




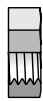

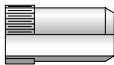
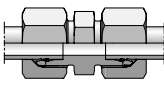
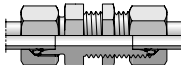
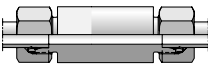
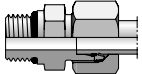
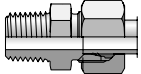
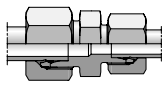

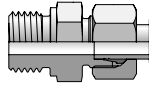
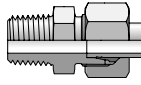
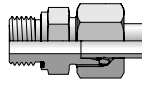
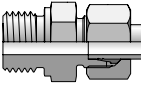

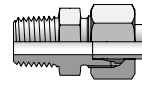
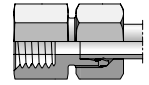
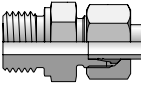
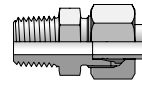
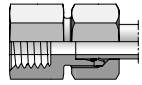
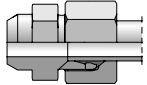
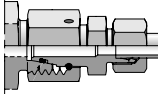
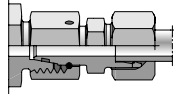
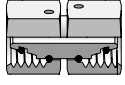
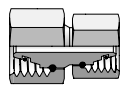
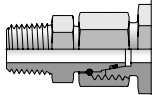
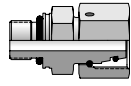
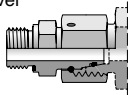
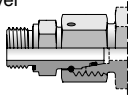
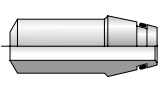
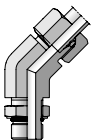
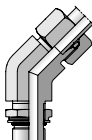
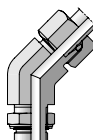
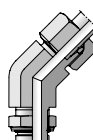
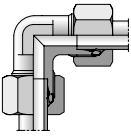
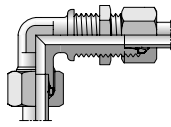
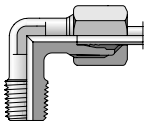
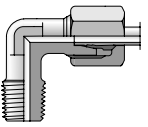
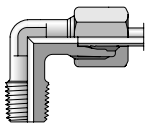
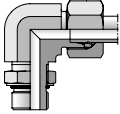
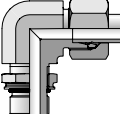
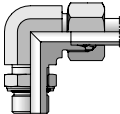
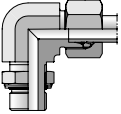
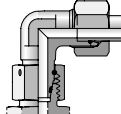
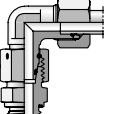
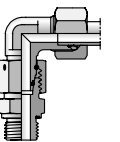
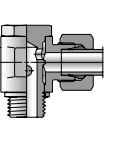
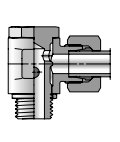
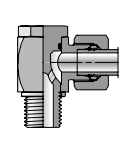
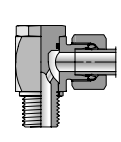
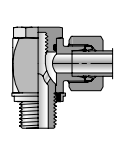
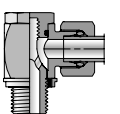
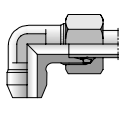

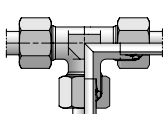
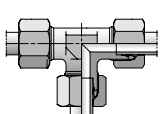
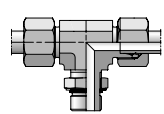
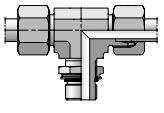
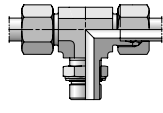
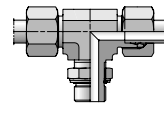
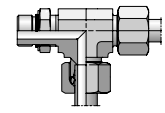
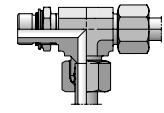
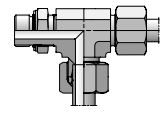
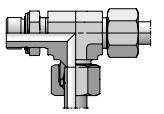
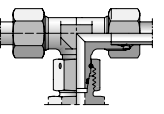
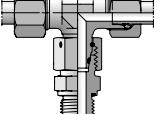
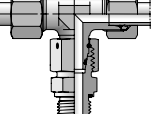
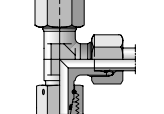
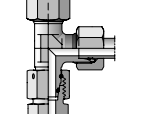
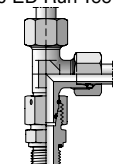
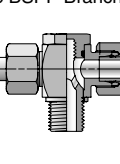
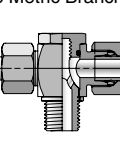
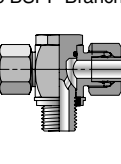
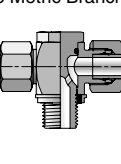
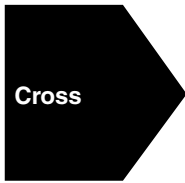
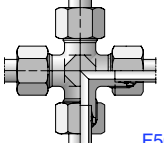

