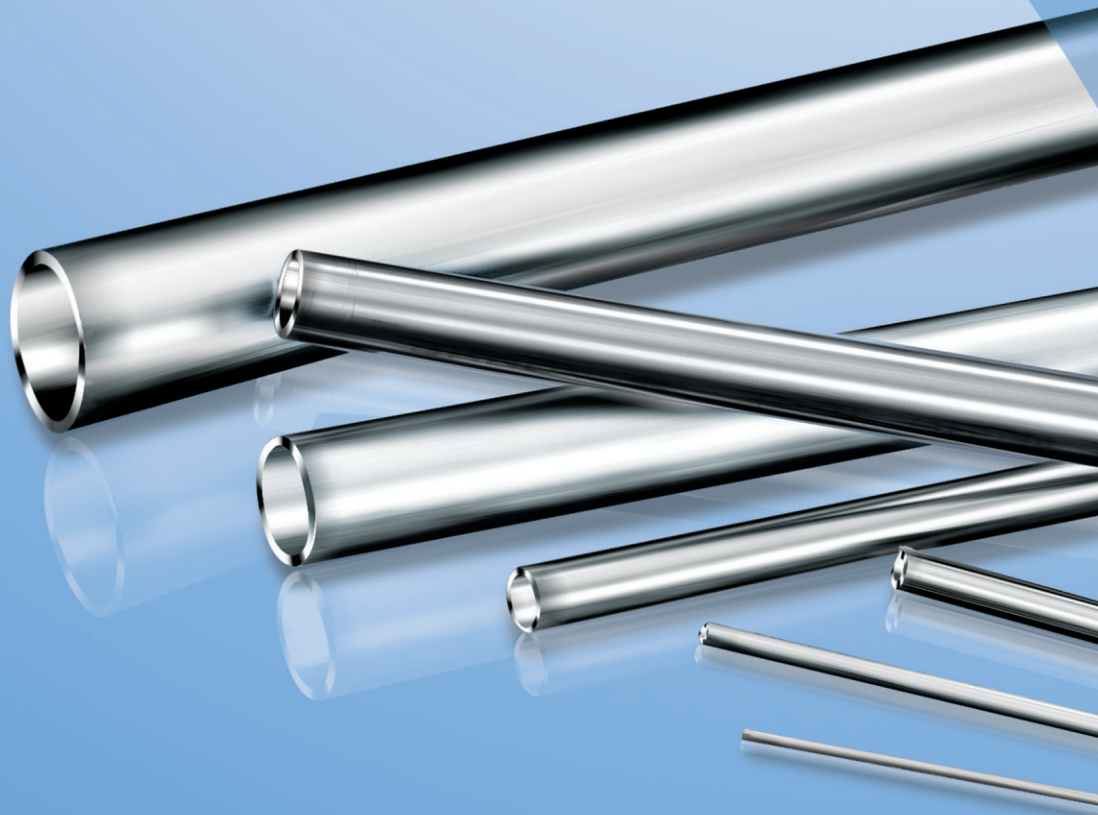


Stainless Steel Seamless Tubes AP/BA/EP



Fine Stainless Steel Seamless AP Tubes

for Instrumentation & High Tech Application

Features (특징)

- Made of high quality raw materials
- Strict control of tolerances in outside diameter as well as wall thickness in accordance with ASTM A269
- Extra fine surface in both outside and inside
- Excellent internal roughness according to state of the art technology
- Fully bright annealed for outstanding corrosion resistance
- Exact hardness for proper tubing
- 고품질의 스테인레스 스틸을 모재로 사용
- ASTM A269에 따른 외경 및 두께의 허용공차에 대한 철저한 관리
- 최신 생산기술 및 철저한 관리에 따른 튜브 내외면의 뛰어난 조도
- Bright Annealed 방식에 의한 뛰어난 내압성
- 배관작업에 용이한 경도

