Best Technology of Display & Semiconductor

DWC

DWC
Tube & Pipe Fittings

(We Loved Quality & Delivery)

Dong Won Hi-Tech

www.dw-hitech.co.kr

Greetings

동원하이텍은 반도체/Display 공장에 적용되는 고순도(UHP) 배관 부품을 생산 및 유통하는 전문기업으로 국내 유수의 Major 제조사를 고객으로 최고의 품질과 경쟁력 있는 제품을 공급하여, 그 기술력을 대외적으로 인정받게 되었습니다.

동원하이텍의 핵심역량은, 오랜 경험으로부터 축적된 기술력과 노하우에 있으며, 또한 현대화된 공장 자동화 시스템과 생산 관리 시스템을 통한 높은 생산성, 체계적이고 정형화된 품질 관리 시스템을 통한 고품질의 제품 생산에 있다고 할 수 있습니다.

동원하이텍은 지속적인 R&D 투자를 통한 기술선도와 엄격한 품질관리를 통한 고 신뢰성 제품의 생산으로 고객 만족을 위하여 최선을 다할 것이며, 고객과 함께 성장하는 기업이 되도록 노력할 것입니다.
또한, 21세기 국가 산업 발전의 일익을 담당하며, 세계속의 한국 기업이 되기 위하여, 자사 브랜드인 DWC를 세계적인 제품으로 성장시켜 이 분야의 기술을 선도하는 세계 기업으로 성장하여, 고객여러분의 기대에 부응하는 기업이 되고자 항상 노력할 것을 약속드립니다.

Company Profile

동원하이텍은 항상 고객 만족을 위하여 최선의 노력을 다하며 고객이 만족할 때까지 무한 서비스를 제공하는 젊음과 패기가 넘치는 기업 입니다. 또한 현장 경험 30년 이상의 풍부한 경험을 바탕으로 시장을 리드하는 마켓 리더로서의 책임을 다하고자 젊고 진취적인 사고방식으로 신기술 및 신제품 개발에 최선을 다하고 있습니다.

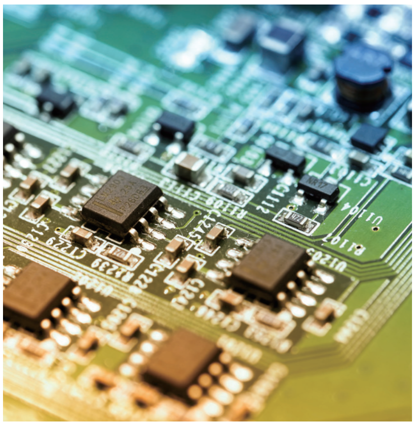
㈜동원하이텍은 아래와 같은 MOTTO로 업무에 임하고 있습니다.
1. 모든 가치의 원동력은 고객이며 고객이 만족할때까지 끝까지 최선을 다하는 기업입니다.
2. 반도체/Display 제조장치용 가스 공급장치 및 밸브, 피팅전문 기업입니다.
3. 유틸리티 시스템 및 환경 설비공사 전문 컨설팅이 가능한 멀티플레이어 기업입니다.
4. 국내외 최신 기술정보 공유 및 신제품 제안으로 고객사의 원가절감과 운전 효율을 높여 드립니다.
5. 일반 설비용 메탈 소재 및 PVC 계통 배관재도 국내 최저가로 대응해 드립니다.

▶ 상호 : 주식회사 동원하이텍
▶ 설립 : 2007년 9월 1일
▶ 대표이사 : 정 진 석

▶ 취급품목 :
1) 제조 분야 : UHP CBV(Clean Ball Valve) : AP, BA, MP, EP
UHP-Pipe Bend Fitting (AP, BA, MP, EP), Vacuum Component
2) 취급 품목 : 취급 품목 : 316L 스테인레스 스틸 파이프, 튜브, 밸브, 레귤레이터 등

▶ 주요 고객

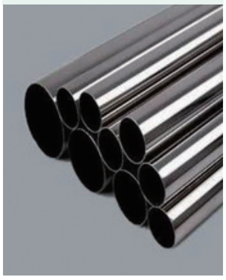
Contents




WE LOVED QUALITY & DELIVERY
UHP TUBE & PIPE

MANUFACTURING PROCESS

원소재 입고



필 거

절단/세정

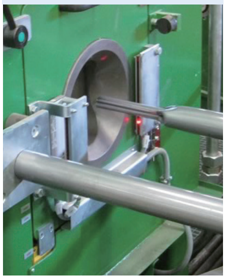
BA 열처리

교 정

SEAMLESS

SEMI

포인팅



인 발

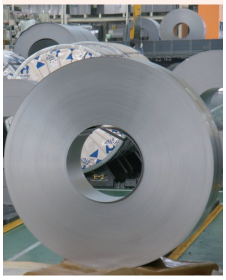
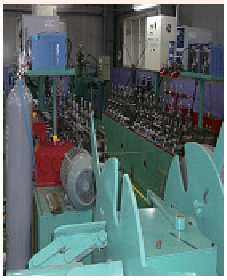
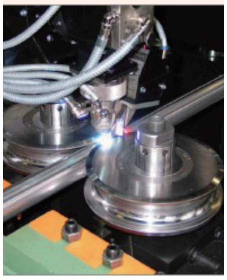
세 정

BA 열처리

정밀 교정

공정명	공정 설명
필거	Tube & Pipe 단면 감소를 60%이상 축관하는 제관법으로, 천공법으로 만든 관소재의 지름을 가늘게 하기 위하여 압연하는 방법
BA(열처리)	금속을 진공이나 보호가스 속에서 달군 다음 천천히 식히는 열처리로서, 금속이 산화되는 것을 막고 금속 겉면의 윤기를 보존하기 위하여 한다.
포인팅	인발작업을 위해 재료의 앞을 다이스에 통과하기 위하여 가늘고 길게 가공하는 것
인발	다이(Die)에 소재를 통과시켜 기계력에 의해 잡아당겨 단면적을 40% 이하로 줄이고 길이 방향으로 늘리는 가공
세정	제품 내외면에 묻은 불순물을 세척액으로 제거하는 공정

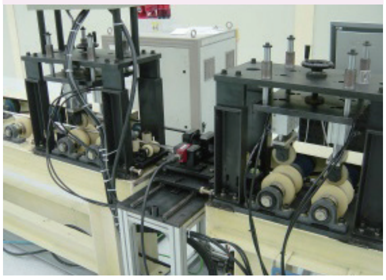
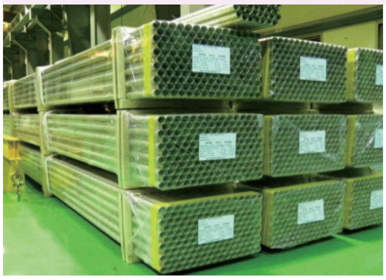
코일 입고 | 조 관 | 용접+B/R | BA 열처리 | 교 정

- SEAMLESS

WELDED

절단/면취 | ECT/검사 | PACKING/출하

공정명	공정 설명
조관	띠 모양의 강판을 성형 롤에 의하여 관 모양으로 성형하고, 그 이음매를 용접하여 제조하는 관을 말한다.
용접/BR	용점 Pass 결과 생긴 일련의 용접부(비드부)를 제거하는 것
절단/면취	파이프 끝단의 BURR 를 제거하고 규격에 맞게 베벨 면취 가공함
교정	열처리한 제품 중 휘어있는 부분을 진직도 향상을 위해 직선으로 펴는 공정
ECT/검사	와류탐상장비(비파괴 검사)를 사용하여 용접부 등 파이프 표면의 결함을 검출하는 비파괴시험 방법

UHP TUBE & PIPE

TUBE & PIPE PART NO.

1. MATERIAL 2. EXTERNAL DIAMETER 3. THICKNESS / LENGTH 4. GRADE

P L J W - 1 0 0 A - 2 1 1 6 - B

1. MATERIAL

P = PIPE
T = TUBE
C = COIL
X = COAXIAL

F = 304
L = 304L
S = 316L Single Melt
D = 316L Double Melt
C = 317
T = 321

*ASTM STD
A = General
H = High Sulfur

*JIS STD
J = General
M = Low Sulfur/Mn
S = High Sulfur

S = SEAMLESS
W = WELDED
M = SEMI SEAMLESS
B = WELDED + B/R

2. EXTERNAL DIAMETER

0250 = 1/4" = 6.35 mm
0375 = 3/8" = 9.53 mm
0500 = 1/2" = 12.7mm
0750 = 3/4" = 19.05 mm
1000 = 1" = 25.4 mm

015A = 15A = 21.7 mm
020A = 20A = 27.2 mm
025A = 25A = 34.0 mm
100A = 100A = 114.3 mm
10KA= 1000A = 1016.0 mm

040M = 4 mm
080M = 8 mm
100M = 10 mm
120M = 12mm

3. THICKNESS / LENGTH

089 = 0.89 mm
100 = 1.00 mm
124 = 1.24 mm
165 = 1.65 mm
211 = 2.11 mm
277 = 2.77 mm

05S = Schedule 5S
10S = Schedule 10S
20S = Schedule 20S
40S = Schedule 40S
80S = Schedule 80S

4 = 4000L
6 = 6000L

4. GRADE

E = EP
B = BA
A = AP
M = MP
G = GI (General Industry)

ORDERING EXAMPLES

	TSJS-0500-1004-E		TDAS-1000-1654-E		PSJS-050A-05S6-E	
TUBE/PIPE	T	TUBE	T	TUBE	T	PIPE
MATERIAL	S	316L[SINGLE MELT]	D	316L[SINGLE MELT]	S	316L[SINGLE MELT]
CHEMICAL COMPOSITION	J	JIS General	A	ASTM General	J	JIS General
TYPE	S	SEAMLESS	S	SEAMLESS	S	SEAMLESS
OUT DIAMETER	0500	1/2"[12.7mm]	1000	1"[25.4mm]	050A	50A[60.5mm]
WALL THICKNESS	100	1.00mm	165	1.65mm	05S	5S[1.65mm]
LENGTH	4	4M	4	4M	6	6M
GRADE	E	EP	E	EP	E	EP

PRODUCTION PROCESS

원소재 (Raw Material)

냉간 인발 (Cold Drawing) → 열처리 (Annealing)

특수 냉간 인발 (Special Cold Drawing) → 광휘 열처리 (Bright Annealing)

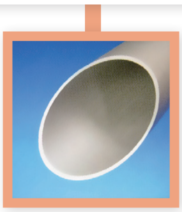
기계 연마 (Mechanical Polishing)

전해 연마 (Electro Polishing)

부동태화처리 (Passivation)

검사 (Inspection)

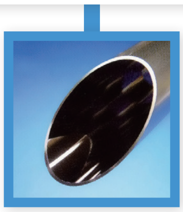
정밀 세정 (Super Mechanical Cleaning)



AP Grade
(Anneal & Pickled)

MP Grade
(Mechanical Polished)

BA Grade
(Bright Annealed)



EP Grade
(Electro Polished)

*AP(Annealing & Pickling) : 열처리(Annealing, 연성 증가 및 잔류 응력 감소) 및 표면산화물 제거를 위한 산세(Pickling, 酸洗)
*MP(Mechanical Polishing) : AP 또는 BA 제품을 사포등을 통한 기계적 가공을 통한 표면 조도 향상
*BA(Bright Annealing) : 조직의 결정립 크기를 미세화시켜 표면 조도 및 기계적 성질 향상
*EP(Electro Polishing) : 전해 연마를 통하여 Pipe 내면의 표면 조도 및 내부식성, 내 화학성 향상

UHP TUBE & PIPE

MATERIAL

MATERIAL	
Austenitic	304(L) / 316(L) Double Melting

STANDARD

STANDARD	
ASTM	A269 / A312
KS	D3576
JIS	G3459
EN & DIN	EN 10216-5 DIN 17456 DIN 17458

PRODUCTION RANGE FOR UHP FIELD

			1/8"	1/2"	1"	50A	300A	500A	1000A
EP	SEAMLESS	Double Melting	◀	—	—	▶			
EP	SEAMLESS	Single Melting	◀	—	—	—	—	▶	
EP	WELDED		◀	—	—	—	—	▶	
BA	SEAMLESS		◀	—	—	—	—	▶	
BA	WELDED		◀	—	—	—	—	—	▶
Precision Cleaning (CFOS)			◀	—	—	—	—	—	▶

SUGGESTED ALLOWABLE WORKING PRESSURE FOR SEAMLESS TUBING

TUBE O.D	Tube Wall Thickness, in.										
	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.12	0.134	0.156	0.188
	Working pressure. Bar(kg/cm²)										
1/8"	645	827	PIPE								
1/4"	304	387	569	774							
3/8"		250	364	493	569						
1/2"		197	281	387	509						
5/8"			220	304	395	455					
3/4"			182	250	319	372	440				
1"				182	235	273	319	357			
1 1/4"					182	213	250	273	311	372	
1 1/2"						175	205	228	258	304	372
2"							152	167	190	220	273

* This table was based on the minimum thickness and the maximum outside dimension of standard ASTM A 269 range.
* Corrosion was not regarded in the above numerical value.

APPLICATION

High Pressure Tube CNG&NGV, Aero Space, Electric, Power-Plant
Instrumentation Tube Ship Building, Petro-Chemistry





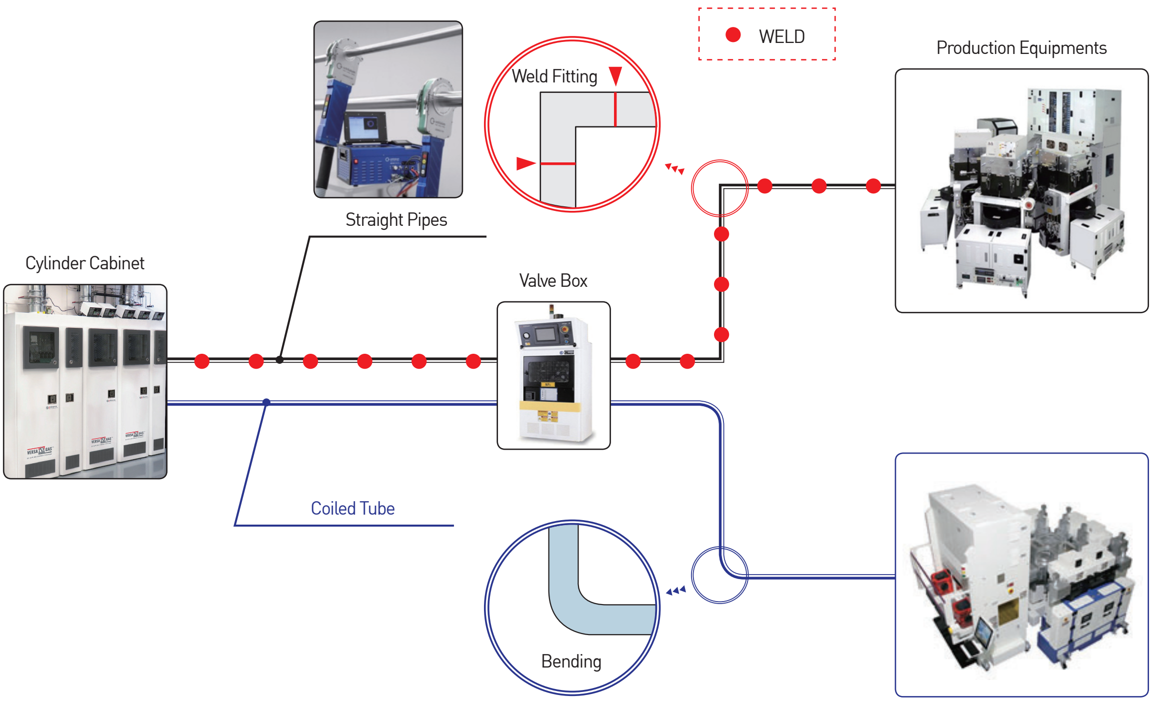
COIL TUBE SEAMLESS/SEMI-SEAMLESS



STANDARD PRODUCT (SEAMLESS)

Material	304[L] / 316[L]							
O.D(Inch)	1/8"		1/4"		3/8"		1/2"	
W.T(mm)	0.71	0.89	0.89	1.0	0.89	1.0	1.0	1.24
L(M)	500	420	220	180	120	100	80	60

