



Parker Grade™ Instrumentation Tube

Super Austenitic 6Mo

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



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NORSOK M650

Parker setting the standards for instrumentation tube fittings

Oil and gas process design projects targeting extreme resistance to corrosion and extended service lifetimes have been boosted by a new metal processing technology.

The advance comes from the instrumentation Products Division of Parker Hannifin – the global leader in motion and control technologies – which is the first company to make fluid instrumentation products manufactured in the specialist alloy 6Mo and conforming to the stringent material quality specifications of the NORSOK M-650 standard.

The Norwegian petroleum industry is pioneering higher standards for equipment manufacturers and the NORSOK M-650 standard verifies that a manufacturer has materials that conform to the requirements to produce reliable products.

Parker is the only instrumentation company offering its products manufactured from a proprietary process and materials which

conform to this requirement. This process applies to all the small bore instrumentation valves, manifolds and fittings manufactured from 6Mo, a standard material with 22 years service in the North Sea.

Parker is one of the world's largest suppliers of instrumentation products for offshore applications, and Parker Grade™ 6Mo super austenitic stainless steel alloy has become the most popular design choice for new North Sea oil and gas instrumentation engineering projects. Compared to standard 300 series and duplex stainless steel, the material offers much greater resistance to chloride-induced pitting, crevice corrosion and stress corrosion cracking, making it ideal for applications demanding long in-service life in hostile environments. Parker Grade™ 6Mo tubing is also now available to complement the tube fitting offering, and will also shortly be available in conformance to NORSOK M650.



Specify Parker Grade™ - 6Mo Tube

In any instrumentation application, one of the first steps to ensuring safety and reliability is to select the right tubing for your process

So important is the chemistry and mechanical properties of the tube when used in conjunction with Parker A-LOK fittings, we have developed our own Parker Grade™ 6Mo tubing. This unique specification of tubing is optimal in terms of hardness, ovality, chemistry, and dimensional tolerances ensuring ideal properties for the fitting.

Super austenitic stainless steel 6Mo is a high performance alloy designed specifically for added corrosion resistance. It has the same structure as the common austenitic alloys, and greater levels of elements such as chromium, nickel, molybdenum, copper, and nitrogen, which gives it enhanced strength and corrosion resistance.

6Mo is especially suited for high-chloride environments such as brackish water, seawater, pulp mill bleach plants, and other high-chloride process streams. It is often used as a replacement in critical components where alloy 316/316L has failed by pitting, crevice attack, or chloride stress corrosion cracking. In many applications, the super austenitic stainless steels have been found to be a technically suitable and much more cost-effective alternative than nickel-base alloys.

Typical applications of this alloy are:

- Seawater Handling Equipment
- Pulp Mill Bleach Systems
- Tall Oil Distillation Columns and Equipment
- Chemical Processing Equipment
- Food Processing Equipment
- Desalination Equipment

- Flue Gas Desulfurization Scrubbers
- Oil and Gas Production Equipment

Why selecting Steel 6Mo grade over Steel 316 grade?

- For all those applications which involve moderate to high chloride presence.
- For those applications in which 316 has failed or is likely to fail due to pitting, crevice or induced stress corrosion cracking.
- For those applications that require compliance to NACE standards and the existing 316 range can not meet such demand.
- For NACE equipment in processes over 60 °C, where 316 is not permitted.

Parker Hannifin carried out Stress Corrosion Cracking Testing as per ASTM G48 conducted by an independent party that determined the time to failure of 6Mo to be 3 times higher of that of 316. In service applications, those results translate into a life expectancy of 6Mo three times longer than that of 316 in the same given conditions, reducing leakage and downtime and increasing safety by over 60%.

Why selecting Steel 6Mo grade over Super duplex grades?

- Choose 6Mo for improved corrosion resistance and super duplex for increased strength. The higher strength of super duplex grades can make this material more susceptible to stress corrosion cracking under certain conditions.

- For those applications that are likely to suffer from pitting corrosion. The pitting resistance given by the PREN or Pitting Resistance Equivalent Number is higher for 6Mo than for its super duplex counterparts.



Typical Composition	
Element	Weight (%)
Carbon	0.02 max
Manganese	1.00 max
Chromium	19.5 to 20.5
Nickel	17.5 to 18.5
Molybdenum	6.0 to 6.5
Nitrogen	0.18 to 0.22
Copper	0.5 to 1.0

Typical Specifications	
Product	Standard
Bar	ASTM A479
	ASTM A276
Forging	ASTM A182 F44
Tube	ASTM A269
Other	NACE MR0175
	NACE MR0103
UNS No.	S31254

Performance Under Pressure

Although Parker's Instrument tube fittings have been engineered and manufactured to consistently provide this level of reliability, no systems integrity is complete without considering the critical link, tubing

Whilst it is the responsibility of the system designer/user to ensure the correct specification of materials and tube to ensure system integrity, this brochure is intended as a guide to assist the designer in properly selecting and ordering quality tubing and details the compatibility of selected tubing with Parker fittings.

Correct tube selection and installation, we believe, are key ingredients in building leak-free reliable tubing systems.

The following parameters should be considered when designing a leak-free system and ordering tubing for use with Parker tube fittings:

- Tubing Hardness
- Tubing Wall Thickness
- Tubing Surface Finish
- Material Compatibility

Tubing Hardness: Remember Parker Instrumentation Tube Fittings are designed to work within specific hardness ranges. Fittings are designed so the differential hardness between tube and fitting are optimum for a reliable and trouble-free operation.

Tube Wall Thickness: Proper wall thickness is necessary to accommodate accepted safety factors relative to desired working pressures.

Tube Surface Finish: As best practice, it is fundamental to control the tubing finish and straightness.

