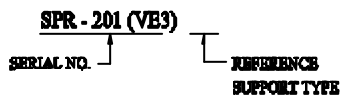


VARIABLE SPRING SUPPORT



NOTES

1. SUPPORT LEGEND IS AS FOLLOWS



2. SUPPORTING ELEMENTS SPECIFIED ABOVE AS B.V. SHALL BE PROVIDED BY VENDOR.

3. "SPECIAL PIPING SUPPORT DRAWINGS" FOR EACH DETAIL SHALL BE USED FOR INSTALLATION AND FABRICATION.

4. CONCRETE FOUNDATION AND STEEL SURFACE FOR EACH PIPE SUPPORT SHALL BE PROVIDED BY CIVIL ENGINEER.



LG E&C

**DESIGN
SPECIFICATION**

**PIPING SUPPORTS
ATTACHMENT 2
STANDARD PIPING SUPPORTS
(FOR COLD INSULATED LINES)**

LDM-L002

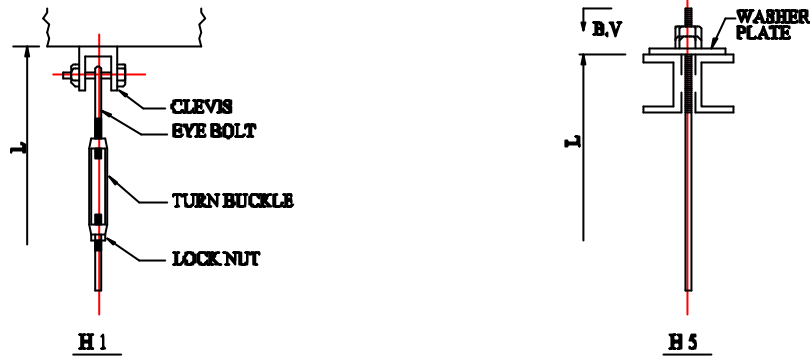
REV. 0

PAGE : 11 OF 17

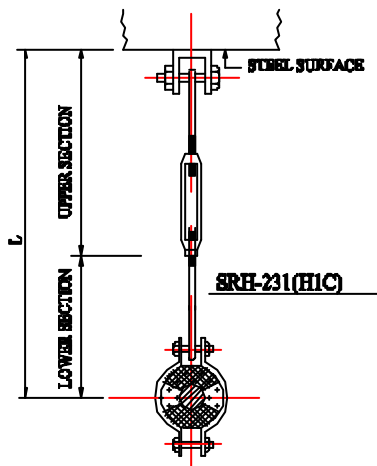
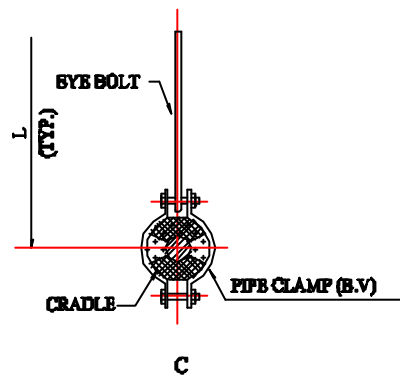
DATE : SEP. 2002

9. RIGID HANGERS

UPPER SECTION



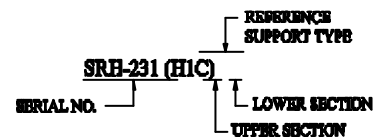
LOWER SECTION



SAMPLE : SRH-231(H1C)