APPLICATION COIL TUBE



QUALITY ASSURANCE

INSPECTION ITEM

Items	AP	MP	BA	EP	Double Melting
Chemical Composition	O	O	O	O	O
Mechanical Properties	O	O	O	O	O
Dimension & Tolerance	O	O	O	O	O
Roughness	O	O	O	O	O
Surface Microscope	O	O	O	O	O
Visual Inspection	O	O	O	O	O
Particle Test	O	O	O	O	O
Moisture Test	O	O	O	O	O
Oil Content				User in request	User in request
SEM Test				User in request	User in request
ESCA Test				User in request	User in request
AES				User in request	User in request
EDX				User in request	User in request

CHEMICAL COMPOSITION

Chemical Composition		C	Si	Mn	P	S	Ni	Cr	Mo
JIS G3459	SUS304	≤0.080	≤1.00	≤2.00	≤0.040	≤0.030	8.00~11.00	18.00~20.00	-
	SUS316	≤0.080	≤1.00	≤2.00	≤0.040	≤0.030	10.00~14.00	16.00~18.00	2.00~3.00
	SUS316L	≤0.030	≤1.00	≤2.00	≤0.040	≤0.030	12.00~16.00	16.00~18.00	2.00~3.00
ASTM A269	TP316L	≤0.035	≤1.00	≤2.00	≤0.045	≤0.030	10.00~15.00	16.00~18.00	2.00~3.00
Double Melting		≤0.018	≤0.50	≤0.05	≤0.040	≤0.003	14.50~16.00	16.00~18.00	2.20~3.00

PHYSICAL CHARACTERISTIC

Material	Standard	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Hardness (HRB)	Elongation (%)
304	ASTM	min 205	min 515	145~188	min 35
	KS/JIS	min 205	min 520		
316L	ASTM	min 170	min 485	150~187	
	KS/JIS	min 175	min 480		

QUALITY ASSURANCE

SIZE / TOLERANCE

<ASTM A269>

<table>
<tr><th colspan="6">TUBE</th></tr>
<tr><th colspan="3">O.D</th><th colspan="3" rowspan="2">Thickness</th></tr>
<tr><th>Inch</th><th>mm</th><th>Tolerance (mm)</th></tr>
<tr><td>1/8"</td><td>3.17</td><td rowspan="8">±0.127</td><td colspan="3" rowspan="4">0.71~1.65</td></tr>
<tr><td>1/4</td><td>6.35</td></tr>
<tr><td>3/8</td><td>9.53</td></tr>
<tr><td>1/2</td><td>12.7</td></tr>
<tr><td>3/4</td><td>19.05</td><td>1.24</td><td>1.65</td><td>2.11</td></tr>
<tr><td>1</td><td>25.4</td><td>1.65</td><td>2.11</td><td>2.77</td></tr>
<tr><td>1 1/4</td><td>31.75</td><td>1.65</td><td>2.11</td><td>2.77</td></tr>
<tr><td>1 1/2</td><td>38.1</td><td>1.65</td><td>2.11</td><td>2.77</td></tr>
<tr><td>2</td><td>50.8</td><td rowspan="2">±0.254</td><td>1.65</td><td>2.11</td><td>2.77</td></tr>
<tr><td>3</td><td>76.2</td><td>1.65</td><td></td><td></td></tr>
<tr><td>4</td><td>101.6</td><td rowspan="2">±0.381</td><td>2.11</td><td></td><td></td></tr>
<tr><td>5</td><td>127</td><td>2.8</td><td></td><td></td></tr>
<tr><td>6</td><td>152.4</td><td>±0.762</td><td>2.8</td><td></td><td></td></tr>
</table>

<JIS G3459, ASTM A312>

<table>
<tr><th colspan="13">PIPE</th></tr>
<tr><th colspan="4">O.D</th><th colspan="9">Thickness</th></tr>
<tr><th rowspan="2">A</th><th rowspan="2">B</th><th rowspan="2">KS(JIS)</th><th rowspan="2">ASTM</th><th colspan="2">5S</th><th colspan="2">10S</th><th>20S</th><th colspan="2">40S</th><th colspan="2">80S</th></tr>
<tr><th>KS(JIS)</th><th>ASTM</th><th>KS(JIS)</th><th>ASTM</th><th>KS(JIS)</th><th>KS(JIS)</th><th>ASTM</th><th>KS(JIS)</th><th>ASTM</th></tr>
<tr><td>6</td><td>1/8</td><td>10.5</td><td>10.29</td><td>1</td><td></td><td>1.2</td><td>1.24</td><td>1.5</td><td>1.7</td><td>1.73</td><td>2.4</td><td>2.41</td></tr>
<tr><td>8</td><td>1/4</td><td>13.8</td><td>13.72</td><td rowspan="2">1.2</td><td></td><td rowspan="2">1.65</td><td rowspan="2">1.65</td><td rowspan="2">2</td><td>2.2</td><td>2.24</td><td>3</td><td>3.02</td></tr>
<tr><td>10</td><td>3/8</td><td>17.3</td><td>17.15</td><td></td><td>2.3</td><td>2.31</td><td>3.2</td><td>3.20</td></tr>
<tr><td>15</td><td>1/2</td><td>21.7</td><td>21.34</td><td rowspan="6">1.65</td><td rowspan="6">1.65</td><td rowspan="2">2.1</td><td rowspan="2">2.11</td><td rowspan="2">2.5</td><td>2.8</td><td>2.77</td><td>3.7</td><td>3.73</td></tr>
<tr><td>20</td><td>3/4</td><td>27.2</td><td>26.67</td><td>2.9</td><td>2.87</td><td>3.9</td><td>3.91</td></tr>
<tr><td>25</td><td>1</td><td>34</td><td>33.4</td><td rowspan="4">2.8</td><td rowspan="4">2.77</td><td rowspan="3">3</td><td>3.4</td><td>3.38</td><td>4.5</td><td>4.55</td></tr>
<tr><td>32</td><td>1 1/4</td><td>42.7</td><td>42.16</td><td>3.6</td><td>3.56</td><td>4.9</td><td>4.85</td></tr>
<tr><td>40</td><td>1 1/2</td><td>48.6</td><td>48.26</td><td>3.7</td><td>3.68</td><td>5.1</td><td>5.08</td></tr>
<tr><td>50</td><td>2</td><td>60.5</td><td>60.33</td><td rowspan="2">3.5</td><td>3.9</td><td>3.91</td><td>5.5</td><td>5.54</td></tr>
<tr><td>65</td><td>2 1/2</td><td>76.3</td><td>73.03</td><td rowspan="4">2.1</td><td rowspan="4">2.11</td><td rowspan="4">3</td><td rowspan="4">3.05</td><td>5.2</td><td>5.16</td><td>7</td><td>7.01</td></tr>
<tr><td>80</td><td>3</td><td>89.1</td><td>88.9</td><td rowspan="3">4</td><td>5.5</td><td>5.49</td><td>7.6</td><td>7.62</td></tr>
<tr><td>90</td><td>3</td><td>101.6</td><td>101.6</td><td>5.7</td><td>5.74</td><td>8.1</td><td>8.08</td></tr>
<tr><td>100</td><td>4</td><td>114.3</td><td>114.3</td><td>6.0</td><td>6.02</td><td>8.6</td><td>8.56</td></tr>
<tr><td>125</td><td>5</td><td>139.8</td><td>141.3</td><td rowspan="3">2.8</td><td rowspan="3">2.77</td><td rowspan="2">3.4</td><td rowspan="2">3.40</td><td rowspan="2">5</td><td>6.6</td><td>6.55</td><td>9.5</td><td>9.52</td></tr>
<tr><td>150</td><td>6</td><td>165.2</td><td>168.28</td><td>7.1</td><td>7.11</td><td>11</td><td>10.97</td></tr>
<tr><td>200</td><td>8</td><td>216.3</td><td>219.08</td><td rowspan="2">4</td><td>3.76</td><td rowspan="3">6.5</td><td>8.2</td><td>8.18</td><td>12.7</td><td>12.7</td></tr>
<tr><td>250</td><td>10</td><td>267.4</td><td>273.05</td><td>3.4</td><td>3.40</td><td>4.19</td><td>9.3</td><td>9.27</td><td>15.1</td><td>12.7</td></tr>
<tr><td>300</td><td>12</td><td>318.5</td><td>323.85</td><td rowspan="2">4</td><td rowspan="2">3.96</td><td>4.5</td><td>4.57</td><td>10.3</td><td>9.52</td><td>17.4</td><td>12.7</td></tr>
<tr><td>350</td><td>14</td><td>355.6</td><td>355.60</td><td rowspan="3">5</td><td rowspan="3">4.78</td><td rowspan="3">8</td><td>11.1</td><td></td><td>19</td><td></td></tr>
<tr><td>400</td><td>16</td><td>406.4</td><td>406.40</td><td rowspan="2">4.5</td><td rowspan="2">4.19</td><td>12.7</td><td></td><td>21.4</td><td></td></tr>
<tr><td>450</td><td>18</td><td>457.2</td><td>457.20</td><td>14.3</td><td></td><td>23.8</td><td></td></tr>
<tr><td>500</td><td>20</td><td>508.0</td><td>508.00</td><td>5</td><td>4.78</td><td>5.5</td><td>5.54</td><td>9.5</td><td>15.1</td><td></td><td>26.2</td><td></td></tr>
</table>

Other sizes should be requested

INNER SURFACE ROUGHNESS ASSURANCE VALUES

Grade	Size	Inner surface roughness Ra (μ inch)
AP	1/4" ≤ OD ≤ 1"	≤40
	OD ≤ 100A	≤40
MP	1/4" ≤OD ≤ 1"	≤20
	25A ≤ OD ≤ 100A	
BA	1/4" ≤OD ≤ 1"	≤20
	25A ≤ OD ≤ 100A	≤25
EP	1/4" ≤OD ≤ 1"	Double Melt ≤5 Single Melt ≤7
	25A ≤ OD ≤ 100A	

ASSURANCE VALUES OF PRECISION CLEANING

Grade	Particle (number / CFM)		Oil Content	Dew Point (ppm)
	0.1μm	0.3μm		
BA	≤ 5	0	≤ 0.01mg/ft^2	1.2ppm
EP	≤ 1	0	≤ 0.01mg/ft^2	Single melt 1.2ppm
				Double melt 0.1ppm

SEM(Scanning Electron Microscope)

	SPEC	REMARK
Double Melt	Abnormal defects ≤ 10EA	Measuring abnormal defects of below 2.5μm on 4"X 5"photos magnified to 3,500 (±100) times
Single Melt	Abnormal defects ≤ 25EA	

AES(Auger Electron Spectroscopy)

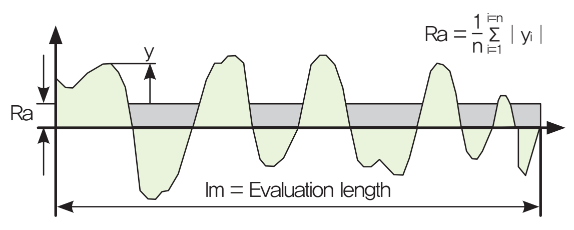
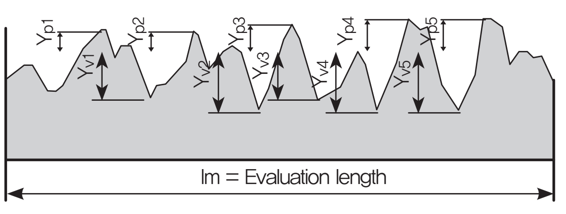
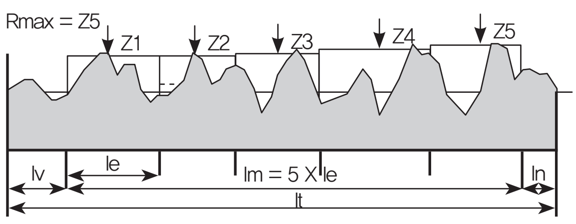
SPEC	
Chromium Oxide layer thickness	≥ 25 angstrom

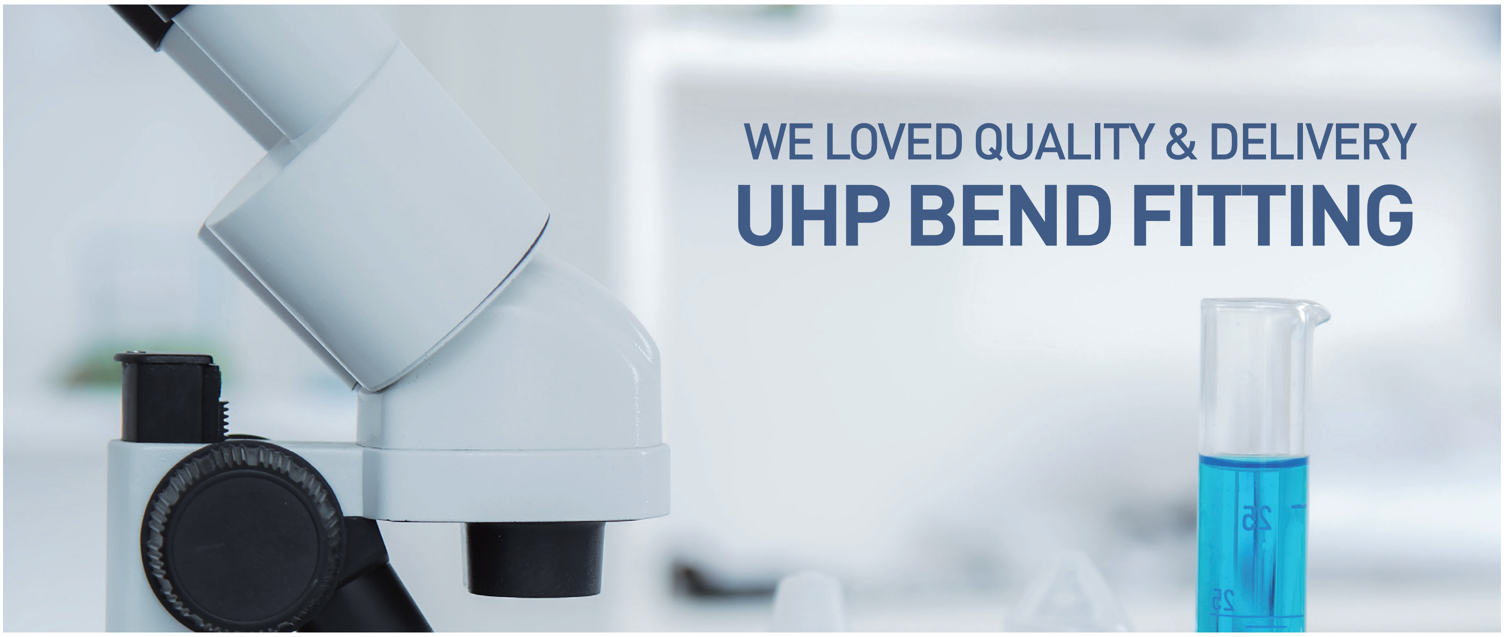
표면 거칠기 정의 및 표시방법

표면조도 관련 용어의 정의

표면 거칠기	대상물의 표면(이하 대상면이라 한다.)으로 부터 임의로 채취한 각 부분에서의 표면 거칠기를 나타내는 파라미터인 산술 평균 거칠기(Ra), 최대 높이(Ry), 10점 평균 거칠기(Rz), 요철의 평균 간격(Sm), 국부 산봉우리의 평균 간격(S) 및 부하 길이율(tp)의 각각의 산술 평균값
단면 곡선	대상면에 직각인 평면으로 대상면을 절단하였을 때 그 단면에 나타나는 윤곽
거칠기 곡선	단면 곡선에서 소정의 파장보다 긴 표면 굴곡 성분을 위상 보상형 고역 필터로 제거한 곡선
거칠기 곡선의 컷오프 값 (λc)	위상 보상형 고역 필터의 이득이 50%가 되는 주파수에 대응하는 파장
거칠기 곡선의 기준 길이 (l)	거칠기 곡선으로부터 컷오프 값의 길이를 뺀 부분의 길이
거칠기 곡선의 평가 길이 (lM)	표면 거칠기의 평가에 사용하는 기준 길이를 하나 이상 포함하는 길이. 평가 길이의 표준값은 기준 길이의 5배로 한다.
여파 굴곡 곡선	단면 곡선에서 소정의 파장보다 짧은 표면 거칠기의 성분을 위상 보상형 저역 필터로 제거한 곡선
거칠기 곡선의 평균선 (m)	단면 곡선의 표본 부분에서의 여파 굴곡 곡선을 직선으로 바꾼 선

