

# High Purity Tubing

TEP and PEP Series



**FITOK**

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# High Purity Tubing

## TEP and PEP Series

### Introduction

FITOK EP tubing is suitable for high purity and ultra high purity fluid systems such as in the semiconductor industry. FITOK adopts strict specifications for materials, machining and electropolishing processes, etc., as well as eliminates undesired contaminant residues through high standard cleaning and packaging process to meet high cleanliness and high performance requirements of valves, fittings and tubing in the semiconductor manufacturing industry.

### Features

- ⦿ Materials: 316L, 316L VAR, 316L VIM-VAR
- ⦿ Standards: ASTM A269, A632, A312 or JIS G3459
- ⦿ Sizes: TEP series ASTM A269/A632: 1/4"-2 1/2"  
PEP series JIS G3459: 6A-50A  
PEP series ASTM A312: NPS 1/8"-NPS 2
- ⦿ Process: internal surface electropolished to roughness of  $Ra \leq 10 \mu\text{in}$  ( $0.25 \mu\text{m}$ ),  
 $Ra \leq 7 \mu\text{in}$  ( $0.18 \mu\text{m}$ ),  $Ra \leq 5 \mu\text{in}$  ( $0.13 \mu\text{m}$ ); external surface roughness of  
 $Ra \leq 40 \mu\text{in}$  ( $1 \mu\text{m}$ )
- ⦿ Inspection: visual inspection, surface roughness measurement, particle testing, moisture testing, scanning electron microscopy (SEM), Auger electron spectroscopy (AES), electron spectroscopy for chemical analysis (ESCA or XPS)
- ⦿ Cleaning: ultrasonically cleaned, washed, rinsed, and purged and dried with high purity hot nitrogen in ISO Class 6 cleanroom
- ⦿ Packaging: packaged in ISO Class 4 cleanroom, cleaned with ultra high pressure nitrogen, tubing ends are capped and tubing is packed in double polyethylene bags with inner bag filled with 99.999% nitrogen
- ⦿ Marking: packing bags are marked with brand, material grade, specification and heat number
- ⦿ Standard length: 20 ft, 4 m and 6 m



### Materials

Grade	Standard	FITOK Designator	Composition %							
			C	Mn	P	S	Si	Ni	Cr	Mo
316L	ASTM	6L	$\leq 0.035$ <sup>①</sup>	$\leq 2.00$	$\leq 0.045$	$\leq 0.03$	$\leq 1.00$	10.0-15.0	16.0-18.0	2.0-3.0
	JIS G3459		12.0-16.0							
316L VAR	ASTM	6LV	$\leq 0.03$	$\leq 1.50$	$\leq 0.045$	$\leq 0.01$		10.0-15.0		
316L VIM-VAR		6LW								

① The carbon content of tubing with outside diameter smaller than 1/2" or wall thickness smaller than 0.049" is allowed up to 0.04%.

## Surface Roughness

Tube O.D. (D) mm	External Surface $\mu\text{in. } (\mu\text{m})$	Internal Surface $\mu\text{in. } (\mu\text{m})$		
	TEP/PEP	TEP/PEP		
		A	B	C
$6.35 \leq D \leq 48.6$	$Ra \leq 40 (1.0)$	$Ra \leq 5 (0.13)$	$Ra \leq 7 (0.18)$	$Ra \leq 10 (0.25)$
$48.6 < D \leq 63.5$				

## Tubing

### Dimensional Tolerance and Scope of Supply

ASTM A269/A632 Compliant TEP Series							
Tube O.D.	Wall Thickness	O.D. Tolerance	Wall Thickness Tolerance	Tubing Length		Process	
in.	in.	in. (mm)	%	m	ft	Seamless	Seam
1/4	0.035	$\pm 0.004 (0.10)$	$\pm 10$	4 or 6	20	✓	✓
	0.039						
3/8	0.035						
	0.039						
	0.049						
1/2	0.035						
	0.039						
	0.049						
3/4	0.049						
	0.065						
1	0.049						
	0.065						
1 1/2	0.065	$\pm 0.008 (0.20)$	$\pm 10$	4 or 6	20	✓	✓
2	0.065	$\pm 0.010 (0.25)$					
2 1/2	0.065						

## 03 High Purity Tubing

### Working Pressure at Ambient Temperature

For seamless tubing, working pressures are calculated from an S value of 20,000 psi (137,800 kPa) at -20 °F to 100 °F (-28°C to 37°C) for ASME B31.3.