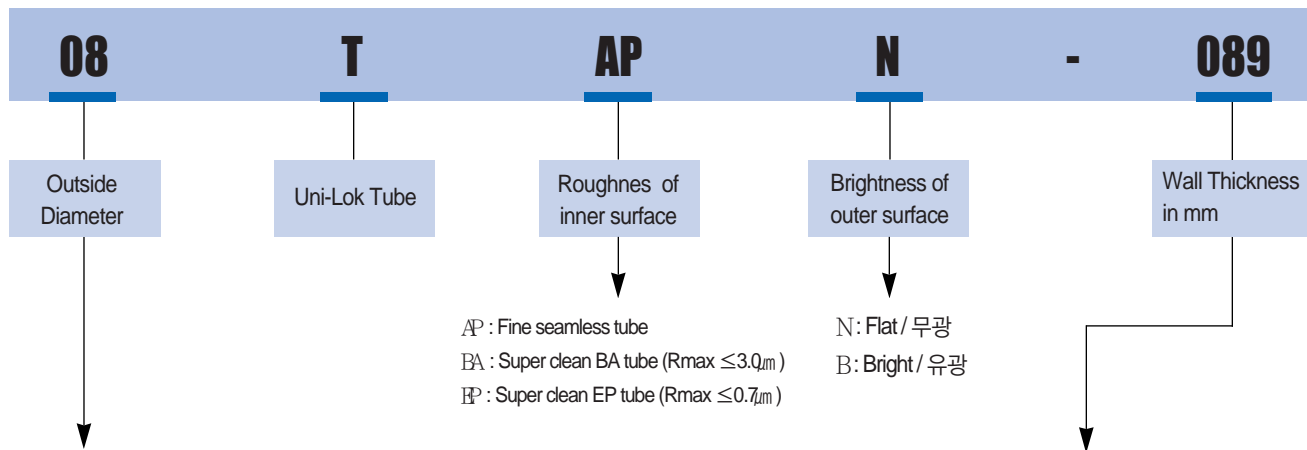
Materials

- ASTM A213/A269 TP316/TP316L

How to Order

- Uni-Lok Tubes are ordered by part number a shown index.

• Nomenclature for Tubes



Tube O.D Designation

| Tube O.D | Inch | 1/8 | 3/16 | 1/4 | 5/16 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1 |
|--------------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| | mm | 3.17 | 4.76 | 6.35 | 7.93 | 9.52 | 12.70 | 15.87 | 19.05 | 22.22 | 25.40 |
| Designation | | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.8 | 10 | 12 | 14 | 16 |
| Tube O.D(mm) | M6 | M8 | M10 | M12 | M15 | M16 | M18 | M20 | M22 | M25 | |
| Designation | M06 | M08 | M10 | M12 | M15 | M16 | M18 | M20 | M22 | M25 | |

Wall Thickness Designation

| Designation | 089 | 124 | 165 | 211 |
|-------------|-------|-------|-------|-------|
| mm | 0.89 | 1.24 | 1.65 | 2.11 |
| inch | 0.035 | 0.049 | 0.065 | 0.085 |
| Designation | 100 | 150 | 200 | 250 |
| mm | 1.00 | 1.15 | 2.00 | 2.50 |

■ Note : Brightness of outer surface is adopted for AP tubes only. In case of BA/EP tubes are ultra precision bright surface.

(튜브외경 광택의 선택은 AP 튜브에만 적용되며, BA/EP튜브의 경우는 유광으로 공급됩니다.)