표면 거칠기 표시방법

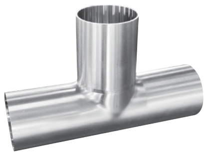
	개념도	정 의
Ra 평균 조도		**Arithmetic roughness value (중심선 평균 조도)** : 중심선에서 단면곡선까지의 평균 높이 ※ 중심선(Centerling, arithmetic mean line of profile) : 평균선에 평행하며 단면곡선으로 둘러싸인 상하면적이 같게 되는 위치의 곡선
Rz 10점 평균 조도		**Ten point height (10점 평균 조도)** : 제일 높은 봉우리에서 5번째까지의 평균높이와 제일 낮은 골에서 5번째까지의 평균골 깊이 사이의 거리로 나타내는 Parameter ※ 각종 규정(ISO, DIN, JIS, ANSI..) 별로 측정방법에 차이가 있음. $Rziso = \frac{1}{5}\left[\sum_{i=1}^{5} \lvert Y_{pi} \rvert + \sum_{i=1}^{5} \lvert Y_{vi} \rvert\right]$
Rmax 최대 높이 조도		**Maximum height roughness (최대 높이 조도)** : 채취부분의 기준길이(cut-off)내의 조도 곡선에서 중심선에 평행하고 그 곡선의 최고점을 지나는 두 평행 선간의 상하거리로 조도의 크기를 나타내는 Parameter


WE LOVED QUALITY & DELIVERY
UHP BEND FITTING

STANDARD FITTINGS

20 90°ELBOW

20 45°ELBOW

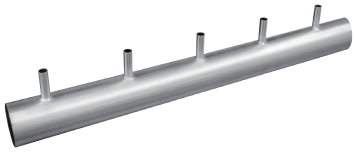


21 EQUAL TEE

21 CAP

22 REDUCING TEE

23 MULTI-HEADER TEE



23 CON REDUCER

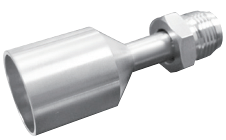
23 ECC REDUCER

24 CAP RECUDER

JOINT FITTINGS

25 JOINT TEE

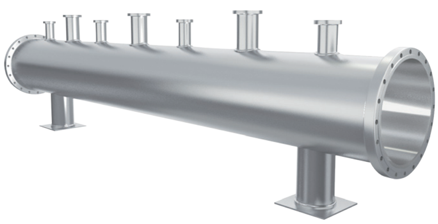
25 JOINT MULTI- HEADER TEE



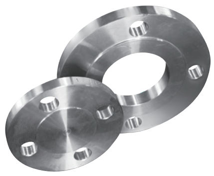
26 JOINT REDUCER

26 JOINT CAP REDUCER

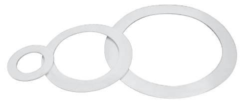
27 SPECIAL CLEAN SPOOL HEADER ASSEMBLY



FLANGE CONNECTION



28 RF/BLIND FLANGE

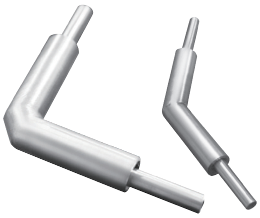


29 TEFLON GASKET

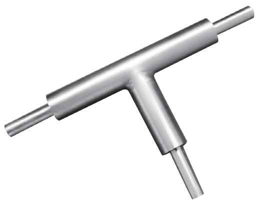
28 LAP JOINT

29 PIPE FLANGE

COAXIAL FITTINGS



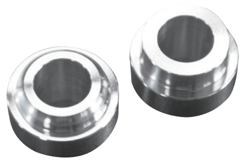
30 COAXIAL ELBOW



30 EQUAL TEE

31 COAXIAL REDUCING TEE

32 COAXIAL REDUCER



32 STOP SPACER

33 COAXIAL HALF TUBE

33 COAXIAL OVER TUBE

DWC Fitting

HOW TO ORDER BEND FITTINGS

Bend Fittings Part No.

W	4S	P	25A	LE	AP

TYPE	
S	SEAMLESS
W	WELDED

MATERIAL	
6	316L
4S	304

TUBE TYPE	
T	TUBE
P	PIPE

SIZE	
4	1/4"
6	3/8"
8	1/2"
12	3/4"
16	1"
20	1 1/4"
24	1 1/2"
32	2"
40	2 1/2"
48	3"
64	4"
XXXA	PIPE SIZE

PRODUCT	
EB	90° LONG ELBOW
SEB	90° SHORT ELBOW
HEB	45° LONG ELBOW
ET	EQUAL TEE
ST	SHORT TEE
RT	REDUCING TEE
RC	CONCENTRIC REDUCER
RE	ECCENTRIC REDUCER
CP	CAP
RC	CAP REDUCER
JTM	JOINT TEE (MALE)
JTF	JOINT TEE (FEMALE)
JRM	JOINT CAP REDUCER (MALE)
JRF	JOINT CAP REDUCER (FEMALE)
JCM	JOINT CAP (MALE)
JCF	JOINT CAP (FEMALE)
TG	TEFLON GASKET
PF	PIPE FLANGE
RFF	RF FLANGE
BLF	BLIND FLANGE
LAJ	LAP JOINT
MHT	MULTI-HEADER TEE
MJT	MULTI-HEADER JOINT TEE
CLE	COAXIAL 90° ELBOW
CHE	COAXIAL 45° ELBOW
CRC	COAXIAL REDUCER
CET	COAXIAL EQUAL TEE
CRT	COAXIAL REDUCING TEE
SS	STOP SPACER
CHT	COAXIAL HALF TUBE
COT	COAXIAL OVER TUBE

INNER SURFACE LEVEL	
AP	AP
MP	MP
BA	BA
EP	EP

Ordering Examples

	S6T4EB-BA		W4SP50×25RT-AP		W6P25AHEB-MP	
TYPE	S	SEAMLESS	W	WELDED	W	WELDED
MATERIAL	6	SUS316L	4S	SUS304	6	SUS316L
TUBE / PIPE	T	TUBE	P	PIPE	P	PIPE
SIZE	4	1/4"	50×25	50A×25A	25A	25A
PRODUCT	EB	ELBOW	RT	REDUCING TEE	HEB	45° ELBOW
INNER SURFACE LEVEL	BA	BA	AP	AP	MP	MP

TUBE SIZE & PIPE SIZE

TUBE SIZE (INCH-SIZE)

(Unit = mm)

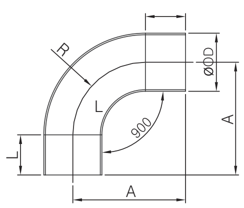
Normal Tube	Outside Diameter at End	Wall Thickness at End	Straight End Length	Thinning Length
	OD(OD1, OD2)	T(T1, T2)	L	J
1/8"	3.18	0.7	29	7
1/4"	6.35	1.0(0.89)	29	7
3/8"	9.53	1.0(0.89)	29	7
1/2"	12.70	1.0, 1.24(1.65)	29	7
5/8"	15.88	1.0(1.24)	36	7
3/4"	19.05	1.65(1.24)	36	7
1"	25.40	1.65(1.24)	36	7
1 1/4"	31.80	1.65	36	7
1 1/2"	38.10	1.65	46	7
2"	50.80	1.65	46	7
2 1/2"	63.50	1.65	51	7
3"	76.20	1.65	51	11
4"	101.60	2.11	51	11
5"	127.00	2.77, 3.05	56	11
6"	152.40	2.77, 3.05	56	11

PIPE SIZE (A SIZE)

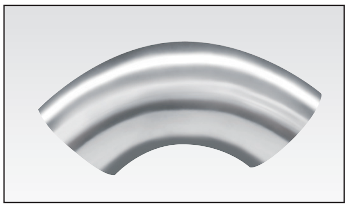
(Unit = mm)

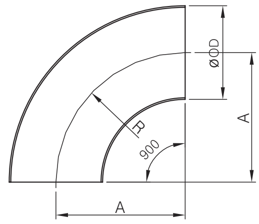
Normal Pipe	Outside Diameter at End	Wall Thickness at End		Straight End Length	Thinning Length	
	OD(OD1, OD2)	T		L	J	
		5S	10S		5S	10S
8A	13.8	1.20	1.65	29	4	7
10A	17.3	1.20	1.65	36	4	7
15A	21.7	1.65	2.10	36	5	7
20A	27.2	1.65	2.10	36	5	7
25A	34	1.65	2.80	36	5	7
32A	42.7	1.65	2.80	46	5	7
40A	48.6	1.65	2.80	46	5	7
50A	60.5	1.65	2.80	46	5	7
65A	76.3	2.10	3.00	51	6	11
80A	89.1	2.10	3.00	51	6	11
100A	114.3	2.10	3.00	51	6	11
125A	139.8	2.80	3.40	-	7	-
150A	165.2	2.80	3.40	-	7	-
200A	216.3	2.80	4.00	-	7	-
250A	267.4	3.40	4.00	-	-	-
300A	318.5	4.00	4.50	-	-	-
350A	355.6	4.00	4.80	-	-	-
400A	406.4	4.20	4.80	-	-	-
450A	457.2	4.20	4.80	-	-	-
500A	508	4.80	5.50	-	-	-
550A	558.8	4.80	5.50	-	-	-
600A	609.6	5.50	6.40	-	-	-

90° ELBOW



AUTO-WELDING 90° ELBOW(8A~100A)





MANUAL-WELDING 90°ELBOW (125A~300A)

- Long Radius

(Unit = mm)

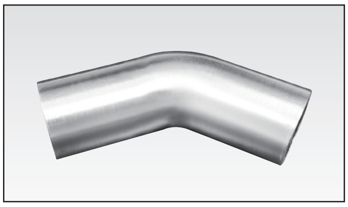
PIPE SIZE (A Size)															
OD	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
R	25.4	25.4	38.1	38.1	38.1	47.6	57.2	76.2	63.5	76.2	101.6	190.5	228.6	304.8	381.0	457.2
A	55.0	62.0	75.0	75.0	75.0	94.0	104.0	123.0	115.0	128.0	153.0					
L	29.0	36.0	36.0	36.0	36.0	46.0	46.0	46.0	51.0	51.0	51.0	-	-	-	-	-

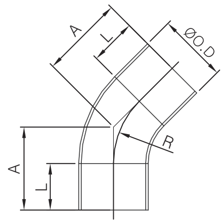
TUBE SIZE (Inch Size)														
OD	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
R	20.0	23.0	25.0	28.0	30.0	33.0	47.6	57.2	76.2	95.3	95.3	133.4	190.5	228.6
A	49.0	52.0	54.0	64.0	66.0	69.0	84.0	104.0	123.0	147.0	147.0	185.0	250.0	290.0
L	29.0	29.0	29.0	36.0	36.0	36.0	36.0	46.0	46.0	51.0	51.0	51.0	56.0	56.0

- Short Radius

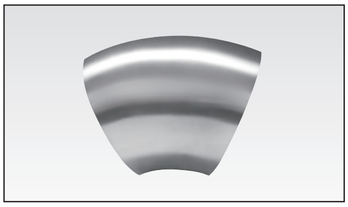
PIPE SIZE (A Size)															
OD	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
R	12.7	12.7	12.7	19.1	25.4	31.8	38.1	50.8	63.5	76.2	101.6	127.0	152.4	203.2	254.0	304.8
A	42.0	49.0	49.0	56.0	62.0	78.0	85.0	97.0	115.0	128.0	153.0					
L	29.0	29.0	29.0	36.0	36.0	36.0	36.0	46.0	46.0	51.0	51.0	-	-	-	-	-

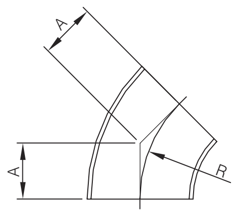
45° ELBOW





AUTO-WELDING 45° ELBOW(8A~100A)





MANUAL-WELDING 45°ELBOW(125A~300A)

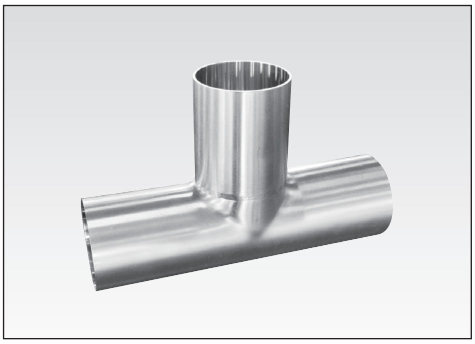
- Long Radius

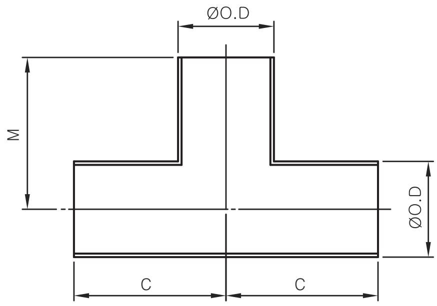
(Unit = mm)

PIPE SIZE (A Size)															
OD	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
R	25.4	25.4	38.1	38.1	38.1	47.6	57.2	76.2	95.3	114.3	152.4	190.5	228.6	304.8	381.0	457.2
A	40.0	47.0	52.0	52.0	52.0	66.0	70.0	78.0	91.0	99.0	115.0	78.9	94.7	126.2	157.8	189.4
L	29.0	36.0	36.0	36.0	36.0	46.0	46.0	46.0	51.0	51.0	51.0	-	-	-	-	-

TUBE SIZE (Inch Size)														
OD	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
R	20.0	23.0	25.0	28.0	30.0	33.0	47.6	57.2	76.2	95.3	95.3	133.4	190.5	228.6
A	38.0	39.0	40.0	48.0	49.0	50.0	56.0	70.0	78.0	91.0	91.0	107.0	140.0	155.0
L	29.0	29.0	29.0	36.0	36.0	36.0	36.0	46.0	46.0	51.0	51.0	51.0	56.0	56.0

EQUAL TEE





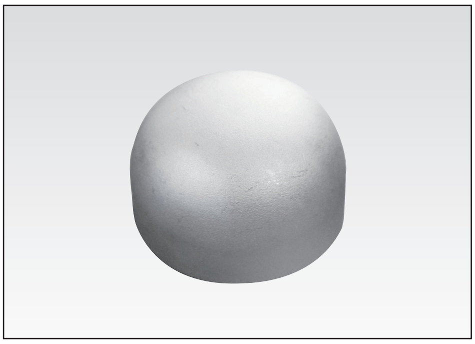
- Standard TEE

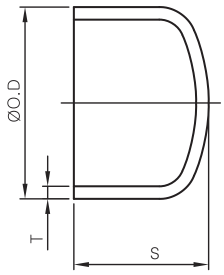
(Unit = mm)

PIPE SIZE (A Size)															
OD	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
C	42	49	59	65	68	88	95	102	121	130	145	123.8	142.9	177.8	215.9	254.0
M	42	49	59	65	68	88	95	102	121	130	145					

TUBE SIZE (Inch Size)														
OD	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
C	35	37	39	49	52	55	59	74	77	90	97	110	140	160
M	35	37	39	49	52	55	59	74	77	90	97	110	140	160

CAP



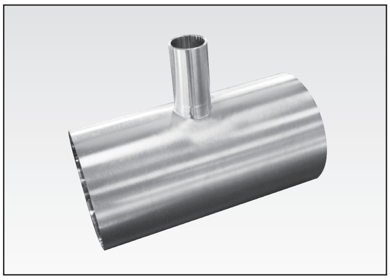


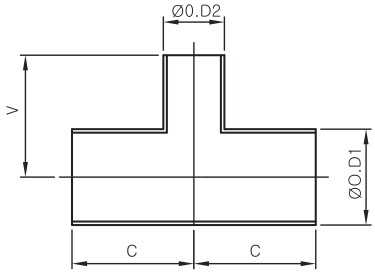
(Unit = mm)

PIPE SIZE (A Size)																
OD	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
S	12.7	19.1	25.4	25.4	38.1	38.1	38.1	38.1	38.1	50.8	63.5	76.2	88.9	101.6	127.0	152.4
T	1.20	1.20	1.65	1.65	1.65	1.65	1.65	1.65	2.10	2.10	2.10	3.40	3.40	4.00	4.00	4.50