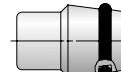

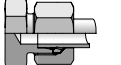
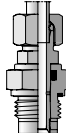
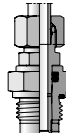
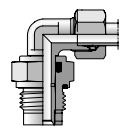
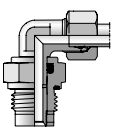

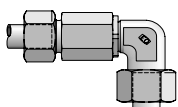
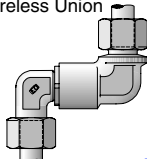

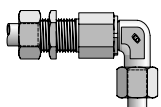
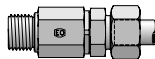
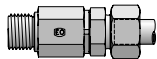
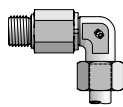
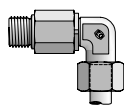
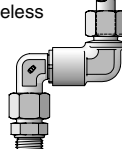

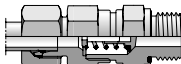

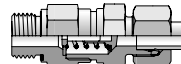
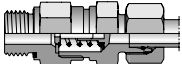


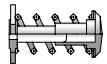
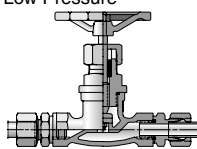
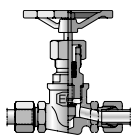
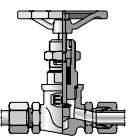
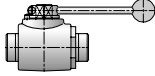
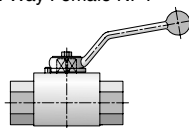
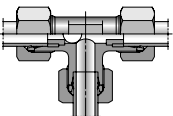
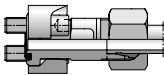
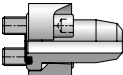
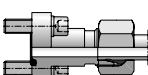
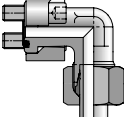
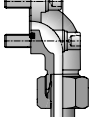


<b>Nuts, Sleeves, Locknut, Inserts</b>	<b>M</b> Nut  F13	<b>FM</b> Functional Nut  F14	<b>DPR</b> Progressive Ring  F13	<b>D</b> Cutting Ring  F13	<b>PSR</b> Progressive Ring  F13
	<b>GM</b> Bulkhead Locknut  F15	<b>E</b> Insert for Plastic Tube  F15	<b>VH</b> Insert for Metal Tube  F15	<b>Straights</b>	<b>G</b> Union  F16
<b>SV</b> Bulkhead Union  F17	<b>ESV</b> Weld Bulkhead Union  F17	<b>GE-UNF/UN</b> SAE-ORB / Flareless  F18	<b>GE-NPT</b> NPT / Flareless  F18		<b>GR</b> Reducer Union  F16
<b>GEO</b> ISO 6149 / Flareless  F19	<b>GE-R</b> BSPP / Flareless  F20	<b>GE-R keg</b> BSPT / Flareless  F20	<b>GE-M-ED</b> Metric-ED / Flareless  F21	<b>GE-M</b> Metric / Flareless  F22	<b>GE-R-ED</b> BSPP-ED / Flareless  F19
<b>GE-M keg</b> Metric Taper / Flareless  F22	<b>GAI-M</b> Female Metric / Flareless  F23	<b>GE-M</b> Metric / Flareless  F22	<b>GE-M keg</b> Metric Taper / Flareless  F22	<b>GAI-R</b> Female BSPP / Flareless  F22	
<b>AS</b> Butt Weld / Flareless  F23	<b>Straight Swivels</b>	<b>RED</b> Tube End Reducer  F24	<b>DA</b> Extender  F25	<b>GZ</b> Swivel Union  F25	
<b>GZR</b> Swivel Union Reducer  F25		<b>EGE-NPT</b> NPT / Flareless Swivel  F25	<b>EGEO</b> ISO 6149 / Flareless Swivel  F26	<b>EGE-R-ED</b> BSPP-ED / Flareless Swivel  F26	<b>EGE-M-ED</b> Metric-ED / Flareless Swivel  F26
<b>SKA</b> Butt Weld / Flareless Swivel  F26	<b>VEE-UNF/UN</b> SAE-ORB / Flareless  F27	<b>VEE-OR</b> ISO 6149 / Flareless  F27	<b>VEE-R</b> BSPP-ORR / Flareless  F28	<b>VEE-M</b> Metric-ORR / Flareless  F28	
<b>45° Elbows</b>	<b>W</b> Union Elbow  F29	<b>WSV</b> Bulkhead Union Elbow  F30	<b>WE-NPT</b> NPT / Flareless  F30	<b>WE-R keg</b> BSPT / Flareless  F31	<b>WE-M keg</b> Metric Taper / Flareless  F31
<b>90° Elbows</b>					