Standard Specification/AP Tubes

Fractional(Inch) Size

| Part No. | Outside Diameter | | Wall Thickness | | Weight Kg/m | Working Pressure(bar) / Temperature(°c) | | | | |
|----------------|------------------|-------|----------------|------|----------------|---|--------|--------|--------|--------|
| | inch | mm | Inch | mm | | @20°c | @100°c | @200°c | @300°c | @400°c |
| 02TAPN -071-SS | 1/8 | 3,18 | 0,028 | 0,71 | 0,059 | | | | | |
| 04TAPN -089-SS | 1/4 | 6,35 | 0,035 | 0,89 | 0,122 | 309 | 242 | 203 | 182 | 167 |
| 04TAPN -124-SS | 1/4 | 6,35 | 0,049 | 1,24 | 0,159 | 496 | 389 | 326 | 292 | 269 |
| 06TAPN -089-SS | 3/8 | 9,53 | 0,035 | 0,89 | 0,193 | 198 | 155 | 130 | 117 | 107 |
| 06TAPN -124-SS | 3/8 | 9,53 | 0,049 | 1,24 | 0,257 | 310 | 243 | 204 | 183 | 168 |
| 08TAPN -089-SS | 1/2 | 12,70 | 0,035 | 0,89 | 0,263 | 146 | 114 | 96 | 86 | 79 |
| 08TAPN -124-SS | 1/2 | 12,70 | 0,049 | 1,24 | 0,356 | 226 | 177 | 149 | 133 | 122 |
| 08TAPN -165-SS | 1/2 | 12,70 | 0,065 | 1,65 | 0,456 | 327 | 256 | 215 | 192 | 177 |
| 10TAPN -124-SS | 5/8 | 15,88 | 0,049 | 1,24 | 0,454 | 178 | 139 | 117 | 105 | 96 |
| 12TAPN -124-SS | 3/4 | 19,05 | 0,049 | 1,24 | 0,553 | 146 | 115 | 96 | 86 | 79 |
| 12TAPN -165-SS | 3/4 | 19,05 | 0,065 | 1,65 | 0,720 | 209 | 164 | 137 | 123 | 113 |
| 16TAPN -165-SS | 1 | 25,40 | 0,065 | 1,65 | 0,982 | 153 | 120 | 101 | 90 | 83 |
| 16TAPN -211-SS | 1 | 25,40 | 0,085 | 2,11 | 1,232 | 205 | 161 | 135 | 121 | 111 |

• In case of flat surface, add B of N (유광의 경우, N대신 B표기)

Metric Size

| Part No | Outside Diameter | Wall Thickness | Weight | Working Pressure(bar)/Temperature(°c) | | | | |
|----------------|------------------|----------------|--------|---------------------------------------|--------|--------|--------|--------|
| | mm | mm | Kg/m | @20°c | @100°c | @200°c | @300°c | @400°c |
| M06TAPB-100-SS | 6 | 1,0 | 0,125 | 390 | 306 | 256 | 230 | 211 |
| M08TAPB-100-SS | 8 | 1,0 | 0,175 | 281 | 221 | 185 | 166 | 153 |
| M10TAPB-100-SS | 10 | 1,0 | 0,225 | 220 | 173 | 145 | 130 | 119 |
| M12TAPB-100-SS | 12 | 1,0 | 0,275 | 181 | 142 | 119 | 107 | 98 |
| M12TAPB-150-SS | 12 | 1,5 | 0,394 | 308 | 241 | 202 | 181 | 167 |
| M15TAPB-150-SS | 15 | 1,5 | 0,507 | 240 | 189 | 158 | 142 | 130 |
| M16TAPB-150-SS | 16 | 1,5 | 0,544 | 224 | 176 | 147 | 132 | 121 |
| M18TAPB-150-SS | 18 | 1,5 | 0,619 | 197 | 155 | 130 | 116 | 107 |
| M20TAPB-200-SS | 20 | 2,0 | 0,901 | 251 | 196 | 165 | 148 | 136 |
| M22TAPB-200-SS | 22 | 2,0 | 1,000 | 226 | 177 | 149 | 133 | 122 |
| M25TAPB-200-SS | 25 | 2,0 | 1,150 | 197 | 154 | 129 | 116 | 107 |
| M25TAPB-250-SS | 25 | 2,5 | 1,410 | 251 | 196 | 165 | 148 | 136 |

• In case of flat surface, add N of B (유광의 경우, B대신 N표기)

• Basic length per unit is 6 meter. Other Size Tubes / Roll Tubes / Welded Tubes are also available upon request.
(한본당 길이는 6미터 입니다. 상기에 기재되어 있지 않은 규격의 튜브, 롤튜브, 용접형튜브도 공급 가능합니다.)

※ Note : Above information shown in above table are theoretical and reference only.
(상기 정보는 이론적인 데이터이며, 참조용입니다.)

Super Clean & Ultra Precision Seamless BA/EP Tubes for Semiconductor & Display



In advanced technology areas such as semiconductor equipment and ultra high vacuum equipment, high quality and a high degree of cleanliness are extremely important requirements for the parts of manufacturing equipment.