Always select tubing free of visible draw marks or surface scratches. If possible, cut off any undesirable sections. These 'deep' scratches can cause leaks when attempting to seal low-density gases such as argon, nitrogen, or helium. In addition, tubing shall be reasonably straight and ends must be smooth and free of burrs or any other imperfections.

Tubing Specification: High Quality, Fully Annealed, Super Stainless Steel Tubing to ASTM A269/A213 Grade UNS S31254. Recommended Tube Hardness 80 HRB. Maximum Permissible Hardness 90 HRB.

Tube O.D. Size	6Mo				Imperial		
	Wall Thickness, inches						
	0.02	0.028	0.035	0.049	0.065	0.083	0.095
1/16							
1/8	7100	10500					
3/16		6700	8600				
1/4		4900	6300				
5/16			4900	7100			
3/8			4000	5800	8000		
1/2			3200	4600	6200		
5/8				3600	4900		
3/4				3000	4000	5200	
7/8				2500	3400	4400	
1					2900	3800	4400

Working pressure is measured in 'psig'

- Not recommended for gas service
- Recommended for all services - standard assembly
- Recommended for all services - Use pre-assembly tool

Tube O.D. Size	6Mo					Metric		
	Wall Thickness, mm							
	0.8	1	1.2	1.5	1.8	2	2.2	2.5
3	550							
6	410	520						
8		380	470					
10		300	370	470				
12		250	300	380	470			
14			270	340	420			
15			250	320	390			
16			230	300	360			
18			210	260	320	360		
20			180	230	290	320		
22				210	260	290	320	
25					220	250	280	320

Working pressure is measured in 'bar'

- Recommended for all services - Use 'Hyferset' pre-assembly tool
- No data/Not recommended/No solution

Part Numbering

Tubing for use with Parker instrument fittings must be carefully ordered to ensure adequate quality for good performance. Each purchase order must specify the material nominal outside diameter, and wall thickness. Ordering to ASTM specifications ensures that the tubing will be dimensionally, physically, and chemically within strict limits. Also, more stringent requirements may be added by the user. All tubing should be ordered free of scratches and suitable for bending and flaring.

Item	Tube OD Metric	Wall Thickness
Tube 6Mo	3MM	x 0.8
	6MM	x 0.8
	6MM	x 1
	8MM	x 1
	8MM	x 1.2
	10MM	x 1
	10MM	x 1.2
	10MM	x 1.5
	12MM	x 1
	12MM	x 1.2
	12MM	x 1.5
	12MM	x 1.8
	14MM	x 1.2
	14MM	x 1.5
	14MM	x 1.8
	15MM	x 1.2
	15MM	x 1.5
	15MM	x 1.8
	16MM	x 1.2
	16MM	x 1.5
	16MM	x 1.8
	18MM	x 1.2
	18MM	x 1.5
	18MM	x 1.8
	18MM	x 2
	20MM	x 1.2
	20MM	x 1.5
	20MM	x 1.8
	20MM	x 2
	22MM	x 1.5
	22MM	x 1.8
	22MM	x 2
	22MM	x 2.2
	25MM	x 1.8
	25MM	x 2
	25MM	x 2.2
	25MM	x 2.5

Item	Tube OD Imperial	Wall Thickness
Tube 6Mo	1/8	x 0.02
	1/8	x 0.028
	3/16	x 0.028
	3/16	x 0.035
	1/4	x 0.028
	1/4	x 0.035
	5/16	x 0.035
	5/16	x 0.049
	3/8	x 0.035
	3/8	x 0.049
	3/8	x 0.065
	1/2	x 0.035
	1/2	x 0.049
	1/2	x 0.065
	5/8	x 0.049
	5/8	x 0.065
	3/4	x 0.049
	3/4	x 0.065
	3/4	x 0.083
	7/8	x 0.049
	7/8	x 0.065
	7/8	x 0.083
	1	x 0.065
	1	x 0.083
	1	x 0.095

Not recommended for gas service
 Recommended for all services - standard assembly
 Recommended for all services - Use pre-assembly tool
 Recommended for all services - Use 'Hyferset' pre-assembly tool
 No data/Not recommended/No solution

Asset Integrity Formula

The Right Tube +
 The Right Fitting +
 The Right Tubing Support +
 A Parker Trained Fitter =
A High Integrity Solution



A-LOK® is a twin-ferrule compression fitting that dominates low pressure applications, aided by the unique anti corrosion performance of its Suparcase® treated ferrule.



CPI™ delivers a single-ferrule version (Suparcase® treated) of the industry standard twin-ferrule fitting, reducing potential leak paths.



MPI™ brings the two ferrule (Suparcase® treated) compression assembly principle to medium pressures, for applications up to 15,000 psi (1,034 bar).



Phastite® extends the time and cost saving compression approach to even higher pressures (20,000 psi/1,378 bar), providing an easy-install alternative to many permanent connection applications currently served by welded technology.



Snap-Trap®+ is an innovative clamp, designed to radically simplify the installation and maintenance of instrumentation tubing. It is an ideal solution for customers who are looking at corrosion resistant alloys to extend field operation for instrumentation equipment. The tube clamp perfectly complements Parker's corrosion resistant alloy offering of compression fittings and Parker Grade™ tube.

SBEx - Safety Training

The course has been developed as an upgrade and replacement to our industry leading Safety at Work Programme, providing material that is relevant to your on site engineers.

Some of the advantages over our existing programme:

- Greater knowledge of small bore tubing systems
- Increased product familiarity
- Increased skills and confidence in dealing with small bore systems

The benefits that your trained engineer include:

- Increased understanding of their own systems and installation practices
- Improvements in the safety and integrity of their small bore tubing system
- Overall asset integrity improvement

This will be the only licensed and certified training course that can be run with our support



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