TUBE SIZE (Inch Size)												
OD	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
S	12.7	12.7	12.7	12.7	19.1	25.4	38.1	38.1	38.1	38.1	38.1	63.5
T	1.00	1.00	1.24	1.24	1.65	1.65	1.65	1.65	1.65	1.65	1.65	2.11

REDUCING TEE





(Unit = mm)

PIPE SIZE (A Size)

OD1	OD2	C	V
8A	1/2", 3/8", 1/4"	42	42
10A	8A, 1/2", 3/8", 1/4"	47	44
15A	8A, 1/2", 3/8", 1/4"	47	44
	10A, 3/4", 5/8"	52	52
20A	8A, 1/2", 3/8", 1/4"	47	47
	15A, 10A, 1", 3/4", 5/8'	55	55
25A	8A, 1/2", 3/8", 1/4"	47	50
	20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	59	59
32A	8A, 1/2", 3/8", 1/4"	57	54
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	68	62
40A	8A, 1/2", 3/8", 1/4"	57	57
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	68	65
	32A, 1 1/2"	77	77
50A	8A, 1/2", 3/8", 1/4"	57	63
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	68	71
	40A, 32A, 2", 1 1/2"	83	83
65A	8A, 1/2", 3/8", 1/4"	61	71
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	72	79
	50A, 40A, 32A, 2", 1 1/2"	88	90
	2 1/2"	97	97
80A	8A, 1/2", 3/8", 1/4"	61	77
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	72	85
	50A, 40A, 32A, 2", 1 1/2"	88	96
	65A, 3", 2 1/2"	103	103
100A	8A, 1/2", 3/8", 1/4"	61	90
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	72	98
	50A, 40A, 32A, 2", 1 1/2"	88	109
	80A, 65A, 4", 3", 2 1/2"	116	116

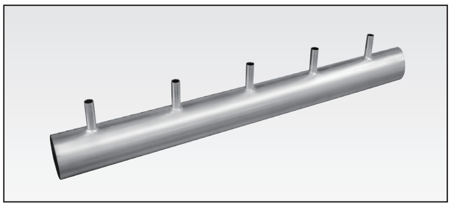
OD1	OD2	C	V
125A	8A, 1/2", 3/8", 1/4"	80	110
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	100	120
	50A, 40A, 32A, 2", 1 1/2"	120	130
	100A, 80A, 65A, 4", 3", 2 1/2"	140	140
150A	8A, 1/2", 3/8", 1/4"	90	130
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	110	140
	50A, 40A, 32A, 2", 1 1/2"	130	150
	100A, 80A, 65A, 4", 3", 2 1/2"	150	160
	125A, 5"	142.9	136.5
200A	8A, 1/2", 3/8", 1/4"	100	150
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"	120	160
	50A, 40A, 32A, 2", 1 1/2"	140	170
	100A, 80A, 65A, 4", 3", 2 1/2"	160	180
	125A, 5"	177.8	161.9
	150A, 6"	177.8	168.3
250A	8A, 1/2", 3/8", 1/4"	110	180
	25A, 20A, 15A, 10A, 1", 3/4"	130	190
	50A, 40A, 32A	150	200
	100A, 80A, 65A	170	210
	125A	215.9	190.5
	150A	215.9	193.7
	200A	215.9	203.2
300A	8A, 1/2", 3/8", 1/4"	120	200
	25A, 20A, 15A, 10A, 1", 3/4"	140	210
	50A, 40A, 32A	160	220
	100A, 80A, 65A	180	230
	125A	254	215.9
	150A	254	219.1
	200A	254	228.6
	250A	254	241.3

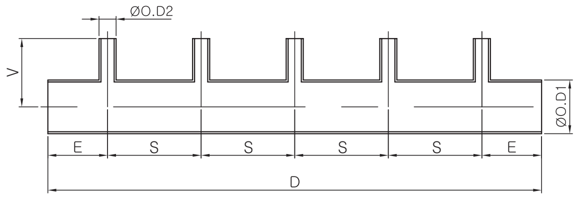
TUBE SIZE (INCH SIZE)

OD1	OD2	C	V
3/8"	1/4"	37	37
1/2"	3/8", 1/4"	39	39
5/8"	1/2", 3/8", 1/4", 8A	47	44
3/4"	1/2", 3/8", 1/4", 8A	47	44
	5/8", 10A	52	52
1"	1/2", 3/8", 1/4", 8A	47	47
	3/4", 5/8", 15A, 10A	55	55
1 1/4"	1/2", 3/8", 1/4", 8A	47	50
	1", 3/4", 5/8", 20A, 15A, 10A	59	59
1 1/2"	1/2", 3/8", 1/4", 8A	57	54
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	68	62
2"	1/2", 3/8", 1/4", 8A	57	57
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	68	65
	1 1/2", 40A, 32A	77	77
2 1/2"	1/2", 3/8", 1/4", 8A	61	63
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	72	71
	2", 1 1/2", 50A, 40A, 32A	90	83

OD1	OD2	C	V
3"	1/2", 3/8", 1/4", 8A	61	71
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	72	79
	2", 1 1/2", 50A, 40A, 32A	90	90
	2 1/2", 65A	97	97
4"	1/2", 3/8", 1/4", 8A	61	87
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	72	95
	2", 1 1/2", 50A, 40A, 32A	90	105
	3", 2 1/2", 80A, 65A	110	110
5"	1/2", 3/8", 1/4", 8A	70	100
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	90	110
	2", 1 1/2", 50A, 40A, 32A	110	120
	4", 3", 2 1/2" 100A, 80A, 65A	140	140
6"	1/2", 3/8", 1/4", 8A	80	115
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A	100	125
	2", 1 1/2", 50A, 40A, 32A	120	135
	4", 3", 2 1/2" 100A, 80A, 65A	140	145
	5", 125A	160	160

MULTI-HEADER TEE



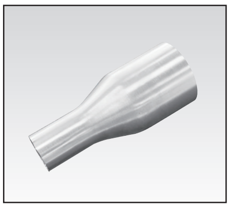


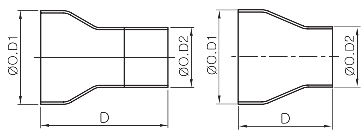
(Unit = mm)

PIPE SIZE (A Size)													
OD			8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A
Length at End		E	60								70		
Pitch		S	100								145		
Total Length (D)	Number of Branches	2	245								285		
		3	370								430		
		4	495								575		
		5	620								720		
Branch Tube Height	Tube-End(V)		42	44	44	47	50	54	57	63	71	77	90
	Female(V)		35	37	39.5	42.5	46.5	51	54	60	68	74.5	87

TUBE SIZE (INCH SIZE)														
OD			1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
Length at End		E	76.2											
Pitch		S	152.4											
Total Length (D)	Number of Branches	2	304.8											
		3	457.2											
		4	609.6											
		5	762.0											
Branch Tube Height	Tube-End(V)		35	37	39	44	44	47	50	54	57	63	71	87
	Female(V)		31.5	33.5	35	36.5	38	42	45.5	48	55	61.5	68	81

CONCENTRIC REDUCER





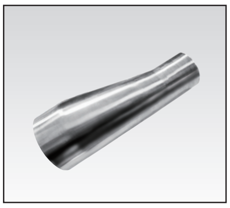
Auto-Welding & Mechanical Working Type
Concentric Reducer [RC] (8A~100A)

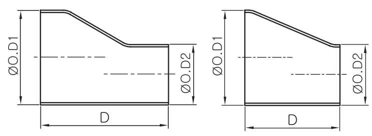
Auto Welding Type Concentric Reducer /Eccentric Reducer

(Unit = mm)

PIPE SIZE (A Size)		
OD1	OD2	D
20A	15A	105
25A	20A, 15A	120
32A	25A, 20A, 15A	125
40A	32A, 25A, 20A	130
50A	40A, 32A, 25A	140
65A	50A, 40A, 32A	165
80A	65A, 50A, 40A	170
100A	80A, 65A, 50A	180

ECCENTRIC REDUCER





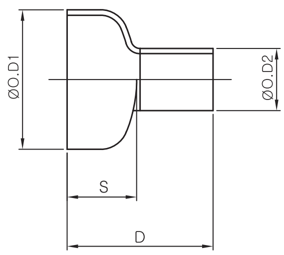
Auto-Welding & Mechanical Working Type
Eccentric Reducer [RE] (8A~100A)

Mechanical Working Type Concentric Reducer /Eccentric Reducer

(Unit = mm)

PIPE SIZE (A Size)		
OD1	OD2	D
15A	3/4", 1/2"	100
20A	1", 3/4", 1/2"	105
25A	1", 3/4", 1/2", 3/8", 1/4"	120
32A	1 1/2", 1 1/4", 1"	125
40A	1 1/2", 1 1/4", 1", 3/4" 1/2" 3/8"	130
50A	2", 1 1/2", 1 1/4", 1", 3/4"	140

CAP REDUCER



(Unit = mm)

PIPE SIZE (A Size)

OD1	OD2	S	D
15A	8A, 1/2", 3/8", 1/4"	25.4	60
	10A, 3/4", 5/8"		(67)
20A	8A, 1/2", 3/8", 1/4"	25.4	60
	15A, 10A, 1", 3/4", 5/8"		67
25A	8A, 1/2", 3/8", 1/4"	38.1	73
	20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		(80)
32A	8A, 1/2", 3/8", 1/4"	38.1	73
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		80
40A	8A, 1/2", 3/8", 1/4"	38.1	73
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		80
	32A, 1 1/2"		(90)
50A	8A, 1/2", 3/8", 1/4"	38.1	73
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		80
	40A, 32A, 2", 1 1/2"		(90)
65A	8A, 1/2", 3/8", 1/4"	38.1	73
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		80
	50A, 40A, 32A, 2", 1 1/2"		(90)
	2 1/2"		(100)
80A	8A, 1/2", 3/8", 1/4"	50.8	85
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		92
	50A, 40A, 32A, 2", 1 1/2"		102
	65A, 3", 2 1/2"		(110)
100A	8A, 1/2", 3/8", 1/4"	63.5	98
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		105
	50A, 40A, 32A, 2", 1 1/2"		115
	80A, 65A, 4", 3", 2 1/2"		125

OD1	OD2	S	D
125A	8A, 1/2", 3/8", 1/4"	76.2	120
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		130
	50A, 40A, 32A, 2", 1 1/2"		140
	100A, 80A, 65A, 4", 3", 2 1/2"		(150)
150A	8A, 1/2", 3/8", 1/4"	88.9	130
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		140
	50A, 40A, 32A, 2", 1 1/2"		150
	100A, 80A, 65A, 4", 3", 2 1/2"		160
200A	8A, 1/2", 3/8", 1/4"	101.6	140
	25A, 20A, 15A, 10A, 1 1/4", 1", 3/4", 5/8"		150
	50A, 40A, 32A, 2", 1 1/2"		160
	100A, 80A, 65A, 4", 3", 2 1/2"		170
250A	8A, 1/2", 3/8", 1/4"	127.0	170
	25A, 20A, 15A, 10A, 1", 3/4"		180
	50A, 40A, 32A		190
	100A, 80A, 65A		200
300A	8A, 1/2", 3/8", 1/4"	152.4	200
	25A, 20A, 15A, 10A, 1", 3/4"		210
	50A, 40A, 32A		220
	100A, 80A, 65A		230

* 125A(100A, 80A, 65A, 50A) / 150A(125A, 100A, 80A, (65A))/200A(150A, 125A, 100A) Bevel end at large dia. side.

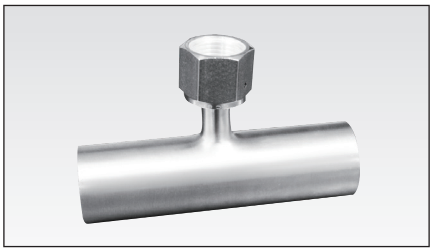
(Unit = mm)

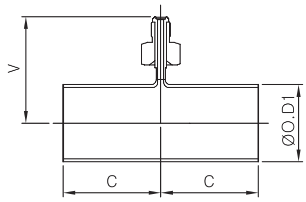
TUBE SIZE (Inch Size)

OD1	OD2	S	D
3/4"	1/2', 3/8", 1/4", 8A	19.1	54
	5/8", 10A		60
1"	1/2', 3/8", 1/4", 8A	25.4	60
	3/4", 5/8", 15A, 10A		67
1 1/4"	1/2", 3/8", 1/4", 8A	38.1	73
	1", 3/4", 5/8" 20A, 15A, 10A		80
1 1/2"	1/2", 3/8", 1/4", 8A	38.1	73
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A		80
2"	1/2", 3/8", 1/4", 8A	38.1	73
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A		80
	1 1/2", 40A, 32A		(90)

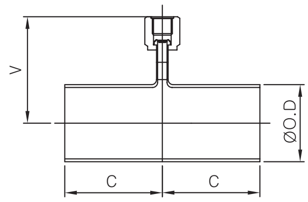
OD1	OD2	S	D
2 1/2"	1/2", 3/8", 1/4", 8A	38.1	73
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A		80
	2", 1 1/2", 50A, 40A, 32A		(90)
3"	1/2", 3/8", 1/4", 8A	38.1	73
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A		80
	2", 1 1/2", 50A, 40A, 32A		(90)
	2 1/2"		(95)
4"	1/2", 3/8", 1/4", 8A	63.5	98
	1 1/4", 1", 3/4", 5/8", 25A, 20A, 15A, 10A		105
	2", 1 1/2", 50A, 40A, 32A		115
	3", 2 1/2", 80A, 65A		(125)

JOINT TEE





Male Type



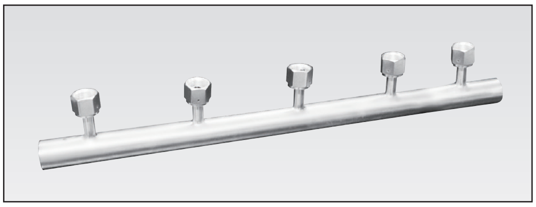
Female Type

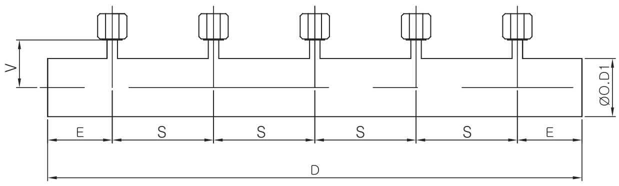
(Unit = mm)

PIPE SIZE (A Size)															
OD		8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A
C		45	52	52	55	59	68	68	68	72	72	72	100	110	120
Female	V	35	37	39.5	42.5	46.5	51	54	60	68	74.5	87	100	113	138.5
Male	V	45	47	49.5	52.5	56.5	61	64	70	78	84.5	97	110	123	148.5

TUBE SIZE (Inch Size)															
OD		1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
C		43	45	45	52	52	55	59	68	68	72	72	72	90	100
Female	V	31.5	33.5	35	36.5	38	42	45.5	48	55	61.5	68	81	94	107
Male	V	41.5	43.5	45	46.5	48	52	55.5	58	65	72.5	78	91	104	117

JOINT MULTI-HEADER TEE



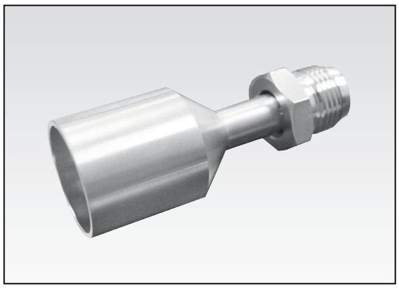


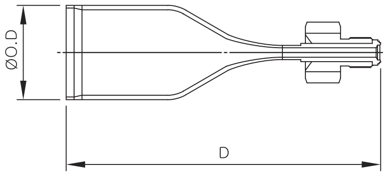
(Unit = mm)

PIPE SIZE (A Size)													
OD			8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A
Length at End		E	23	29	31	34	42	46	49	60	68	74.5	87
Pitch		S	125								145		
Total Length (D)	Number of Branches	2	245								285		
		3	370								430		
		4	495								575		
		5	620								720		
Branch Tube Height	Tube-End(V)		42	44	44	47	50	54	57	63	71	77	90
	Female(V)		35	37	39.5	42.5	46.5	51	54	60	68	74.5	87