NOTES

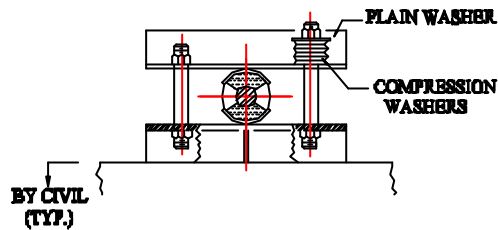
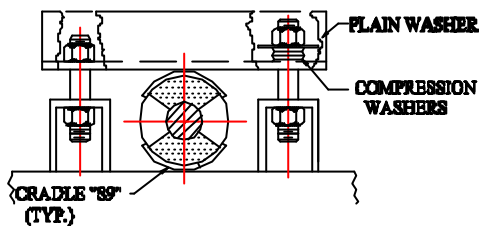
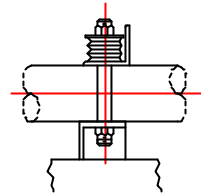
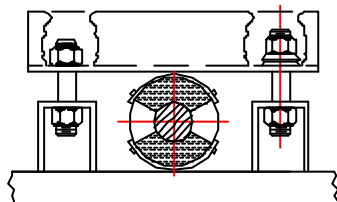
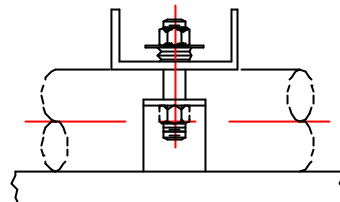
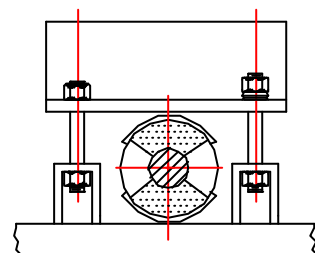
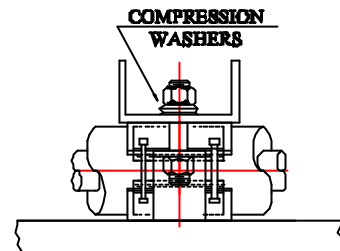
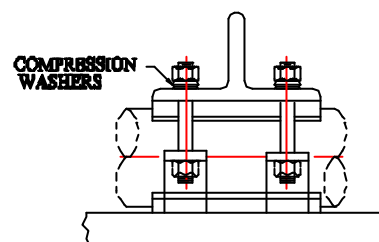
1. RIGID HANGER SUPPORT LEGEND IS AS FOLLOWS.