SUPER CLEAN SEAMLESS EP TUBES are manufactured using "PRIMET", a material in which the impurities have been reduced to the absolute minimum and nonmetallic inclusions and gas components have been reduced to the minimum possible.

This tube meets the requirements for ultra high purity gas supply lines such as internal smoothness, cleanliness, improved corrosion

resistance and reduced gas and particle emission from the metal. Thus, the tubes make a major contribution to improving performance of the semiconductor manufacturing equipment process.

최신의 생산 기술 및 최상의 품질이 요구되는 반도체 및 디스플레이 산업에서는 제조 설비 및 장비에 사용되는 부품에 대한 완벽한 진공 및 청정도가 가장 중요한 요소로 인식되고 있습니다. uni-primet® EP Tube는 가스 및 비금속성 성분의 유입을 방지하기 위해 일본 다이토사의 VIM/VAR로 생산되어 내면 조도 및 청정도, 튜브의 가스 및 입자의 방출을 최소화하여 고순도 가스가 사용되는 반도체 및 디스플레이 생산 설비 및 장비의 성능에 최적의 조건을 제공합니다.

Guaranteed Levels of Chemical Components in (uni-primet® 소재의 화학조성)

| Chemical Components : Wt% | C | Si | Mn | P | S | Cu | Ni | Cr | Mo | Al | N* | O* | H* |
|---|---------|---------|--------|---------|---------|--------|---------------|---------------|-------------|---------|-------|------|-------|
| PRIMET Guaranteed Levels in Manufacturing Stage | ≤ 0,010 | ≤ 0,30 | ≤ 0,40 | ≤ 0,030 | ≤ 0,030 | ≤ 0,25 | 14,50 ~ 15,00 | 16,50 ~ 17,00 | 2,20 ~ 3,00 | ≤ 0,010 | ≤ 150 | ≤ 15 | ≤ 2,0 |
| PRIMET Actual Levels in Manufactured Product | 0,005 | 0,05 | 0,25 | 0,020 | 0,001 | 0,17 | 14,57 | 16,91 | 2,23 | <0,002 | 64 | 5 | 1,3 |
| PRIMET - VIM/VAR Guaranteed Levels in Manufacturing Stage | ≤ 0,010 | ≤ 0,020 | ≤ 0,05 | ≤ 0,020 | ≤ 0,002 | ≤ 0,25 | 14,50 ~ 15,00 | 16,50 ~ 17,00 | 2,20 ~ 2,50 | ≤ 0,010 | ≤ 150 | ≤ 15 | ≤ 2,0 |
| Japanese Standard JIS G3459 SUS316LTP | ≤ 0,030 | ≤ 1,00 | ≤ 2,00 | ≤ 0,040 | ≤ 0,030 | — | 12,00 ~ 15,00 | 16,00 ~ 18,00 | 2,00 ~ 3,00 | — | — | — | — |
| USA Standard ASTM A269 TP216L | ≤ 0,035 | ≤ 0,75 | ≤ 2,00 | ≤ 0,040 | ≤ 0,030 | — | 10,00 ~ 15,00 | 16,00 ~ 18,00 | 2,00 ~ 3,00 | — | — | — | — |

Comparison of Cleanliness of uni-primet® Tube and General AP Tube

(uni-primet® EP Tube와 일반 AP Tube의 청정도 비교)