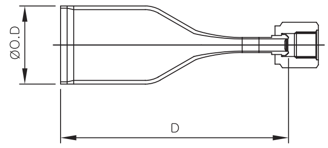
TUBE SIZE (Inch Size)														
OD			1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
Length at End		E	21	21	21	27	30	33	40	45	50	65	68	86
Pitch		S	152.4											
Total Length (D)	Number of Branches	2	304.8											
		3	457.2											
		4	609.6											
		5	762.0											
Branch Tube Height	Tube-End(V)		35	37	39	44	44	47	50	54	57	63	71	87
	Female(V)		31.5	33.5	35	36.5	38	42	45.5	48	55	61.5	68	81

JOINT REDUCER





Male Type



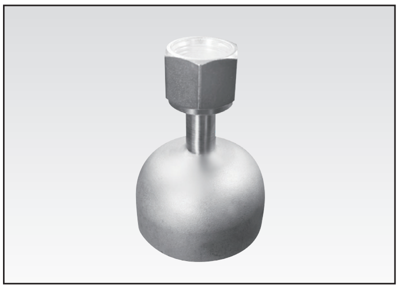
Female Type

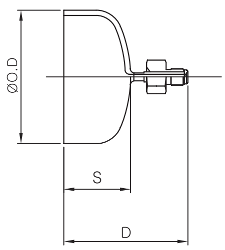
(Unit = mm)

PIPE SIZE (A Size)						
OD		8A	10A	15A	20A	25A
Female	D	90	100	110	115	130
Male	D	100	110	120	125	140

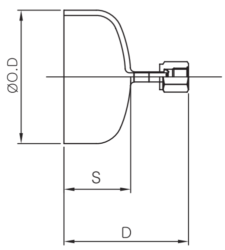
TUBE SIZE (Inch Size)						
OD		3/8"	1/2"	5/8"	3/4"	1"
Female	D	80	85	100	110	115
Male	D	90	95	110	120	125

JOINT CAP REDUCER





Male Type



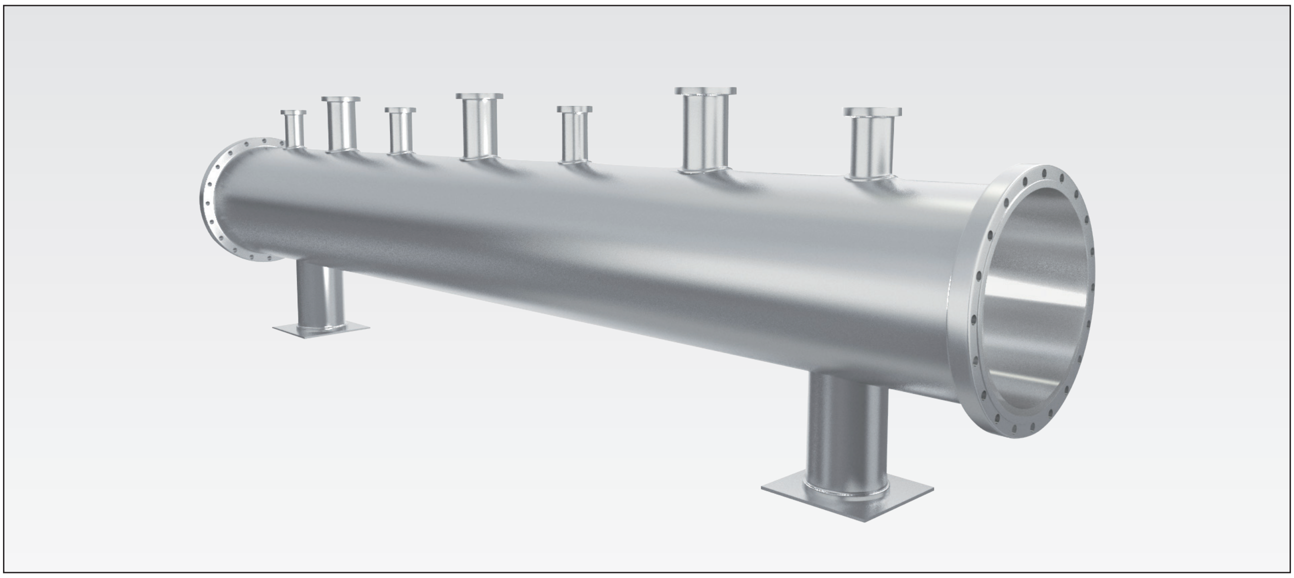
Female Type

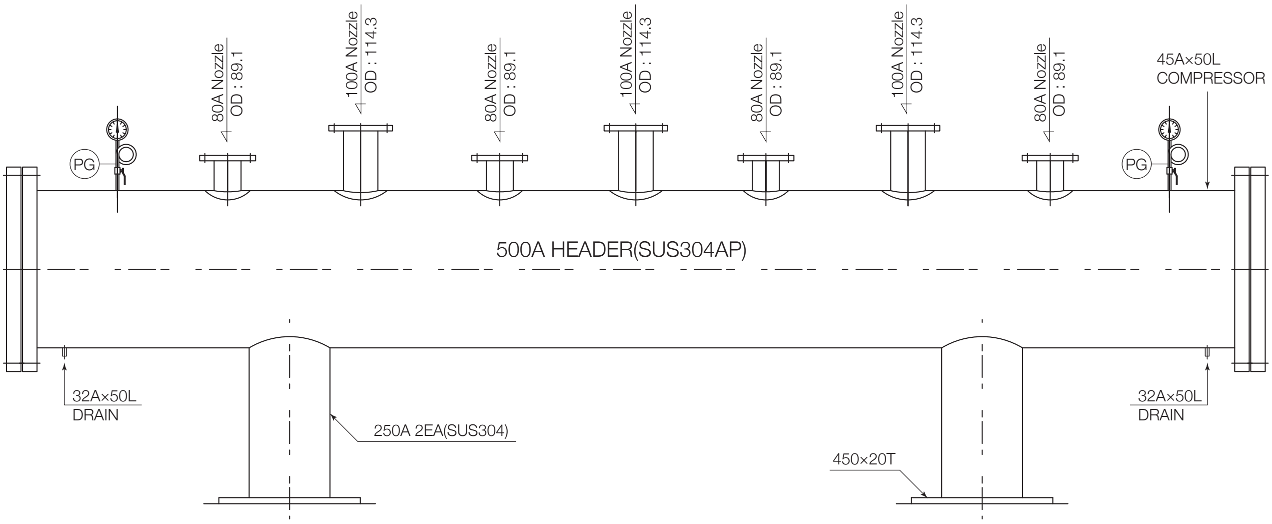
(Unit = mm)

PIPE SIZE (A Size)														
OD		10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A
Cap Length	S	19.1	25.4	25.4	38.1	38.1	38.1	38.1	38.1	50.8	63.5	76.2	88.9	101.6
Female	D	48	55	55	68	68	68	68	68	81	94	107	120	133
Male	D	58	65	65	78	78	78	78	78	91	104	117	130	143

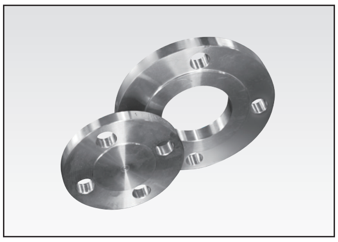
TUBE SIZE (Inch Size)									
OD		3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
Cap Length	S	19.1	25.4	38.1	38.1	38.1	38.1	38.1	63.5
Female	D	48	55	68	68	68	68	68	94
Male	D	58	65	78	78	78	78	78	104

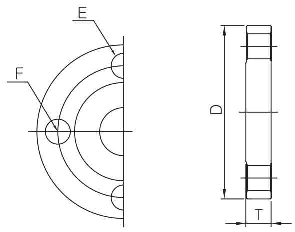
SPECIAL CLEAN SPOOL HEADER ASSEMBLY





RF/BLIND FLANGE



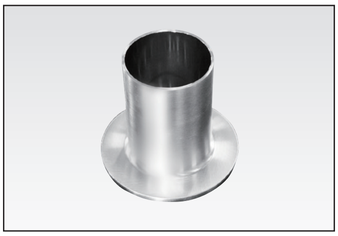


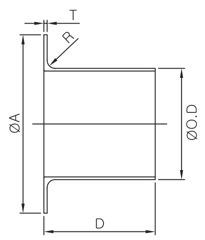
(Unit = mm)

PIPE SIZE (A Size)															
JIS 10K															
OD	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
D	90	95	100	125	135	140	155	175	185	210	250	280	330	400	445
T	12	12	14	14	16	16	16	18	18	18	20	22	22	24	24
E	4	4	4	4	4	4	4	4	8	8	8	8	12	12	16
F	F12	F12	F12	F16	F16	F16	F16	F16	F16	F16	F20	F20	F20	F22	F22
JIS 5K															
OD	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
D	75	80	85	95	115	120	130	155	180	200	235	265	320	385	430
T	9	9	10	10	12	12	14	14	14	16	16	18	20	22	22
E	4	4	4	4	4	4	4	4	4	8	8	8	8	12	12
F	F10	F10	F10	F10	F12	F12	F12	F12	F16	F16	F16	F16	F20	F20	F20

TUBE SIZE (INCH SIZE)										
OD	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2'	3"	4"	5"	6"
D	95	100	125	135	140	155	175	195	250	280
T	12	14	14	16	16	16	18	18	20	22
E	4	4	4	4	4	4	4	8	8	8
F	F12	F12	F16	F16	F16	F16	F16	F16	F20	F20

LAP JOINT



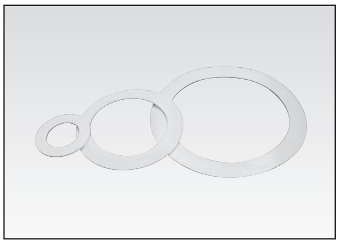


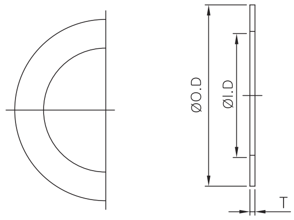
(Unit = mm)

PIPE SIZE (A SIZE)																
OD		10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
D		55	55	55	55	70	70	70	75	75	75	50	50	65	65	65
A	JIS 10K	46	51	56	67	76	81	96	116	126	151	182	212	262	324	368
	JIS 5K	39	44	49	59	70	75	85	110	121	141	182	212	262	324	368
R		3	3	3	3	3	3	4	4	5	5	5	5	5	5	5
T		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	7	7	9

TUBE SIZE (INCH SIZE)										
OD	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
D	55	55	55	70	70	70	75	75	85	90
A	51	56	67	76	81	96	116	136	182	212
R	3	3	3	3	3	4	4	5	5	5
T	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3

TEFLON GASKET



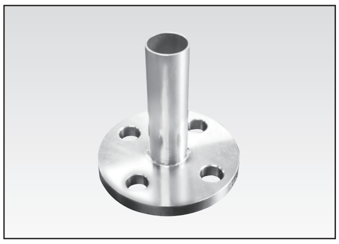


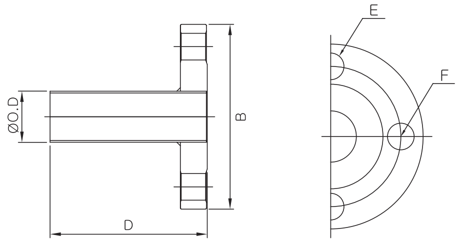
(Thickness T=2mm, Unit = mm)

PIPE SIZE (A Size)															
JIS 10K															
D	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
OD	53	58	63	74	84	89	104	124	134	159	190	220	270	333	378
ID	18	22	28	35	43	49	61	77	90	115	141	167	218	270	321
JIS 5K															
D	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
OD	45	50	55	65	78	83	93	118	129	149	184	214	260	325	370
ID	18	22	28	35	43	49	61	77	90	115	141	167	218	270	321

TUBE SIZE (INCH SIZE)										
D	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2'	3"	4"	5"	6"
OD	58	63	74	84	89	104	124	144	190	220
ID	19.5	26	32.5	38.5	51.5	64	77	102.5	128	153.5

PIPE FLANGE



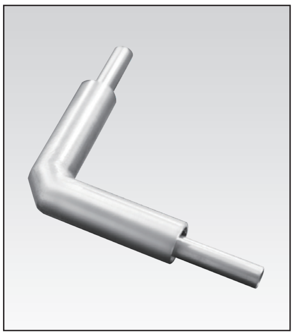


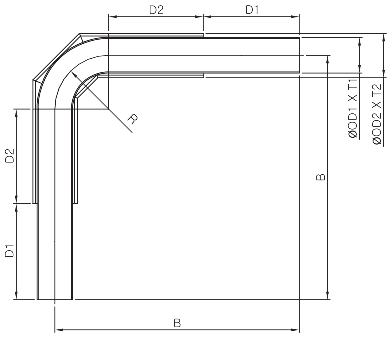
(Unit = mm)

PIPE SIZE (A Size)															
OD	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	250A	300A
D	100	100	100	100	100	100	100	100	100	100	200	200	200	200	200
B	90	95	100	125	135	140	155	175	185	210	250	280	330	400	445
E	4	4	4	4	4	4	4	4	8	8	8	8	12	12	16
F	F12	F12	F12	F16	F16	F16	F16	F16	F16	F16	F20	F20	F20	F22	F22

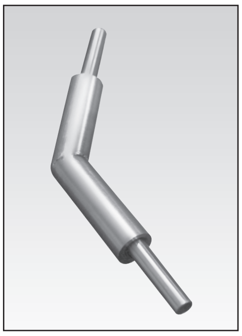
TUBE SIZE (INCH SIZE)										
OD	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2'	3"	4"	5"	6"
D	100	100	100	100	100	100	100	100	200	200
B	95	100	125	135	140	155	175	195	250	280
E	4	4	4	4	4	4	4	8	8	8
F	F12	F12	F16	F16	F16	F16	F16	F16	F20	F20

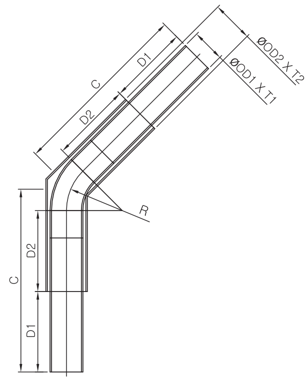
COAXIAL ELBOW





Coaxial 90° Elbow



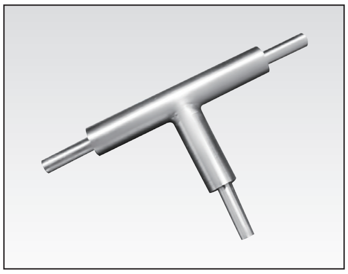


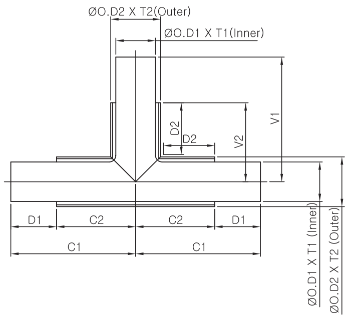
Coaxial 45° Elbow

(Unit = mm)

TUBE SIZE / PIPE SIZE															
INNER TUBE	1/4" X 1T		3/8"X1T		1/2" X 1T 1/2" X 1.24T		3/4" X1.24T 3/4" X1 .65T	1"X1.24T 1"X1.65T	1 1/2"X1.65T	2" X 1.65T	10A X 5S	15A X 5S	20A X 5S	25A X 5S	32A X 5S
OUTER TUBE	1/2" X 1T 1/2" X 1.24T	8A X 5S	5/8" X 1T 5/8" X 1.24T	10A X 5S	3/4" X 1.24T	15A X 5S	20A X 5S	25A X 5S	2" X 1.65T	2 1/2" X 1.65T	20A X 5S	25A X 5S	32A X 5S	40A X 5S	50A X 5S
D1	40	40	40	40	40	40	40	40	46	46	40	40	40	40	46
D2	29	29	36	36	36	36	36	36	46	51	36	36	46	46	46
R	25	26	28	30	35	38	47.6	57.2	95.3	120	47.6	57.2	76.2	95.3	114.3
B	94	95	104	106	111	114	124	134	188	217	124	134	163	182	207
C	80	80	88	89	91	92	96	100	132	147	96	100	118	126	140