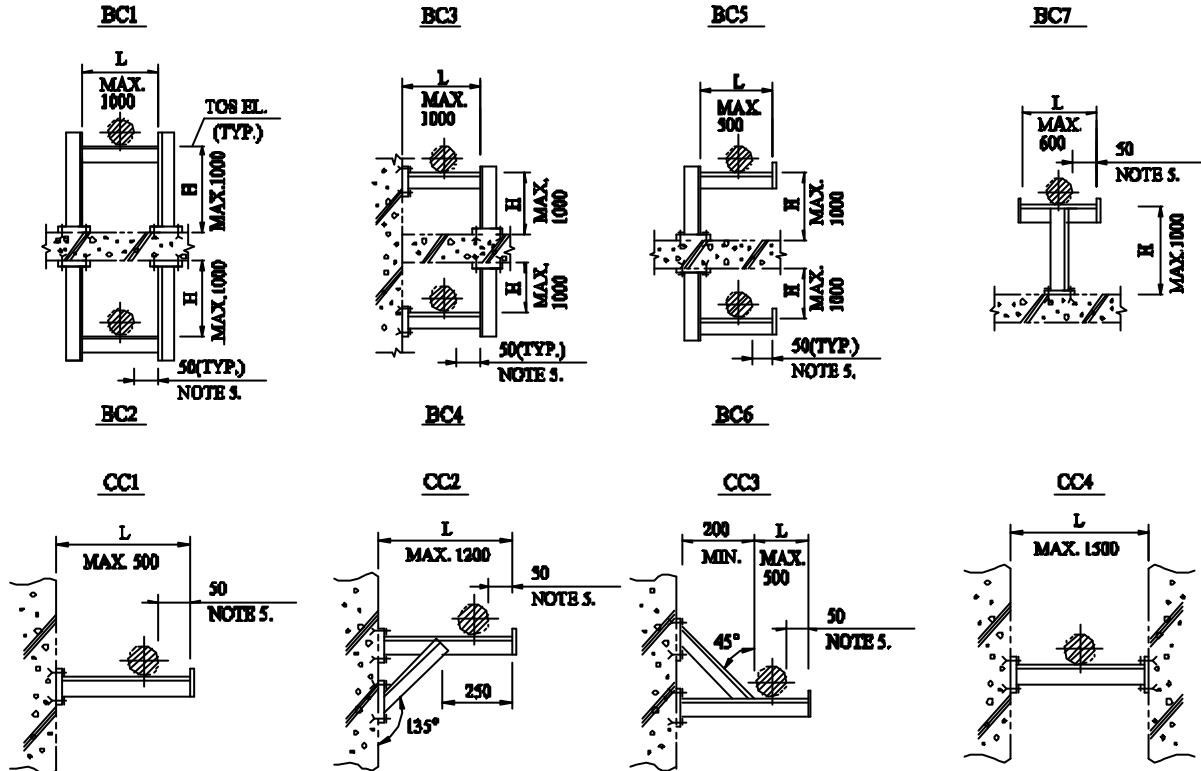
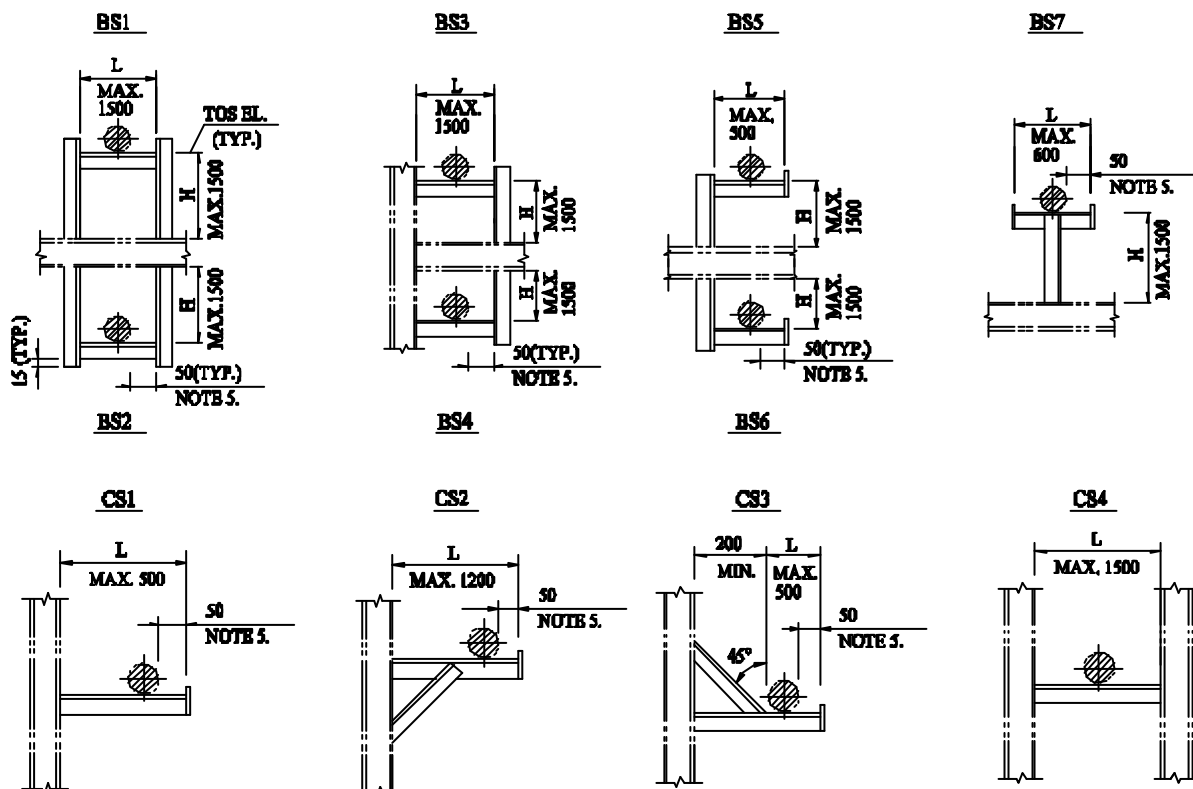
2. SUPPORTING ELEMENTS SPECIFIED ABOVE AS B.V. SHALL BE PROVIDED BY VENDOR.

**LG E&C****DESIGN
SPECIFICATION**

**PIPING SUPPORTS
ATTACHMENT 2
STANDARD PIPING SUPPORTS
(FOR COLD INSULATED LINES)**

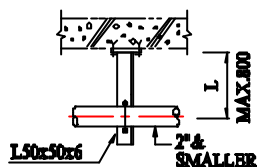
LDM-L002**REV. 0****PAGE : 12 OF 17****DATE : SEP. 2002****10. HOLD-DOWNS**3/4" THRU 3"4" THRU 10"12" THRU 24"26" THRU 36"HDC**NOTES****1. HOLD-DOWN SUPPORT LEGEND IS AS FOLLOWS.****2. THE HOLD-DOWN SHALL BE INSTALLED WHERE REQUIRED BY VIBRATION ANALYSIS, ESPECIALLY ON RECIPROCATING PUMP AND COMPRESSOR LINES.****3. CRADLE HEIGHTS ARE AS FOLLOWS.**