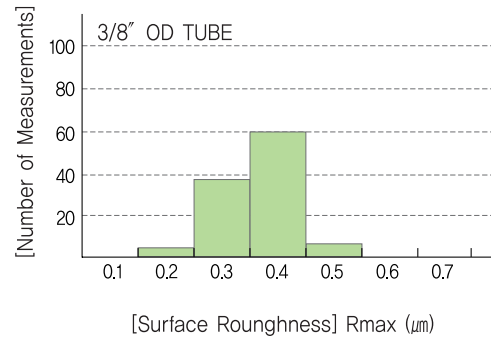
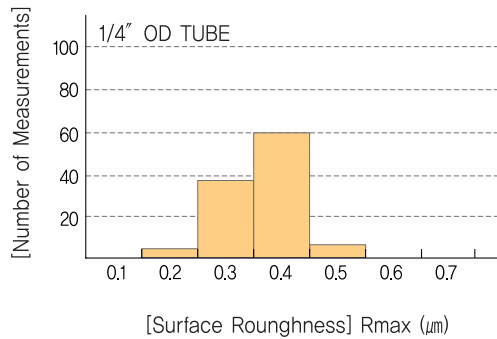
| Measurement Method Type of Steel | JIS Method (TOTAL) | | | | ASTM Method | | | | |
|-------------------------------------|--------------------|------|------|------|-------------|-----|-----|-----|-----|
| | 0,02 | 0,04 | 0,06 | 0,08 | 0,5 | 1,0 | 1,5 | 2,0 | 2,5 |
| PRIMET | █ | | | | █ | | | | |
| JIS 316L | █ | █ | █ | | █ | █ | █ | █ | █ |

Guaranteed Level of Internal Roughness (uni-primet® 의 내면조도)

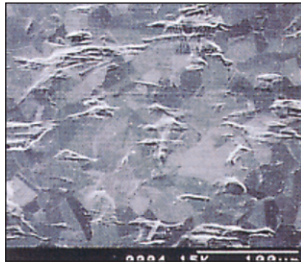
External 3.18mm ≤ OD ≤ 12.70 : ≤ Rmax 0.5μm Ave.

Diameter 12.70mm < OD ≤ 25.40 : ≤ Rmax 0.7μm Ave.

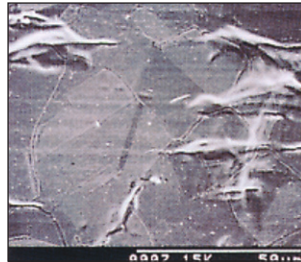
Internal Roughness Statistics (내면 조도)



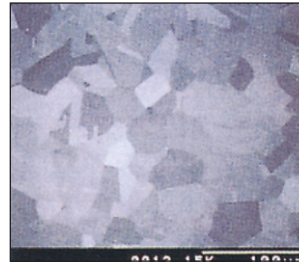
Electro-Polishing (BA와 EP 튜브 비교)



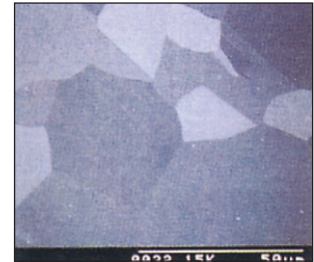
BA Tube Surface x300



BA Tube Surface x1000

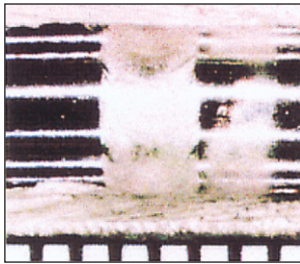


EP Tube x300

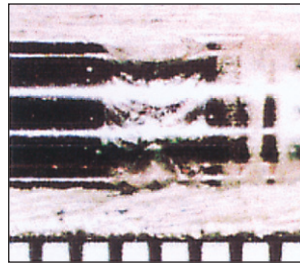


EP Tube x1000

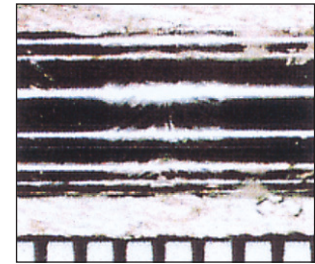
Weldability (uni-primet® 소재와 일반 316L의 용접성 비교)



Std.316L (1.6%Mn)



uni-primet® (0.3%Mn)



uni-primet®-VIM/VAR (0.05%Mn)

Quality Assurance System (uni-primet® 품질관리체계)

• uni-primet® Tubes are subjected to the quality tests listed below. (uni-primet® Tube는 다음의 품질 보증 시스템에 의하여 생산됩니다.)