For welded tubing, multiply the pressure rating by the quality factor to achieve weld integrity;

For single butt weld tubing, multiply the pressure rating by 0.8.

ASTM A269/A632 Compliant TEP Series				
Tube O.D.	Wall Thickness in.			
	0.035	0.039	0.049	0.065
	Working Pressure psig			
1/4	5100	5700	-	-
3/8	3300	3700	4800	-
1/2	2600	3000	3700	-
3/4	-	-	2400	3300
1	-	-	1800	2400
1 1/2	-	-	-	1600
2	-	-	-	1200
2 1/2	-	-	-	950

### Elevated Temperature Factors

Temperature		Factor
°F	°C	316L
200	93	1.00
400	204	0.96
600	315	0.85
800	426	0.79
1000	537	0.76

Example:

1/2 in. O.D. × 0.035 in. wall thickness EP tubing at 600 °F (315 °C):

1. Working pressure is 2600 psig at -20 °F to 100 °F (-28 °C to 37 °C);

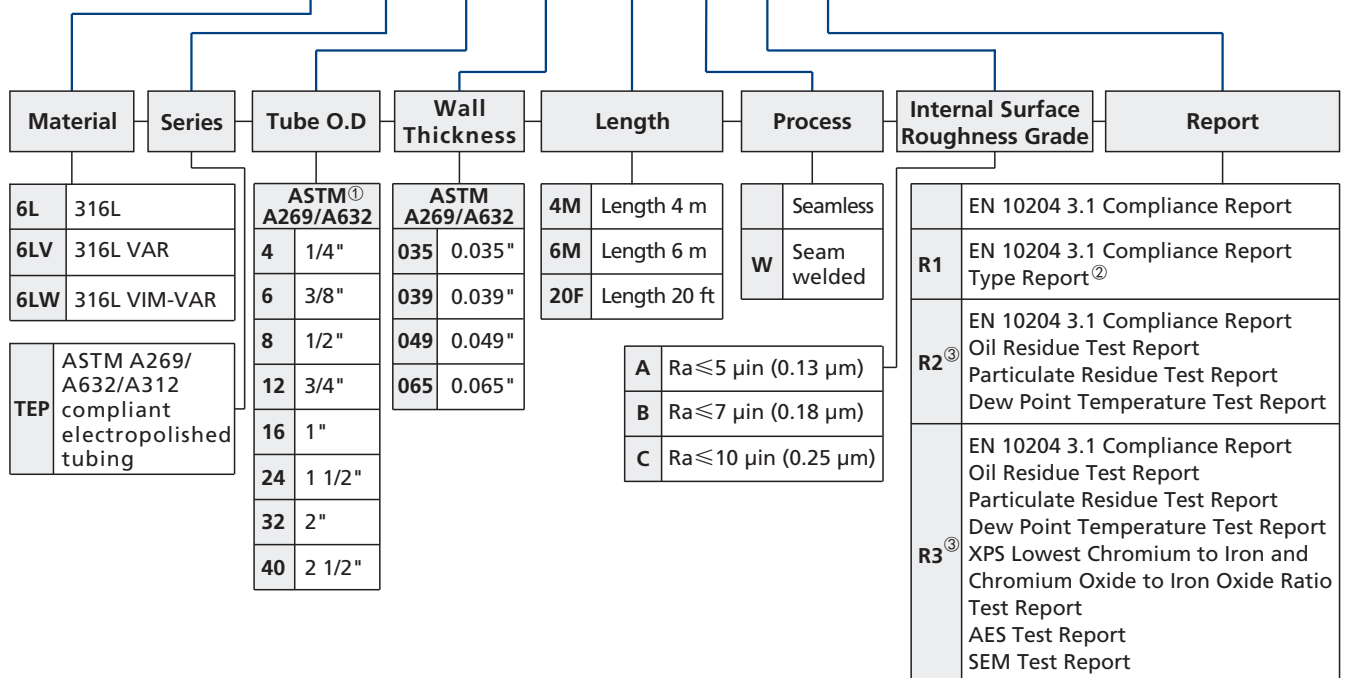
2. Elevated temperature factor is 0.85 at 600 °F (315 °C);

$2600 \text{ psig} \times 0.85 = 2210 \text{ psig}$

conclude the working pressure of 1/2 in. O.D. × 0.035 in. wall thickness EP tubing at 600 °F (315 °C) is 2210 psig.