INSUL. THK	CRADLE HEIGHT	DESIGNATION
BELOW 30	50	NONE
31 ~ 75	100	A
76 ~ 125	150	B
126 ~ 175	200	C
176 ~ 225	250	D
226 ~ 275	300	E

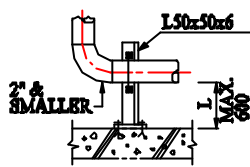
**PIPING SUPPORTS
ATTACHMENT 2
STANDARD PIPING SUPPORTS
(FOR COLD INSULATED LINES)****11. BRACKETS-SINGLE LINE SUPPORTING (1 OF 3)****FOR CONCRETE BEAM OR FLOOR (LOOKING ORIENTATION VIEW)****FOR STEEL COLUMN OR BEAM (LOOKING ORIENTATION VIEW)**

11. BRACKETS-SINGLE LINE SUPPORTING (2 OF 3)

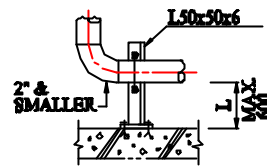
FOR CONCRETE BEAM OR FLOOR



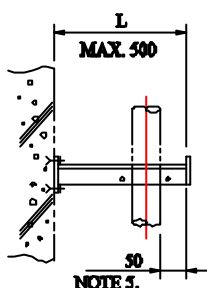
**BC8
(W/GBU)**



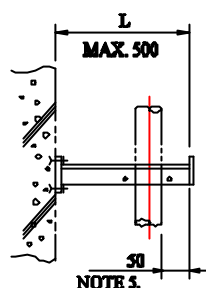
**BC9
(W/GBU)**



**BC10
(W/ABU)**

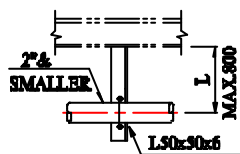


**CC5 (W/GBU)
(LOOKING ORIENTATION VIEW)**

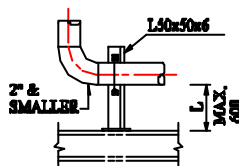


**CC6 (W/ABU)
(LOOKING ORIENTATION VIEW)**

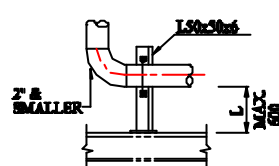
FOR STEEL COLUMN OR BEAM



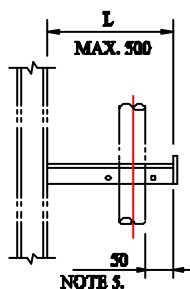
**BS8
(W/GBU)**



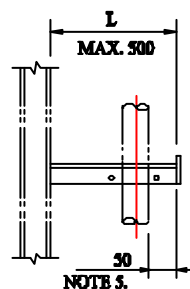
**BS9
(W/GBU)**



**BS10
(W/ABU)**



**CS5 (W/GBU)
(LOOKING ORIENTATION VIEW)**



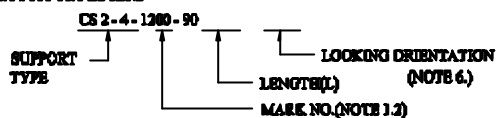
**CS6 (W/ABU)
(LOOKING ORIENTATION VIEW)**

11. BRACKETS - SINGLE LINE SUPPORTING (3 OF 3)

NOTES

1. BRACKET SUPPORT LEGEND IS AS FOLLOWS.

1.1 SUPPORT LEGEND



1.2 MEMBER SIZE MARK NO.

MARK NO.	MEMBER SIZE
1	150x50x6
2	165x65x6
3	175x75x9
4	190x90x7.5
5	190x75x6.5x10

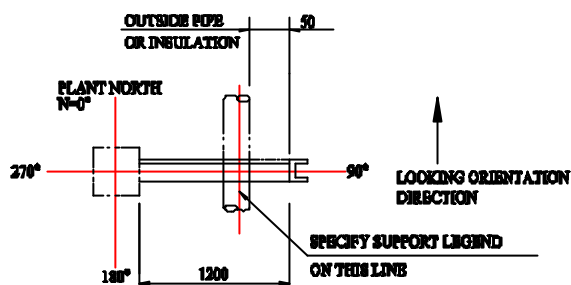
2. ANY ANCHOR ON THE BRACKET SUPPORTS EXCEPT BC(S)10, CC(S)6 SHALL NOT BE USED. HOWEVER, GUIDES CAN BE USED ONLY ON BC(S)1,2,3,4 FOR 6" AND BELOW.