1. First Material Tests

- Analysis of Chemical Constituents
- Analysis of Nonmetallic Inclusions
- Mechanical Property Test
- Ultrasonic Flow Detection Examination
- Inspection of Appearance and Dimensions

2. Second Material Tests

- Internal Quality Test
- Permeability Test
- Hardness Test

3. First and Second Product Test

- Internal Roughness Measurement Tests
- Inspection of Appearance and Dimensions

4. Third Product Tests

- Internal Roughness Measurement Test
- Inspection of Appearance and Dimensions
- Moisture Measurement Test
- Oiliness Measurement Test

5. Fourth Product Tests

- The following tests are implemented at the request of customers
- ESCA : Electron Spectroscopy for Chemical Analysis.
 - AES : Auger Electron Spectroscopy
 - Corrosion Test
 - Internal Surface Pitting Measurement
 - Elusion Ion Measurement
 - Micro/Macro Tests
 - Particle Measurement Test

Standard Specification/BA Tubes

| Part No. | Outside Diameter | Wall Thickness | Tolerance | | Roughness |
|-----------|------------------|----------------|----------------|------|---------------------------------------|
| | mm(inch) | mm | O.D.(mm/inch) | W.T. | |
| 04TBA-100 | 6.35 (1/4) | 1.00 | ±0.07 / ±0.003 | ±10% | Rmax 3.0 _{μm} (Ra 12'') |
| 06TBA-100 | 9.53 (3/8) | 1.00 | | | |
| 08TBA-100 | 12.70 (1/2) | 1.00 | ±0.10 / ±0.004 | | |
| 08TBA-124 | 12.70 (1/2) | 1.24 | | | |
| 10TBA-124 | 15.88 (5/8) | 1.24 | | | |
| 12TBA-124 | 19.05 (3/4) | 1.24 | ±0.12 / ±0.005 | | Rmax 4.0 _{μm} (Ra 16'') |
| 12TBA-165 | 19.05 (3/4) | 1.65 | | | |
| 16TBA-165 | 25.40 (1) | 1.65 | | | |

- Basic length per unit is 4 meter. Other Size Tubes are also available upon request.
(한본당 길이는 4미터 입니다. 상기표에 기재되어 있지 않은 규격의 튜브도 공급 가능합니다.)

Standard Specification/uni-primet® EP Tubes

| Part No. | Outside Diameter/Wall Thickness | | Wall Thickness | | Length | | Roundness |
|-----------|---------------------------------|----------------|----------------|-----------|--------|----------------|-----------|
| | mm (inch) | Tolerance | Mm | Tolerance | mm | Tolerance | |
| 02TEP-071 | 3.18 (1/8) | +0.05 -0.00 | 0.71 | ±0.05 | 2,000 | +0.05 -0.00 | 1/1000 |
| 04TEP-100 | 6.35 (1/4) | | 1.00 | ±0.05 | 4,000 | | |
| 06TEP-100 | 9.53 (3/8) | +0.06 -0.00 | 1.00 | ±0.05 | 4,000 | | |
| 08TEP-100 | 12.70 (1/2) | +0.07 -0.00 | 1.00 | ±0.05 | 4,000 | | |
| 08TEP-124 | 12.70 (1/2) | | 1.24 | ±0.05 | 4,000 | | |
| 12TEP-124 | 19.05 (3/4) | +0.09 -0.00 | 1.24 | ±10% | 4,000 | | |
| 12TEP-165 | 19.05 (3/4) | | 1.65 | ±10% | 4,000 | | |
| 16TEP-165 | 25.40 (1) | ±0.10 | 1.65 | ±10% | 4,000 | | |

- Basic length per unit is 4 meter. Other Size Tubes are also available upon request.
(한본당 길이는 4미터 입니다. 상기표에 기재되어 있지 않은 규격의 튜브도 공급 가능합니다.)

※ Note : Above information shown in above table are theoretical and reference only.
(상기 정보는 이론적인 데이터이며, 참조용입니다.)