COAXIAL EQUAL TEE

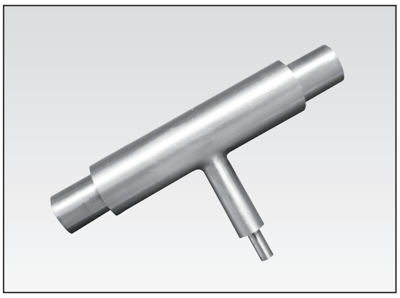


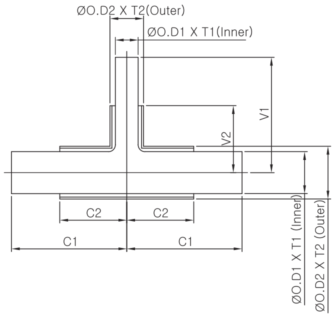


(Unit = mm)

TUBE SIZE / PIPE SIZE															
INNER TUBE	1/4" X 1T		3/8"X1T		1/2" X 1T 1/2" X 1.24T		3/4" X1.24T 3/4" X1 .65T	1"X1.24T 1"X1.65T	1 1/2"X1.65T	2" X 1.65T	10A X 5S	15A X 5S	20A X 5S	25A X 5S	32A X 5S
OUTER TUBE	1/2" X 1T 1/2" X 1.24T	8A X 5S	5/8" X 1T 5/8" X 1.24T	10A X 5S	3/4" X 1.24T	15A X 5S	20A X 5S	25A X 5S	2" X 1.65T	2 1/2" X 1.65T	20A X 5S	25A X 5S	32A X 5S	40A X 5S	50A X 5S
D1	40	40	40	40	40	40	40	40	46	46	40	40	40	40	46
D2	29	29	36	36	36	36	36	36	46	51	36	36	46	46	46
C1, V1	82	82	89	89	92	92	105	108	123	136	95	99	114	117	129
C2, V2	42	42	49	49	52	52	65	68	77	90	55	59	74	77	83

COAXIAL REDUCING TEE

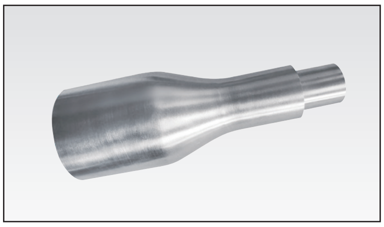


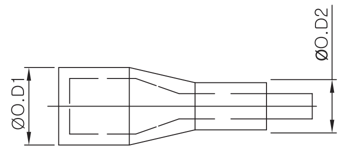


(Unit = mm)

TUBE SIZE / PIPE SIZE							
Normal Tube Size				Inner Tube		Outer Tube	
INNER TUBE		OUTER TUBE					
Normal Tube Size	Branch Tube Size	Normal Tube Size	Branch Tube Size	C1	V1	C2	V2
3/8"	1/4"	5/8", 10A	8A, 1/2"	87	84	47	44
1/2"	1/4"	3/4", 15A	8A, 1/2"	87	84	47	44
	3/8"		10A, 5/8"	92	92	52	52
3/4"	1/4"	1", 20A	8A, 1/2"	87	87	47	47
	3/8", 1/2"		10A, 5/8", 15A, 3/4"	95	95	55	55
1"	1/4"	1 1/4", 25A	8A, 1/2"	87	90	47	50
	3/8", 1/2", 10A, 3/4", 15A		10A, 5/8", 15A, 3/4", 20A, 1", 25A	99	99	59	59
1 1/2"	1/4"	2"	8A, 1/2"	103	97	57	57
	3/8", 1/2", 10A, 3/4", 15A, 1"		10A, 5/8", 15A, 3/4", 20A, 1", 25A, 1 1/4"	114	105	68	65
	20A, 25A		32A, 40A	123	117	77	77
2"	1/4"	2 1/2"	8A, 1/2"	107	103	61	63
	3/8", 1/2", 10A, 3/4", 15A, 1"		10A, 5/8", 15A, 3/4", 20A, 1", 25A, 1 1/4"	118	111	72	71
	20A, 25A		32A, 40A, 2", 50A	136	123	90	83
	1 1/2", 32A		32A, 40A, 2", 50A	136	129	90	83
10A	1/4"	20A	8A, 1/2"	87	87	47	47
	3/8", 1/2"		10A, 5/8", 15A, 3/4"	95	95	55	55
15A	1/4"	25A	8A, 1/2"	87	90	47	50
	3/8", 1/2", 10A, 3/4"		10A, 5/8", 15A, 3/4", 20A, 1"	99	99	59	59
20A	1/4"	32A	8A, 1/2"	97	94	57	54
	3/8", 1/2", 10A, 3/4", 15A, 1"		10A, 5/8", 15A, 3/4", 20A, 1", 25A, 1 1/4"	108	102	68	62
25A	1/4"	40A	8A, 1/2"	97	97	57	57
	3/8", 1/2", 10A, 3/4", 15A, 1"		10A, 5/8", 15A, 3/4", 20A, 1", 25A, 1 1/4"	108	105	68	65
	20A		32A	117	117	77	77
32A	1/4"	50A	8A, 1/2"	103	103	57	63
	3/8", 1/2", 10A, 3/4", 15A, 1"		10A, 5/8", 15A, 3/4", 20A, 1", 25A, 1 1/4"	114	111	68	71
	20A, 25A		32A, 40A	129	123	83	83

COAXIAL REDUCER

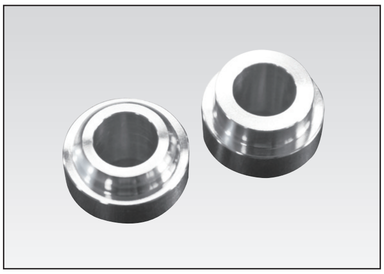


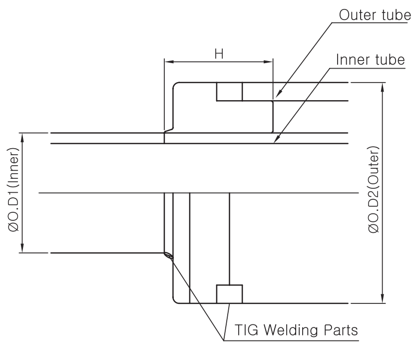


(Unit = mm)

TUBE SIZE / PIPE SIZE			
INNER TUBE		OUTER TUBE	
Large End(ØOD1)	Small End(ØOD2)	Large End(ØOD1)	Small End(ØOD2)
1/4"	[1/8"]	1/2"	3/8", (1/4")
		8A	1/2", 3/8", 1/4"
3/8"	[1/4"]	5/8"	1/2", 8A
		10A	1/2", 8A
1/2"	3/8" [1/4"]	3/4"	5/8", 1/2" 10A, (8A)
		15A	5/8", 1/2" 10A, (8A)
3/4"	1/2" [3/8", 1/4" 10A]	20A	15A, 10A, 8A, 3/4", 1/2", 20A
		1"	3/4", (5/8"), 1/2", 15A, (10A~8A)
1"	3/4", 1/2", [3/8", 1/4", 15A](10A)	1 1/4"	1", (3/4", 20A), (5/8"~1/2", 15A~8A)
		25A	25A, 20A, 15A, 10A, 8A, 1", 3/4", 1/2"
1 1/2"	1", [3/4", 25A](1/2"~1/4", 20A, 10A)	2"	(1 1/4"), 1", (40A), (3/4"~1/2", 32A~8A)
2"	1 1/2", 1", (3/4"~1/4", 32A~10A)	2 1/2"	2", 1 1/4", 50A, (1"~1/2", 40A~8A)
10A	[1/2", 3/8", 1/4"]	20A	15A, [10A, 8A, 3/4", 1/2"]
15A	[10A, 3/4", 1/2", 3/8", 1/4"]	25A	20A, 15A, [10A, 8A, 3/4", 1/2"]
20A	15A, [10A, 1", 3/4" 1/2", 3/8", 1/4"]	32A	25A, 20A, 15A, [1 1/4"] (10A~8A, 1"~1/2")
25A	20A, 15A, [10A, 1", 3/4" 1/2", 3/8", 1/4"]	40A	32A, 25A, 20A, 15A, (10A~8A, 1 1/4"~1/2")
32A	25A, 20A, 15A, [1 1/2"] (10A, 1", 3/4", 1/2" 3/8" 1/4")	50A	40A, 32A, 25A, 20A, [2"] (15A~8A, 1 1/4"~1/2")

STOP SPACER

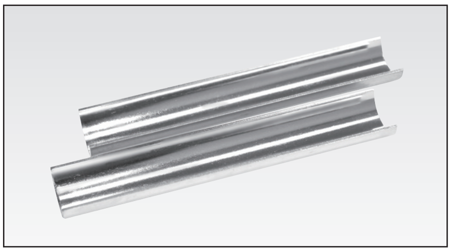


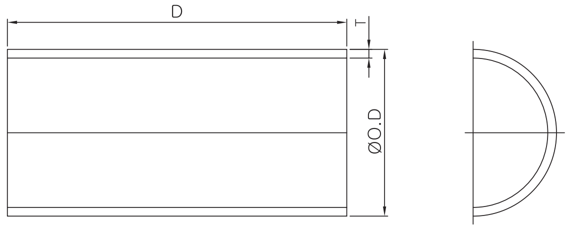


(Unit = mm)

<table>
<tr><th colspan="16">TUBE SIZE / PIPE SIZE</th></tr>
<tr><td rowspan="2">INNER TUBE</td><td colspan="2" rowspan="2">1/4" X 1T</td><td colspan="2" rowspan="2">3/8"X1T</td><td colspan="2">1/2" X 1T</td><td>3/4" X1.24T</td><td>1"X1.24T</td><td rowspan="2">1 1/2"X1.65T</td><td rowspan="2">2" X 1.65T</td><td rowspan="2">10A X 5S</td><td rowspan="2">15A X 5S</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">32A X 5S</td></tr>
<tr><td colspan="2">1/2" X 1.24T</td><td>3/4" X1 .65T</td><td>1"X1.65T</td></tr>
<tr><td rowspan="2">OUTER TUBE</td><td>1/2" X 1T</td><td rowspan="2">8A X 5S</td><td>5/8" X 1T</td><td rowspan="2">10A X 5S</td><td rowspan="2">3/4" X 1.24T</td><td rowspan="2">15A X 5S</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">2" X 1.65T</td><td rowspan="2">2 1/2" X 1.65T</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">32A X 5S</td><td rowspan="2">40A X 5S</td><td rowspan="2">50A X 5S</td></tr>
<tr><td>1/2" X 1.24T</td><td>5/8" X 1.24T</td></tr>
<tr><td>H</td><td>9</td><td>9</td><td>9</td><td>9</td><td>9</td><td>9</td><td>12</td><td>12</td><td>12</td><td>12</td><td>12</td><td>12</td><td>12</td><td>12</td><td>12</td></tr>
</table>

COAXIAL HALF TUBE

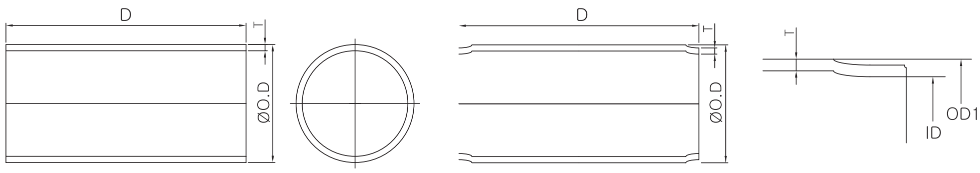




(Unit = mm)

<table>
<tr><th colspan="16">TUBE SIZE/PIPE SIZE</th></tr>
<tr><td rowspan="2">INNER TUBE</td><td colspan="2" rowspan="2">1/4" X 1T</td><td colspan="2" rowspan="2">3/8"X1T</td><td colspan="2">1/2" X 1T</td><td>3/4" X1.24T</td><td>1"X1.24T</td><td rowspan="2">1 1/2"X1.65T</td><td rowspan="2">2" X 1.65T</td><td rowspan="2">10A X 5S</td><td rowspan="2">15A X 5S</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">32A X 5S</td></tr>
<tr><td colspan="2">1/2" X 1.24T</td><td>3/4" X1 .65T</td><td>1"X1.65T</td></tr>
<tr><td rowspan="2">OUTER TUBE</td><td>1/2" X 1T</td><td rowspan="2">8A X 5S</td><td>5/8" X 1T</td><td rowspan="2">10A X 5S</td><td rowspan="2">3/4" X 1.24T</td><td rowspan="2">15A X 5S</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">2" X 1.65T</td><td rowspan="2">2 1/2" X 1.65T</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">32A X 5S</td><td rowspan="2">40A X 5S</td><td rowspan="2">50A X 5S</td></tr>
<tr><td>1/2" X 1.24T</td><td>5/8" X 1.24T</td></tr>
<tr><td rowspan="2">OD X T</td><td>12.7 X 1.00</td><td rowspan="2">13.8 X 1.20</td><td>15.88 X 1.00</td><td rowspan="2">17.3 X 1.20</td><td rowspan="2">19.05 X 1.24</td><td rowspan="2">21.7 X 1.65</td><td rowspan="2">27.2 X 1.65</td><td rowspan="2">34.0 X 1.65</td><td rowspan="2">50.8 X 1.65</td><td rowspan="2">63.5 X 1.65</td><td rowspan="2">27.2 X 1.65</td><td rowspan="2">34.0 X 1.65</td><td rowspan="2">42.7 X 1.65</td><td rowspan="2">48.6 X 1.65</td><td rowspan="2">60.5 X 1.65</td></tr>
<tr><td>12.7 X 1.24</td><td>15.88 X 1.24</td></tr>
</table>

COAXIAL OVER TUBE



TYPE Ⅰ TYPE Ⅱ

- TYPE Ⅰ

(Unit = mm)