3. SUPPLEMENTARY SUPPORT SUCH AS U-BOLT(SBU), C-BAND(CBS), GUIDES OR PIPE SHOES TO EACH OF THE LINES SHALL BE CALLED-OUT SEPARATELY EXCEPT BC(S)8,9,10 AND CC(S)5,6.

4. THE MEMBER SIZE OF BRACKETS SHALL BE SELECTED ACCORDING TO THE TABLES BELOW DEPENDING ON THE VERTICAL PIPING LOAD.

5. THE LENGTH FROM PIPE OUTSIDE (OR INSULATION) TO BRACKET'S EDGE SHALL BE 50MM.

6. LOOKING ORIENTATION & SAMPLE



SAMPLE ; BS3-4-1200-0

BRACKET SELECTION TABLES

FOR TYPE : BS(C) 1 - 4

BRACKET DIMENSION		MAX. ALLOWABLE VERTICAL LOAD (kg)								
LENGTH(L)	HEIGHT(H)	100	200	300	400	500	600	700	1000	
500	300	② 165X65X6								
	1000									
	1500	① 175X75X9								
1000	300	③ 165X65X6								
	1000	④ 190X75X6.5X10								
	1500									
1500	300	④ 190X90X7.5								
	1000	③ 190X75X6.5X10								
	1500	⑤ 190X75X6.5X10								

FOR TYPE : BS(C)5-7, CS(C) 1, CS(C) 3, CS(C) 5,6

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)			
	100	200	300	400
200				
400	③ 175x75x9		④ 190x90x7.5	
500				

FOR TYPE : CS(C) 2

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)									
	100	200	300	400	500	600	700	800	900	1000
500										
800	③ 175x75x9									
1000							④ 190x90x7.5			
1200	④ 190x90x7.5				⑤ 190x75x6.5x10					

FOR TYPE : CS(C) 4

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)				
	200	400	600	800	1000
500					
800	③ 165x65x6				
1000			③ 175x75x9		
1200		④ 190x90x7.5		⑤ 190x75x6.5x10	
1500					④