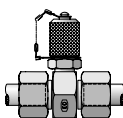
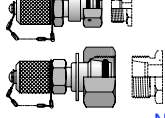

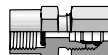
<b>WEE-UNF/UN</b> SAE-ORB / Flareless  F32	<b>WEE-OR</b> ISO 6149 / Flareless  F32	<b>WEE-R</b> BSPP-ORR / Flareless  F33	<b>WEE-M</b> Metric-ORR / Flareless  F33	<b>EW</b> Flareless Swivel / Flareless  F34	<b>EW-R-ED</b> BSPP-ED / Flareless  F35
<b>EW-M-ED</b> Metric-ED / Flareless  F35	<b>SWVE-R</b> Banjo BSPP / Flareless  F36	<b>SWVE-M</b> Banjo Metric / Flareless  F36	<b>WH-R</b> Banjo BSPP / Flareless  F37	<b>WH-M</b> Banjo Metric / Flareless  F37	<b>WH-R-KDS</b> Banjo BSPP / Flareless  F38
<b>WH-M-KDS</b> Banjo Metric / Flareless  F38	<b>WAS</b> Butt Weld / Flareless  F39	 Tees		<b>T</b> Union Tee  F39	<b>TR</b> Reducer Tee  F40
<b>TEE-UNF/UN</b> SAE-ORB Branch Tee  F41	<b>TEE-OR</b> ISO 6149 Branch Tee  F42	<b>TEE-R</b> BSPP-ORR Branch Tee  F42	<b>TEE-M</b> Metric-ORR Branch Tee  F43	<b>LEE-UNF/UN</b> SAE-ORB Run Tee  F43	<b>LEE-OR</b> ISO 6164 Run Tee  F44
<b>LEE-R</b> BSPP-ORR Run Tee  F44	<b>LEE-M</b> Metric-ORR Run Tee  F44	<b>ET</b> Swivel Branch Tee  F45	<b>ET-R-ED</b> BSPP-ED Branch Tee  F45	<b>ET-M-ED</b> Metric-ED Branch Tee  F46	<b>EL</b> Swivel Run Tee  F46
<b>EL-R-ED</b> BSPP-ED Run Tee  F47	<b>EL-M-ED</b> Metric-ED Run Tee  F47	<b>TH-R</b> Banjo BSPP Branch Tee  F48	<b>TH-M</b> Banjo Metric Branch Tee  F48	<b>TH-R-KDS</b> Banjo BSPP Branch Tee  F49	<b>TH-M-KDS</b> Banjo Metric Branch Tee  F49
 Cross		<b>K</b> Union Cross  F50	 Caps and Plugs		<b>VKA</b> Flareless Cap  F50
 Plain Bearing Rotary Fittings	<b>ROV</b> Flareless Plug  F50	<b>DVGE-R</b> BSPP-ED / Flareless  F51	<b>DVGE-M</b> Metric-ED / Flareless  F52	<b>DVWE-R</b> BSPP-ED / Flareless  F51	<b>DVWE-M</b> Metric-ED / Flareless  F52