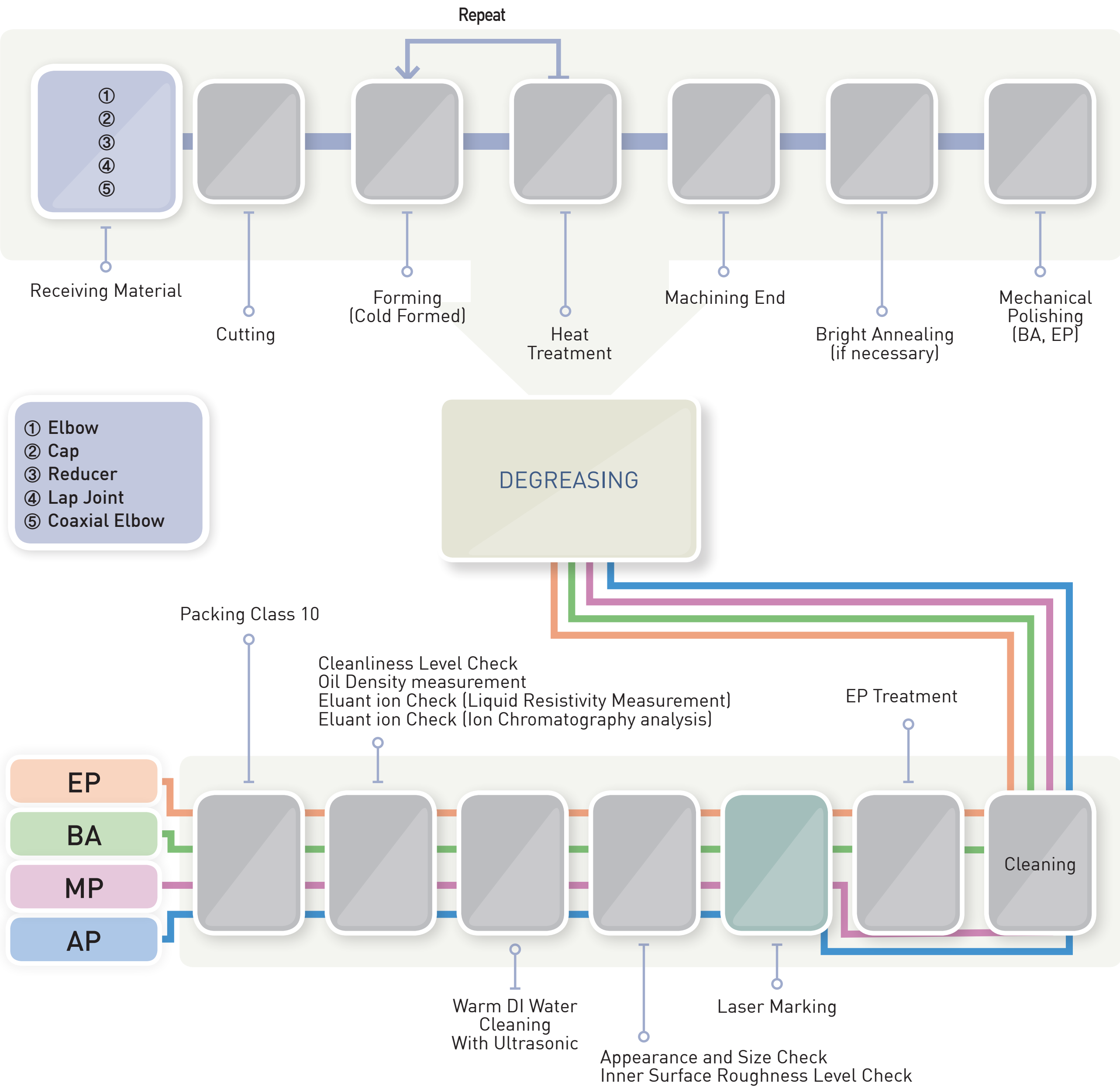
<table>
<tr><th colspan="16">TUBE SIZE/PIPE SIZE</th></tr>
<tr><td rowspan="2">INNER TUBE</td><td colspan="2" rowspan="2">1/4" X 1T</td><td colspan="2" rowspan="2">3/8"X1T</td><td colspan="2">1/2" X 1T</td><td>3/4" X1.24T</td><td>1"X1.24T</td><td rowspan="2">1 1/2"X1.65T</td><td rowspan="2">2" X 1.65T</td><td rowspan="2">10A X 5S</td><td rowspan="2">15A X 5S</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">32A X 5S</td></tr>
<tr><td colspan="2">1/2" X 1.24T</td><td>3/4" X1 .65T</td><td>1"X1.65T</td></tr>
<tr><td rowspan="2">OUTER TUBE</td><td>1/2" X 1T</td><td rowspan="2">8A X 5S</td><td>5/8" X 1T</td><td rowspan="2">10A X 5S</td><td rowspan="2">3/4" X 1.24T</td><td rowspan="2">15A X 5S</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">2" X 1.65T</td><td rowspan="2">2 1/2" X 1.65T</td><td rowspan="2">20A X 5S</td><td rowspan="2">25A X 5S</td><td rowspan="2">32A X 5S</td><td rowspan="2">40A X 5S</td><td rowspan="2">50A X 5S</td></tr>
<tr><td>1/2" X 1.24T</td><td>5/8" X 1.24T</td></tr>
<tr><td>OD X T</td><td>15.0 X 1.05</td><td>165. X 1.25</td><td>18.5 X 1.20</td><td>20.0 X 1.25</td><td>22.0 X 1.35</td><td>25.4 X 1.70</td><td colspan="9">Over Tube TYPE Ⅱ</td></tr>
</table>

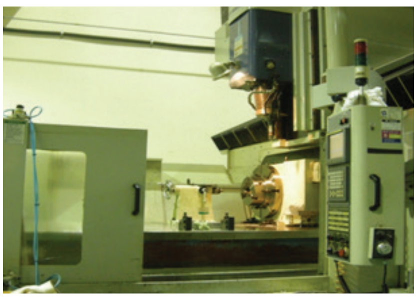
- TYPE Ⅱ

<table>
<tr><th colspan="17">TUBE SIZE/PIPE SIZE</th></tr>
<tr><td>Normal Tube Size</td><td>1/2"</td><td>5/8"</td><td>3/4"</td><td>1"</td><td>1 1/4"</td><td>1 1/2"</td><td>2"</td><td>2 1/2"</td><td>8A</td><td>10A</td><td>15A</td><td>20A</td><td>25A</td><td>32A</td><td>40A</td><td>50A</td></tr>
<tr><td>OD1</td><td>15.88</td><td>19.05</td><td>25.4</td><td>31.8</td><td>38.1</td><td>42.7</td><td>60.5</td><td>76.2</td><td>17.3</td><td>21.7</td><td>25.4</td><td>31.8</td><td>38.1</td><td>48.6</td><td>60.5</td><td>76.3</td></tr>
<tr><td>ID</td><td>13.0</td><td>16.2</td><td>19.3</td><td>25.7</td><td>32.1</td><td>38.4</td><td>51.1</td><td>63.8</td><td>14.1</td><td>17.6</td><td>22</td><td>27.5</td><td>34.3</td><td>43</td><td>48.9</td><td>60.8</td></tr>
<tr><td>D</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>112</td><td>112</td><td>122</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>112</td><td>112</td><td>112</td></tr>
<tr><td>T</td><td>1.0</td><td>1.24</td><td>1.65</td><td>1.65</td><td>1.24</td><td>1.65</td><td>1.65</td><td>1.65</td><td>1.0</td><td>1.24</td><td>1.24</td><td>1.65</td><td>1.65</td><td>1.65</td><td>1.65</td><td>1.65</td></tr>
</table>

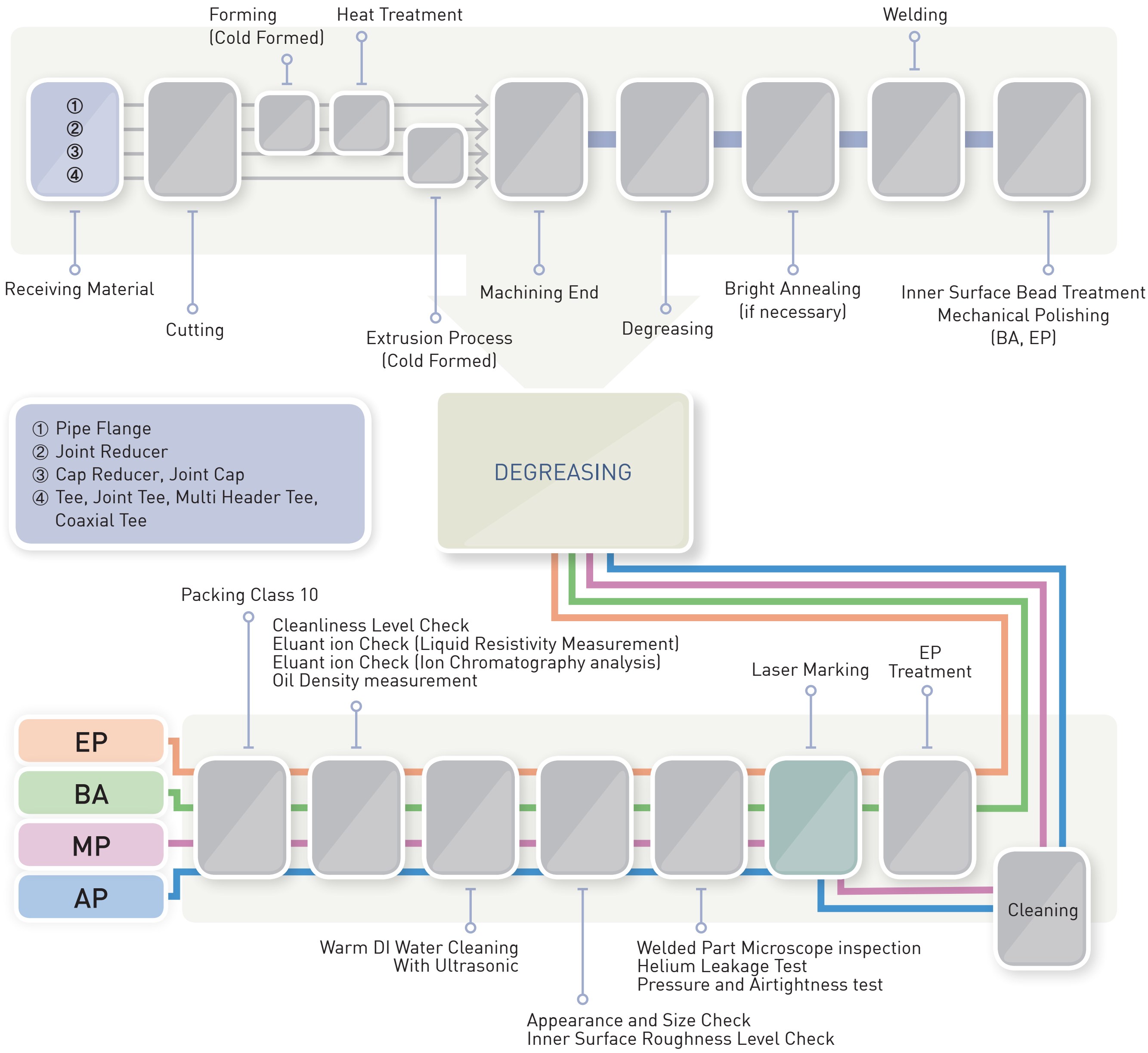
DWC MANUFACTURING PROCESS

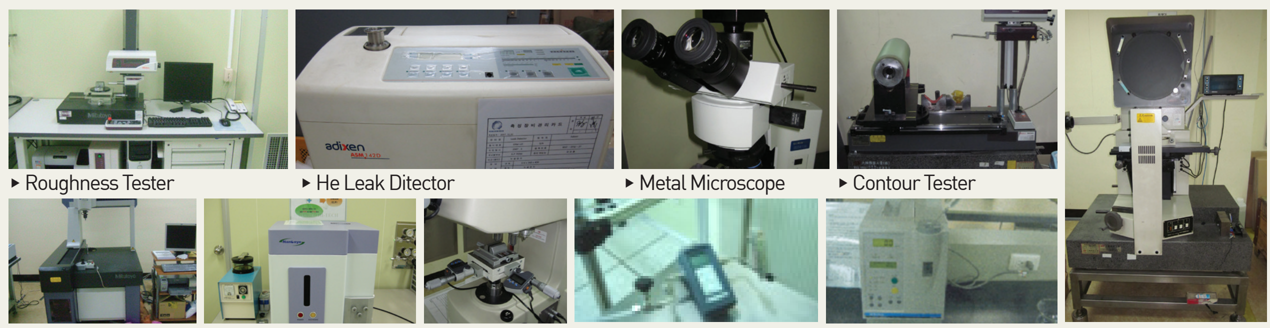
PROCESS Ⅰ





PROCESS II





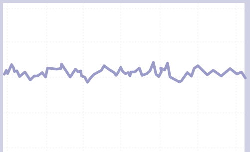
▸ Roughness Tester ▸ He Leak Detector ▸ Metal Microscope ▸ Contour Tester
▸ 3Dimension Tester ▸ SEM ▸ Hardness Tester ▸ Dew-point ▸ Oil Contents Tester ▸ Direct Projector

TECHNICAL DATA

Example of Inner Surface Roughness

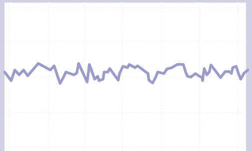
DWC-EP 90° ELBOW SUS 316L 25A×5S

❶ Straight End



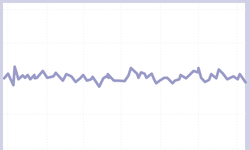
Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	1.2µinch
Ry	=	8.3µinch

❷ Inside of Bend



Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	1.6µinch
Ry	=	8.7µinch

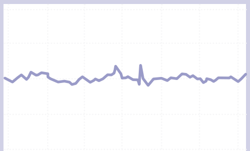
❸ Outside of Bend



Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	1.6µinch
Ry	=	9.1µinch

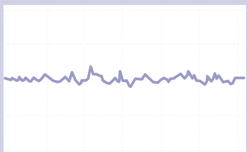
DWC-EP EQUAL TEE SUS 316L 25A×5S

❶ Corner Radius



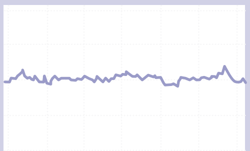
Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	1.6µinch
Ry	=	10.6µinch

❷ Welded Section



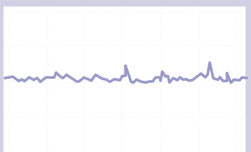
Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	2.0µinch
Ry	=	9.8µinch

❸ Straight part in Pipe



Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	1.6µinch
Ry	=	9.8µinch

❹ Straight part in Branch pipe



Roughness		
Cut Off	=	0.25mm
Tilt Cor	=	CURVE-ML
Length	=	1.25mm
V-Mag	=	20000
H-Mag	=	50
T-Speed	=	0.3mm/s
Polarity	=	Positive
Ra	=	2.0µinch
Ry	=	9.4µinch

INSPECTION

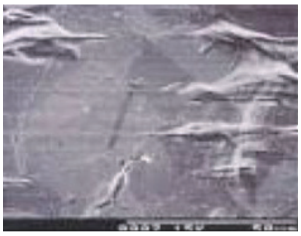
1. SURFACE ROUGHNESS

ITEM	Internal				External(Ra)	
	Ra		Ry			Length : 4~16mm Cutoff : 0.8mm 0.05~0.5
	EP	BA	EP	BA		
PIPE & TUBE FITTINGS	≤10μinch	≤20μinch	≤0.7μm	≤2.5μm	≤30μinch	

2. SEM


BA Tube Surface × 300


EP Tube × 300


BA Tube Surface × 1000


EP Tube × 1000

3. AES

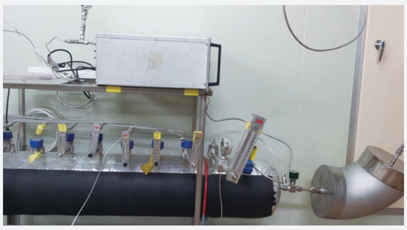
Element	Oxide Thickness	Carbon Layer Thickness	Cr/Fe Ratio at 10 Ang	Carbon	sulfur	Phosphorus	Silicon	Nitrogen
Atomic Percentage	≥20A	≤10A	≤1	≤30	≤1	≤2	≤1.5	≤2

4. XPS

Element	Cr/Fe Ratio	CrO/FeO Ratio
Result	≥2	≥3

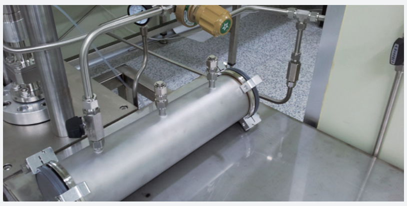
5. INSPECTION EQUIPMENT

▶ He Leak Tester


▶ Moisture Tester

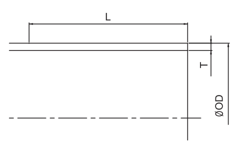
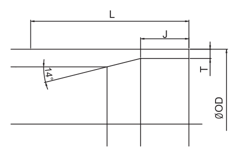
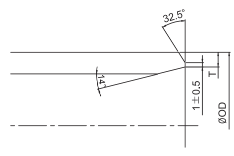
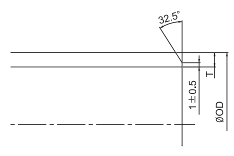
▶ Oil Contents Tester

▶ Partical Contour Tester


▶ Pressure Leak Tester


▶ Roughness Tester

WELD BEVEL END MANUFACTURE FORM

	AUTOMATIC WELDING		MANUAL WELDING	
FORM / TYPE				
ELBOW (LONG/SHORT)	8A~100A	-	125A~600A	-
EQUAL TEE(LONG/SHORT)	8A~65A	8A~100A	125A~600A	-
REDUCING TEE	8A~100A	-	-	125A~600A
CAP	-	15A~100A	125A~600A	-
CAP REDUCER	15A~32A	40A~100A	125A~600A	-
CONCENTRIC REDUCER	15A~100A	-	125A~600A	-
ECCENTRIC REDUCER	15A~100A	-	125A~600A	-

* WELD BEVEL END MANUFACTURE FORM is described by Standard of mother pipe.