LG E&C

**DESIGN
SPECIFICATION**

**PIPING SUPPORTS
ATTACHMENT 2
STANDARD PIPING SUPPORTS
(FOR COLD INSULATED LINES)**

LDM-L002

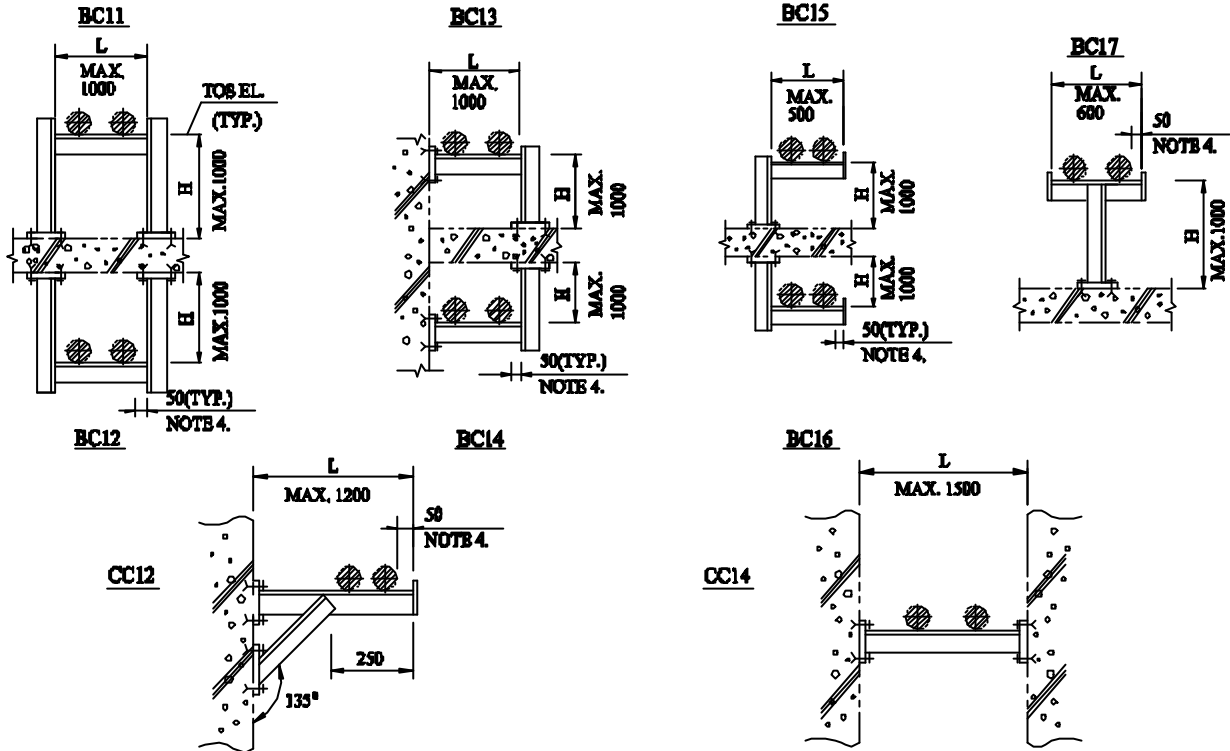
REV. 0

PAGE : 16 OF 17

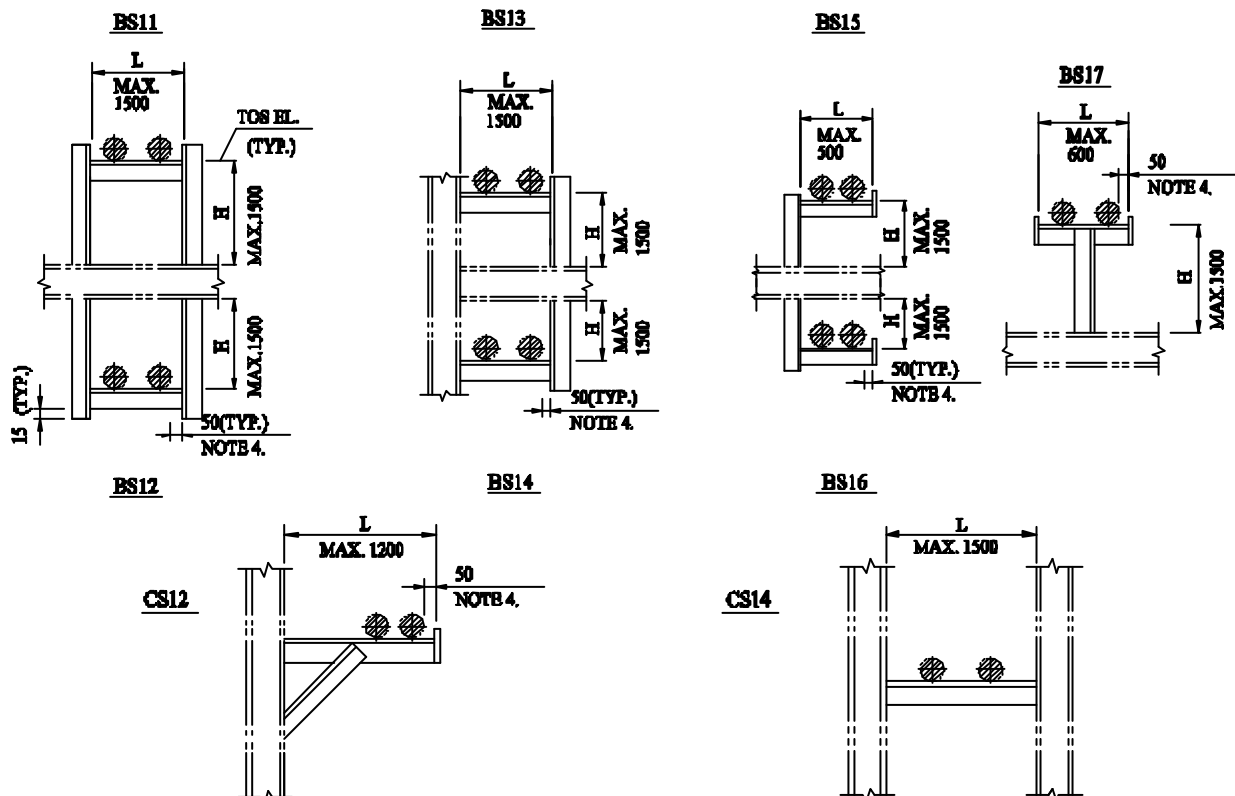
DATE : SEP. 2002

12. BRACKETS-MULTI LINES SUPPORTING (1 OF 2)

FOR CONCRETE BEAM OR FLOOR (LOOKING ORIENTATION VIEW)