Ordering Number Description

6L - TEP - 32 - 065 - 6M - W - A - R1



① To order metric sizes, please contact FITOK Group.

② Sampling test report of purity value and electropolishing characteristic required by FITOK Group.

③ Provide listed reports according to order lot.

## Pipes

## Dimensional Tolerance and Scope of Supply

JIS G3459 Compliant PEP Series									
Nominal O.D.	Pipe O.D.	Nominal Wall Thickness		O.D. Tolerance	Wall Thickness Tolerance	Pipe Length		Process	
		SCH5S	SCH10S			in. (mm)	%	m	ft
A Size	mm	Wall Thickness, mm		in. (mm)	%	m	ft	Seamless	Seam
6A	10.5	1.0	1.2	+/-0.004 (0.10)	+/-10	4 or 6	-	√	√
8A	13.8	1.2	1.65						
10A	17.3	1.2	1.65						
15A	21.7	1.65	2.1						
20A	27.2	1.65	2.1						
25A	34.0	1.65	2.8						
32A	42.7	1.65	2.8	+/-0.012 (0.30)					
40A	48.6	1.65	2.8						
50A	60.5	1.65	2.8	+/-0.020 (0.50)					

ASTM A312 Compliant PEP Series													
Nominal O.D.	Pipe O.D.	Nominal Wall Thickness		Nominal Wall Thickness		O.D. Tolerance	Wall Thickness Tolerance	Pipe Length		Process			
		B36.19M		B36.10M				in. (mm)	%	m	ft	Seamless	Seam
		SCH5S	SCH10S	SCH5	SCH10								
NPS	mm	Wall Thickness, mm		Wall Thickness, mm		in. (mm)	%	m	ft	Seamless	Seam		
1/8	10.3	-	1.24	-	1.24	+0.016 (0.40)/ -0.031 (0.80)	+20/ -12.5	4 or 6	20	√	√		
1/4	13.7	-	1.65	-	1.65								
3/8	17.1	-	1.65	-	1.65								
1/2	21.3	1.65	2.11	1.65	2.11								
3/4	26.7	1.65	2.11	1.65	2.11								
1	33.4	1.65	2.77	1.65	2.77								
1 1/4	42.2	1.65	2.77	1.65	2.77								
1 1/2	48.3	1.65	2.77	1.65	2.77	+/-0.031 (0.80)							
2	60.3	1.65	2.77	1.65	2.77								

## Working Pressure at Ambient Temperature

For seamless pipes, working pressures are calculated from an S value of 20,000 psi (137,800 kPa) at -20 °F to 100 °F (-28 °C to 37 °C) for ASME B31.3.

For welded pipes, multiply the pressure rating by the quality factor to achieve weld integrity;

For single butt weld pipes, multiply the pressure rating by 0.8.

JIS G3459 Compliant PEP Series			
Pipe O.D. A size	Pipe O.D. mm	Wall Thickness	
		SCH5S	SCH10S
		Working Pressure psig	
6A	10.5	3300	4000
8A	13.8	3000	4300
10A	17.3	2400	3300
15A	21.7	2600	3400
20A	27.2	2100	2700
25A	34.0	1600	2900
32A	42.7	1300	2200
40A	48.6	1100	2000
50A	60.5	910	1600

ASTM A312 Compliant PEP Series				
Pipe O.D. in.	Wall Thickness			
	B36.19M		B36.10M	
	SCH5S	SCH10S	SCH5	SCH10
	Working Pressure psig			
1/8	-	4600	-	4600
1/4	-	4600	-	4600
3/8	-	3600	-	3600
1/2	2800	3700	2800	3700
3/4	2300	2900	2300	2900
1	1800	3100	1800	3100
1 1/4	1400	2400	1400	2400
1 1/2	1200	2100	1200	2100
2	970	1700	970	1700

## Elevated Temperature Factors

Temperature		Factor
°F	°C	
		316L
200	93	1.00
400	204	0.96
600	315	0.85
800	426	0.79
1000	537	0.76