INTERNATIONAL SURFACE FINISH STANDARD

Rmax (최대 높이 조도) Micro-meter	Ra (평균 높이 조도)		Rms (10점 평균 조도)	
	Micro-meter	Micro-inch	Micro-meter	Micro-inch
0.3	0.06	2.5	0.05	1.9
0.6	0.10	3.9	0.09	3.5
0.9	0.14	5.3	0.13	5.0
1.2	0.21	8.3	0.19	7.4
1.4	0.25	10.0	0.24	9.8
1.6	0.30	11.8	0.30	11.9
1.8	0.35	13.8	0.35	14.0
2.0	0.40	15.7	0.41	16.0
2.2	0.44	17.6	0.46	18.0
2.4	0.49	19.2	0.51	20.0
2.6	0.53	20.8	0.58	23.0
2.8	0.58	22.7	0.64	25.0
3.0	0.63	24.6	0.67	26.5
3.5	0.71	27.8	0.77	32.0
4.0	0.80	31.4	0.96	38.0
4.5	0.90	35.2	1.07	42
5.0	0.99	38.8	1.24	48
6.0	1.2	47.2	1.40	55
7.0	1.4	55.1	1.65	65
8.0	1.6	63	1.91	75
9.0	1.8	71	2.14	83
10	2.0	79	2.51	91
15	3.2	126	3.20	130
20	4.4	173	4.45	175
30	7.4	292	6.70	260

* Conversion : 1μm = 39.37 μ inch & 1 μ inch = 0.0254 μm

DIMENSIONAL TOLERANCE

(Unit = mm)

<table>
<tr><th rowspan="3">Products</th><th rowspan="3">Item</th><th colspan="5">Normal Size</th></tr>
<tr><th rowspan="2">1/4"~1/2'</th><th>8A~10A</th><th>15A~65A</th><th>80A~200A</th><th rowspan="2">250A~300A</th></tr>
<tr><th>1/2"~3/4"</th><th>1"~3"</th><th>4"~6"</th></tr>
<tr><td rowspan="4">Pipe & Tube Fitting
Multi Tee (J-Tee)</td><td>Outside Diameter at End (OD)</td><td>±0.1mm</td><td colspan="4">±1%</td></tr>
<tr><td>Wall Thickness at End (T)</td><td colspan="5">Either Bigger ± 0.2mm or ± 10%</td></tr>
<tr><td>Straight End Length (L)</td><td colspan="5">+ Not Specified</td></tr>
<tr><td>Thinning Length (J)</td><td colspan="5">+ Not Specified</td></tr>
<tr><td>Elbows</td><td>Bend Radius (R)</td><td colspan="2">±0.8mm</td><td colspan="2">±1.6mm</td><td>±3.2mm</td></tr>
<tr><td>Elbow, Tee, J-Tee
Multi-Tee (J-Tee)
Reducer</td><td>Center to End (A·B·C·D)</td><td colspan="2">±0.8mm</td><td colspan="2">±1.6mm</td><td>±3.2mm</td></tr>
<tr><td>Clean Lap
Pipe Flange
Blind</td><td>Length (FF FP)</td><td colspan="2">±0.8mm</td><td colspan="2">±1.6mm</td><td>±3.2mm</td></tr>
<tr><td>Cap</td><td>Back to End (E, BM)</td><td colspan="2">±0.8mm</td><td colspan="3">±3.2mm</td></tr>
<tr><td>Reducer
Cap Reducer
Pipe size(joint)</td><td>Over all Length (H, Q)</td><td colspan="2">±0.8mm</td><td colspan="2">±1.6mm</td><td>±3.2mm</td></tr>
<tr><td rowspan="2">Clean Lap
Lap Joint</td><td>Thickness of Lap (t)</td><td></td><td colspan="4">±5mm -0</td></tr>
<tr><td>Diameter of Lap (G)</td><td></td><td colspan="3">±1.6mm</td><td>+0 -1.6mm</td></tr>
<tr><td rowspan="3">Multi-Tee (J-Tee)</td><td>Length of End (EL)</td><td colspan="5">±1.6mm</td></tr>
<tr><td>Branch Pitch (P)</td><td colspan="3">±1.6mm</td><td colspan="2">±3.2mm</td></tr>
<tr><td>Total Length (L)</td><td colspan="5">+5mm -0</td></tr>
</table>

He Detector Leak Test

(Applied to Clean Fittings and Joints)

Measuring instrument : ALCATEL

Detection sensitivity : $1x10^{-11}$ Torr.1/s

Pressure / Airtightness Test

(Application for Welded Products)

Pressure Test : 1MPa(10kg/cm^2)

Airtightness Test : 0.7MPa(7kg/cm^2)

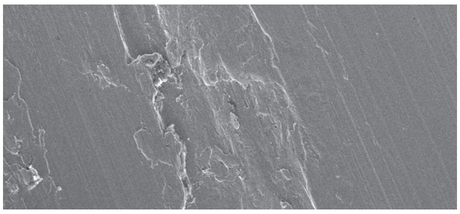
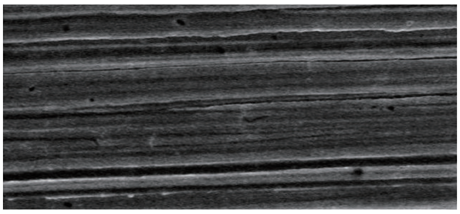
Particle Counter Test

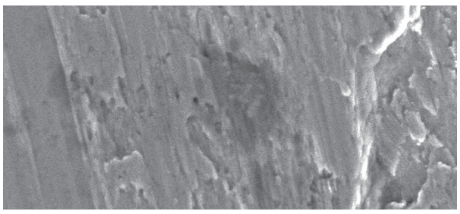
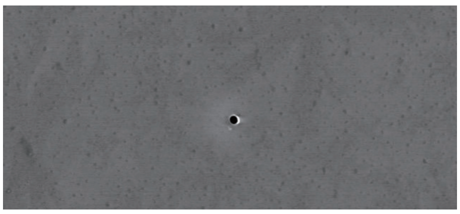
(Customer Requirements)

Measuring instrument : MET ONE

Detection sensitivity : 0.01μm

반도체/디스플레이 고순도 배관재 GRADE 별 분류

항 목	AP (Annealing & Pickling)	MP (Mechanical Polishing)
제조 방법	**산 세정 (酸 洗淨)** 강재 가공이 완료된 후, 산화 열처리로서 응력을 제거하고 이때 발생된 산화 스케일 제거 및 부동태처리를 산 세정으로 마무리하여 제품으로 공급하는 제품	**기계연마 (機械硏磨)** AP 또는 BA 제품을 사포 등을 이용한 기계적 가공을 통해 표면을 매끄럽게 한 제품
내면 조직사진 (SEM)		
표면 조도	Ra = 40~120μinch	Ra = 10~100μinch
Particle 수량	0.3㎛ 10 이하 / CFM	0.1㎛ 5 이하 / CFM
유분 농도	$\le$ 0.1mg/ft^2	$\le$ 0.01mg/ft^2
외관	우유 빛 외관	유광 또는 금속 톤의 무광
반도체 / LCD 용도	CDA · GN2	CDA · GN2 · Pure Bulk–Gas

항 목	BA (Bright Annealing)	EP (Electro Polishing)
제조 방법	**광휘열처리 (光輝熱處理)** 강재 가공이 완료된 후, 광휘열처리로 일반 산화 열처리 시 발생되는 산화 스케일을 발생시키지 않고 응력을 제거하여 산 세정을 실시하지 않는 표면 연마법	**전해연마 (電解硏磨)** 전기화화적 반응을 이용한 연마법으로, 가공물 (BA 또는 MP 제품)을 양극 · 전극을 음극으로 하여 양극 표면에서의 금속용출을 이용해 표면 평활도 · 광택도 · 내식성 등을 향상시키는 연마법
내면 조직사진 (SEM)		
표면 조도	Ra = 10~20μinch / Rmax=5.0㎛	Ra = 5~10μinch / Rmax = 0.7㎛
Particle 수량	0.1㎛ 0 개 / CFM	0.1㎛ 0 개 / CFT
유분 농도	$\le$ 0.01mg/ft^2	$\le$ 0.01mg/ft^2
외관	은은한 은백색의 금속 광택	고 반사도의 경면과 같은 표면
반도체 / LCD 용도	불활성 Gas (Ar · O2 · He)	Special Gas · Chemical Gas

WELDED TUBE VS SEAMLESS TUBE의 비교

Weled Tube & Seamless Tube의 정의

제품 분류	의 미	비 고
Welded Tube	▶ Tube(강관)를 제작하는 방법에 있어, 유니버셜 Roll 또는 홈형 Roll을 이용 강판(띠강)을 성형한후 용접에 의해 만든 이음매 강관을 의미한다.	이음매 강관
Seamless Tube	▶ 강판을 굽혀 이음매를 접합하여 만든 것이 아니고, 강괴에서 Roll을 써서 심봉(Plug등)을 이용하여 중공관을 만든 것으로 이음매가 없는 강관을 의미한다.	이음매 없는 강관

Welded Tube와 Seamless Tube의 장단점

Tube 종류	장 점	단 점
Weled Tube	1. Seamless에 비해 생산성이 매우 좋다. 2. Seamless에 비해 투자 규모가 작다. 3. 공정이 단순하여 Seamless에 비해 공정 Lead Time이 짧다. 4. Seamless에 비해 제조 Cost가 낮다.	1. 용접 이음매 부위의 품질이 Seamless에 비해 그 수준이 낮다. 2. 용접 이음매 부위의 표면조도가 Seamless에 그 수준이 낮다. 3. 용접부 Leak 위험성 때문에 품질 Check 수준이 높다.
Seamless Tube	1. 품질적으로 안정적이다(Welded Tube에 비해). 2. 이음매가 없기 때문에 Leak의 위험성이 적다. 3. 냉간성형으로 인해 전체적으로 매끄러운 표면을 얻을 수 있다.	1. 생산성이 Welded Tube에 비해 현저히 낮다. 2. Welded Tube에 비해 초기 설비 투자규모가 크다 3. 공정이 복잡하여 생산 Lead Time이 길다. 4. Welded에 비해 제조 Cost가 높다.

Welded BA Tube 및 Seamless BA Tube의 품질 수준 비교

보증 항목	단 위	Welded BA Tube	Seamless BA Tube	비 고
표면 상태	–	유 광 (OD Polishing)	유 광 (OD Polishing)	–
Heat Treatment	Furnace	BA(Bright Annealing)	BA(Bright Annealing)	열처리
Leak Test	ASTM A450	Eddy Current (와류탐상)	Eddy Current (와류탐상)	100% Sampling
Roughness	μ"	40 Ra 이하 (Actual 15 ~ 25Ra)	15 Ra 이하 (Actual 10 ~ 15Ra)	단, Welded Tube의 경우 Welded Line은 제외
Cleaning	–	DWC BA Process	DWC BA Process	UPW Process
Particle	EA/CF	0.1μm 초과 Particle 5ea 이하	0.1μm 이상 Particle 5ea 이하	Particle tester
Visual Inpection	–	BA Grade (DWC 한도견본)	BA Grade (DWC 한도견본)	한도견본
Mechanical Properties	–	JIS G 3459 KS D 3576	JIS G 3459 KS D 3576	인장, 항복, 연신율 경도, 편평시험 등
화학성분 및 Dimension外	–	JIS G 3459 KS D 3576	JIS G 3459 KS D 3576	화학성분 외경 및 두께 등

Welded Tube와 Seamless Tube의 품질적 차이점은 Inner Surface의 Roughness차이다. 즉, Seamless의 경우 반복 되는 Cold Drawing에 이해 조도개선이 가능하지만, Welded BA Tube의 경우 용접 조관 후 냉간 Skin Pass로 성형이 마무리되기 때문에 상대적으로 많은 조도개선이 이루어지지 않는다. 특히, Welded line의 경우 용접 조관 상태 그대로 유지되기 때문에 조도 보증이 불가능하다. 다만, 냉간 Skin Pass로 인해 Bead 높이는 Control이 가능하다. 그 외에 Cleaning 및 화학성분, Mechanical Properties, 표면상태, Visual 등은 Seamless와 동일한 수준으로 품질 보증이 가능하다.

Welded Tube의 단점이라 할 수 있는 이음매 부분의 Leak 우려는 100% sampling Eddy Current Test를 진행하므로써 품질 보증이 가능하다.

CERTIFICATE

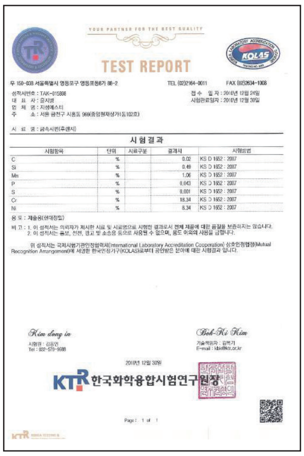
등록증 / 인증서


Certificate
of Registration
This is to certify that :
DONG WON HITECH CO., LTD.
ISO 9001:2008
Certificate No. : QS21112
President

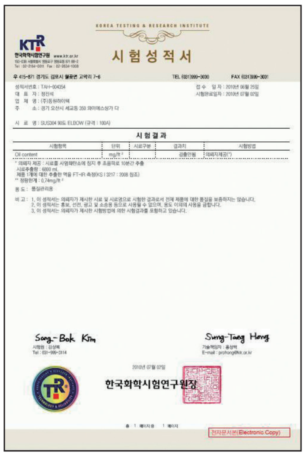
• 품질 경영 시스템 인증서
(ISO 9001 : 2008)


제 2017112363 호
기업부설연구소 인정서
1. 연 구 소 명: (주)동원하이텍 기업부설연구소
[소속기업명: (주)동원하이텍]
3. 신고 연월일: 2017년 04월 28일
미래창조과학부
「기초연구진흥 및 기술개발지원에 관한 법률」 제14조의2제1항 및 같은 법 시행령 제27조제1항에 따라 위와 같이 기업부설연구소로 인정합니다.
2017년 5월 10일
한국산업기술진흥협회장

• 기업부설연구소 인증서

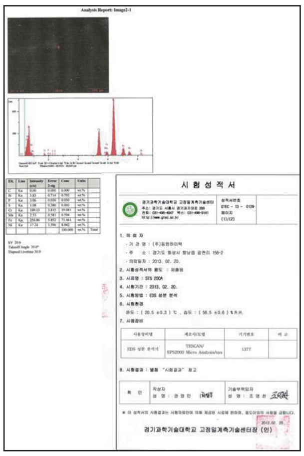

TEST REPORT
시 험 결 과
KTR 한국화학융합시험연구원장

• 재질 분석 결과 인증서


시 험 성 적 서
시 험 결 과
한국화학시험연구원장

• Oil 성분 분석 인증서
(STS304 Pittings)

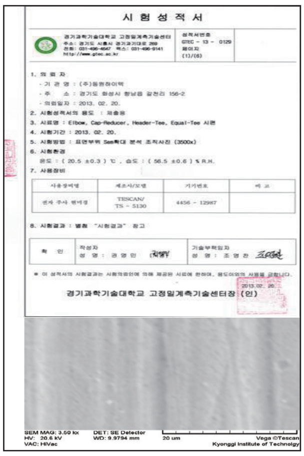
시험 인증서


시 험 성 적 서
경기과학기술대학교 고정밀계측기술센터장 (인)

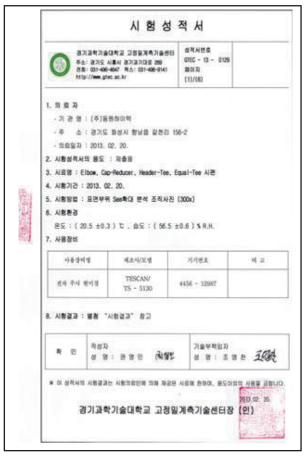
• 성분 함유량 분석 인증서


TEST REPORT
시 험 결 과
KTR 한국화학융합시험연구원장

• 기계적 시험 결과 분석 인증서


시 험 성 적 서
경기과학기술대학교 고정밀계측기술센터장 (인)

• 표면 결점 결과 분석 인증서


시 험 성 적 서
경기과학기술대학교 고정밀계측기술센터장 (인)

• 표면 연마 수준 분석 인증서

PRODUCTS SELECTION GUIDE

UHP Tube & Pipe

Diaphragm Valve

Bellows Valve

Weld & VCR Fitting

Bend Fitting

Cylinder Connector

Casting Bellows Valve

UHP Regulator

Welded Check Valve

Tube Fitting

PTFE Tube & Fitting

Ultra High Purity Gas Filter

Dong Won Hi-Tech

Dong Won Hi-Tech, Co., Ltd

#57, Galcheon-gil, Hyangnam-eup, Hwaseong-si,
Gyeonggi-do, 18625, Republic of Korea
TEL : +82-31-378-9850 FAX : +82-31-378-9851
E-mail : dwkimjs@hanmail.net
www.dw-hitech.co.kr

NAVER 동원하이텍 검색