FOR STEEL COLUMN OR BEAM (LOOKING ORIENTATION VIEW)

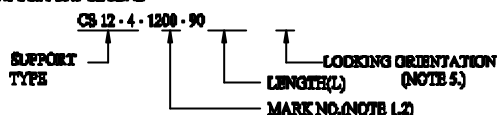


12. BRACKETS - MULTI LINES SUPPORTING (2 OF 2)

NOTES

1. BRACKET SUPPORT LEGEND IS AS FOLLOWS.

1.1 SUPPORT LEGEND



1.2 MEMBER SIZE MARK NO.

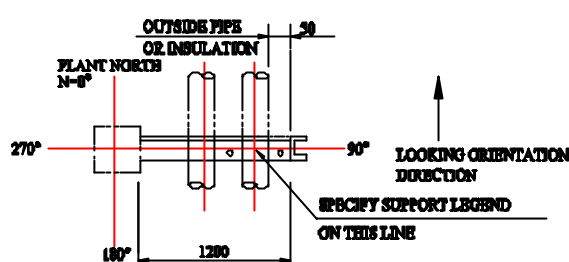
MARK NO.	MEMBER SIZE
2	L63x63x6
3	L75x75x8
4	[100x50x5x7.5
5	[150x75x6.5x10

2. ANY ANCHOR ON THE BRACKET SUPPORTS SHALL NOT BE USED. HOWEVER, GUNDS CAN BE USED ONLY ON BS(C)11,12,13,14 FOR 6" AND BELOW.

3. THE MEMBER SIZE OF BRACKETS SHALL BE SELECTED ACCORDING TO THE TABLES BELOW DEPENDING ON THE VERTICAL PIPING LOAD.

4. THE LENGTH FROM PIPE OUTSIDE (OR INSULATION) TO BRACKET'S EDGE SHALL BE 50MM.

5. LOOKING ORIENTATION & SAMPLE



SAMPLE : BS13-4-1200-0

BRACKET SELECTION TABLES

FOR TYPE : BS(C) 11 - 14

SPAN LIMITATION		MAX. ALLOWABLE VERTICAL LOAD (kg)							
LENGTH(L)	HEIGHT(H)	100	200	300	400	500	600	700	1000
500	500	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③
1000	500	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③
1500	500	③	③	③	③	③	③	③	③
	1000	③	③	③	③	③	③	③	③
	1500	③	③	③	③	③	③	③	③

FOR TYPE : BS(C)15-17

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)			
	100	200	300	400
500				
1000	③	③	③	③
1500				

FOR TYPE : CS(C) 12

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)									
	100	200	300	400	500	600	700	800	900	1000
500										
1000	③	③	③	③	③	③	③	③	③	③
1500	③	③	③	③	③	③	③	③	③	③

FOR TYPE : CS(C) 14

LENGTH (L)	MAX. ALLOWABLE VERTICAL LOAD (kg)				
	200	400	600	800	1000
500					
1000	③	③	③	③	③
1500	③	③	③	③	③

본 PIPING HANDBOOK 은 PROJECT 수행 시 필요한 DESIGN DATA 및 ENGINEERING DATA 를 쉽게 찾아 사용하는 목적으로 발간하게 되었습니다.

본 HANDBOOK 은 ANSI(ASME) CODE 를 중심으로 작성되었으며, DESIGN 의 통일과 신속한 업무처리, 현장 감리 업무 시 많은 도움이 될 것 입니다.

본 PIPING HANDBOOK 은 배관부의 샘플분임조에서 1993 년 초안을 작성하고, 2 년의 수정보완작업을 하여 1995 년 12 월 책으로 정식 발간하게 되었으며, 2002 년 각종 STD.와 CODE 의 변경에 따라 개정 발간을 하게 되었습니다.

본 PIPING HANDBOOK 의 발간을 위해 힘써주신 배관 부서원들에게 감사 드립니다.

REV.0

DATE : DEC., 1995

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REV.1

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박준영 과장, 김인성 과장, 황선장 대리

승 인 : 김성호 부장

본 PIPING HANDBOOK 의 오자, 탈자, 기술적 오기 등에 대한 지적 및 개선 제안은 PLANNING & GENERAL 담당자(홍순완 대리)가 접수하고 있습니다.

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