Example:

10A O.D. × SCH5S wall thickness EP pipes at 600 °F (315 °C):

1. Working pressure is 2400 psig at -20 °F to 100 °F (-28 °C to 37 °C);

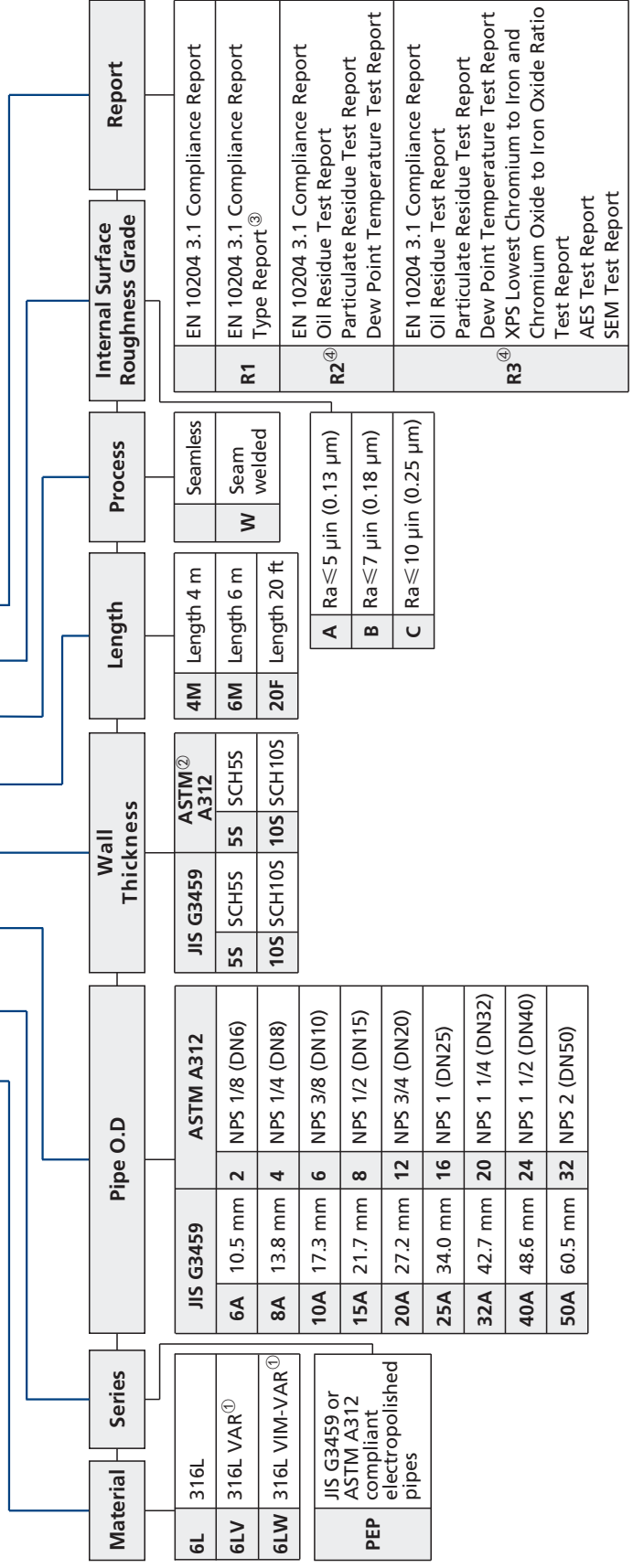
2. Elevated temperature factor is 0.85 at 600 °F (315 °C);

2400 psig × 0.85 = 2040 psig

conclude the working pressure of 10A O.D. × SCH5S wall thickness EP pipes at 600 °F (315 °C) is 2040 psig.

**Ordering Number Description**

6L - PEP - 40A - 5S - 6M - W - A - R1



① Not available for JIS G3459 compliant pipes.  
 ② Wall thickness complies with ASME B36.19M. For ASME B36.10M compliant wall thickness, please contact FITOK Group.  
 ③ Sampling test report of purity value and electropolishing characteristic required by FITOK Group.  
 ④ Provide listed reports according to order lot.



## Ordering Information

To order, add material designator, series, length, process, internal surface roughness grade and report to get a complete ordering number.