Technical Information

Comparison of Chemical Composition

| Code | Standard | | CHEMICAL COMPOSITION | | | | | | | | |
|------|----------|---------------------------|----------------------|---------------------|---------------------|----------------------|----------------------|-------------|-------------|-----------|-------|
| | | | C | Si | Mn | P | S | Ni | Cr | Mo | OTHER |
| 304 | JIS | SUS 304 | 0,080 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 8,00-11,00 | 18,00-20,00 | - | - |
| | AISI | 304 | 0,080 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 8,00-10,50 | 18,00-20,00 | - | - |
| | ASTM | TP 304 | 0,080 ^{max} | 0,75 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 8,00-11,00 | 18,00-20,00 | - | - |
| | DIN | X5CrNi189 Nr,1,4301 | 0,070 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 8,50-10,00 | 17,00-20,00 | * | - |
| 304L | JIS | SUS 304L | 0,030 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 9,00-13,00 | 18,00-20,00 | - | - |
| | AISI | 304L | 0,030 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 8,00-12,00 | 18,00-20,00 | - | - |
| | ASTM | TP 304L | 0,035 ^{max} | 0,75 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 8,00-13,00 | 18,00-20,00 | - | - |
| | DIN | X2CrNi189 Nr,1,4306 | 0,030 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 10,00-12,50 | 17,00-20,00 | * | - |
| 316 | JIS | SUS 316 | 0,080 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 10,00-14,00 | 16,00-18,00 | 2,00-3,00 | - |
| | AISI | 316 | 0,080 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 10,00-14,00 | 16,00-18,00 | 2,00-3,00 | - |
| | ASTM | TP 316 | 0,080 ^{max} | 0,75 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 11,00-14,00 | 16,00-18,00 | 2,00-3,00 | - |
| | DIN | X5CrNiMo1810 Nr,1,4301 | 0,070 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 10,50-13,50 | 16,50-18,50 | 2,00-2,50 | - |
| 316L | JIS | SUS 316L | 0,030 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 12,00-16,00 | 16,00-18,00 | 2,00-3,00 | - |
| | AISI | 316L | 0,030 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 10,00-14,00 | 16,00-18,00 | 2,00-3,00 | - |
| | ASTM | TP 316L | 0,035 ^{max} | 0,75 ^{max} | 2,00 ^{max} | 0,040 ^{max} | 0,030 ^{max} | 10,00-15,00 | 16,00-18,00 | 2,00-3,00 | - |
| | DIN | X2CrNiMo1810 Nr,1,4404 | 0,030 ^{max} | 1,00 ^{max} | 2,00 ^{max} | 0,045 ^{max} | 0,030 ^{max} | 11,00-14,00 | 16,50-18,50 | 2,00-2,50 | - |

Proper Selection of Tubes / Tube의 올바른 선택

1. Use the guaranteed tubes for proper tubing and complete sealing performance as the surface and the tolerance of outside diameter of tubes are very important factors.
2. The materials of tubes are more soft than the tubes.
3. When the material of tubes is the same as tube fittings, the heat treated tubes shall be used.
4. Uni-lok Insert (UI) shall be used together with PVC, PTFE, PFA tubes for the sealing.

1. Tube의 표면처리 상태 및 외경 크기는 Tube Fitting의 올바른 체결 및 배관의 밀폐에 대단히 중요한 요소이므로 반드시 검증된 Tube를 사용하여야 합니다.
2. Tube는 Tube Fitting의 재질보다 연질이어야 합니다.
3. Tube와 Tube Fitting이 동일 재질인 경우 Tube는 열처리 된 것을 사용하여야 합니다.
4. PVC, PTFE, PFA Tube와 Tube Fitting 체결시 배관의 밀폐를 위하여 반드시 Insert를 사용하여야 합니다.

Benefits for using Tubes than Pipes / Tube의 장점

1. Using Tubes is easier than Pipes in assembling and dissembling.
2. Using Tubes is economical and time saved than Pipes as tubes are lighter and easy to bend
3. Using Tubes is providing the complete sealing performance than piping as the ferrules and nuts are guaranteed the complete tightening.

1. Tube는 Pipe보다 체결 및 분리가 훨씬 용이합니다.
2. Tube는 Pipe보다 가볍고 절곡등이 쉬워 취급 및 배관작업이 용이함으로 시간이나 비용면에서 경제적입니다.
3. Tube Fitting의 Ferrule 및 Nut의 작용에 의한 밀폐성이 뛰어나며 절곡이 용이하여 체결부위가 적어 Tube는 Pipe보다 누설위험이 적습니다.



유니온금속공업(주)
UNION METAL INDUSTRIAL CO.,LTD.

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