Examples:

1. Seamless tubing, 316L stainless steel, ASTM A269 compliant, TEP series, 1/4" O.D. x 0.035" wall thickness, 6 m length, internal surface roughness of  $Ra \leq 0.25 \mu\text{m}$ , standard report, the ordering number is 6L-TEP-4-035-6M-C.
2. Seamless pipe, 316L stainless steel, JIS G3459 compliant, PEP series, 8A O.D. x SCH10S wall thickness, 6 m length, internal surface roughness of  $Ra \leq 0.13 \mu\text{m}$ , purity value report according to order lot, the ordering number is 6L-PEP-8A-10S-6M-A-R2.

ASTM A269/A632 Compliant TEP Series		
Tube O.D. in.	Wall Thickness in.	Basic Ordering Number
1/4	0.035	□□-TEP-4-035-□□-□-□-□□
	0.039	□□-TEP-4-039-□□-□-□-□□
3/8	0.035	□□-TEP-6-035-□□-□-□-□□
	0.039	□□-TEP-6-039-□□-□-□-□□
	0.049	□□-TEP-6-049-□□-□-□-□□
1/2	0.035	□□-TEP-8-035-□□-□-□-□□
	0.039	□□-TEP-8-039-□□-□-□-□□
	0.049	□□-TEP-8-049-□□-□-□-□□
3/4	0.049	□□-TEP-12-049-□□-□-□-□□
	0.065	□□-TEP-12-065-□□-□-□-□□
1	0.049	□□-TEP-16-049-□□-□-□-□□
	0.065	□□-TEP-16-065-□□-□-□-□□
1 1/2	0.065	□□-TEP-24-065-□□-□-□-□□
2	0.065	□□-TEP-32-065-□□-□-□-□□
2 1/2	0.065	□□-TEP-40-065-□□-□-□-□□

JIS G3459 Compliant PEP Series		
Nominal Diameter	Nominal Wall Thickness	
	SCH5S	SCH10S
	Basic Ordering Number	
6A	□□-PEP-6A-5S-□□-□-□-□□	□□-PEP-6A-10S-□□-□-□-□□
8A	□□-PEP-8A-5S-□□-□-□-□□	□□-PEP-8A-10S-□□-□-□-□□
10A	□□-PEP-10A-5S-□□-□-□-□□	□□-PEP-10A-10S-□□-□-□-□□
15A	□□-PEP-15A-5S-□□-□-□-□□	□□-PEP-15A-10S-□□-□-□-□□
20A	□□-PEP-20A-5S-□□-□-□-□□	□□-PEP-20A-10S-□□-□-□-□□
25A	□□-PEP-25A-5S-□□-□-□-□□	□□-PEP-25A-10S-□□-□-□-□□
32A	□□-PEP-32A-5S-□□-□-□-□□	□□-PEP-32A-10S-□□-□-□-□□
40A	□□-PEP-40A-5S-□□-□-□-□□	□□-PEP-40A-10S-□□-□-□-□□
50A	□□-PEP-50A-5S-□□-□-□-□□	□□-PEP-50A-10S-□□-□-□-□□

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ASTM A312 Compliant PEP Series		
Nominal Diameter NPS	Nominal Wall Thickness	
	SCH5S	SCH10S
	Basic Ordering Number	
1/8	-	□□-PEP-2-10S-□□-□-□-□□
1/4	-	□□-PEP-4-10S-□□-□-□-□□
3/8	-	□□-PEP-6-10S-□□-□-□-□□
1/2	□□-PEP-8-5S-□□-□-□-□□	□□-PEP-8-10S-□□-□-□-□□
3/4	□□-PEP-12-5S-□□-□-□-□□	□□-PEP-12-10S-□□-□-□-□□
1	□□-PEP-16-5S-□□-□-□-□□	□□-PEP-16-10S-□□-□-□-□□
1 1/4	□□-PEP-20-5S-□□-□-□-□□	□□-PEP-20-10S-□□-□-□-□□
1 1/2	□□-PEP-24-5S-□□-□-□-□□	□□-PEP-24-10S-□□-□-□-□□
2	□□-PEP-32-5S-□□-□-□-□□	□□-PEP-32-10S-□□-□-□-□□

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