Ball Bearing Rotary Fittings	DG101 Flareless Union  F53	DG103 Flareless Union  F53	DG105 Flareless Union  F53	DG107 Union Bulkhead  F53	DG108 90° Union Bulkhead  F54
	DG102-R BSPP-ED / Flareless  F54	DG102-M Metric-ED / Flareless  F54	DG104-R 90° BSPP-ED / Flareless  F54	DG104-M 90° Metric-ED / Flareless  F55	DG106-R Double Elbow BSPP / Flareless  F55
Check Valves	RHD Union  F56	RHV-R-ED BSPP-ED / Flareless  F56	RHV-M-ED Metric-ED / Flareless  F57	RHZ-R-ED BSPP-ED / Flareless  F57	RHZ-M-ED Metric-ED / Flareless  F58
	RHDI Female BSPP Union  F58	RVP Cartridge  F59	I-TL Internal Parts  F59	Shut-Off Valves	DV Low Pressure  F60
VDHA High Pressure  F61	VDHB High Pressure – Panel Mount  F61	Ball Valves	KH 2-Way Flareless Union  F62		KH-NPT 2-Way Female NPT  F63
Alternating Valves	WV Union Tee  F63				







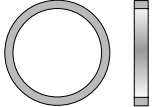
## Flange Adapters (Shown in Section M)

Flange Adapters	<b>GFS</b> Code 61, 62 / Metric Flareless	<b>AS</b> Code 61, 62 / Weld Butt – Tube Metric	<b>BFG</b> DIN Flange / Metric Flareless	<b>WFS</b> Code 61, 62 / Metric Flareless	<b>BFW</b> DIN Flange / Metric Flareless
	 M12	 M24	 M13	 M31	 M32

## Diagnostic and Specialty Adapters (Shown in Section N)

Test Point Connectors	<b>GMA3</b> EO Tube / EO Tube / EMA-3 Diagnostic Tip	<b>VKA3</b> EO Swivel / Diagnostic Tip	<b>MAVE</b> BSPP Gauge / EO Swivel	<b>MAV</b> BSPP Gauge / EO Tube
	 N5	 N8	 N6	 N6

## O-Rings and Seals (Shown in Section O)

O-Rings and Seals	<b>Bonded Seal for Banjo Fittings</b>	<b>Metal Seal for Banjo Fittings</b>	<b>Pressure Gauge Sealing Ring</b>	<b>EOlastic Seal Ring</b>	<b>EO O-Ring</b>
	 O7	 O7	 O8	 O5	 O8
<b>EO-2 Sealing Ring</b>  O6	<b>Metric Retaining Ring</b>  O4				

## EO Progressive Ring Fittings — Introduction

The flareless bite type fitting was pioneered by Ermeto in Germany in the early 1930's. When Parker Hannifin acquired Ermeto, it introduced the EO fittings to the US. Today, the EO fittings are the most widely used bite type fittings in the world.

The EO progressive ring fitting is a flareless metric fitting (for metric tube) that consists of a body, a progressive ring (ferrule) and a nut. On assembly, two cutting edges of the progressive ring "bite" into the outer surface of the tube ensuring the necessary holding power and seal for high operating pressures.



**Fig. H1 — EO fitting components: Body, progressive ring and nut**

The fittings and components listed in this catalog are intended solely for the assembly of connections for fluid applications.

Three series of EO tube fittings (LL, L and S) and accessories are manufactured in accordance with DIN 2353 (summary) which today is represented by international standard 8434-1 on the basis of decades of experience.\*

To ensure functional safety of EO tube fittings, only EO parts should be used in their assembly. Routing of tubes should be carried out in accordance with Parker/EO recommended practices. Assembly instructions are available.

## Design and Construction

The three components of EO fittings are designed and manufactured to produce a strong, reliable, leak-free joint upon proper assembly.

**The EO Body.** EO fitting bodies are available in over thirty configurations. The shaped products (i.e., elbows, tees, crosses) are hot forged, then machined to the stringent EO fitting specifications. The forging process used by Parker further improves the strength and metallurgical properties of the fitting material.

Straight products are made from cold drawn bar stock. The cold drawing operation ensures consistently tight dimensional tolerances, as well as significantly improved strength.

**The EO Progressive Ring (Cutting Ring).** EO progressive rings are precision machined with all dimensions and surfaces, particularly the critical bite edges, monitored on an ongoing basis. The rings are then heat treated in a manner that provides

the hardness, strength, and toughness necessary to satisfy the demanding service conditions that exist in industry today. The original progressive ring, known as DPR, is now being replaced with the new generation, called PSR. PSR is stronger and features a "positive stop" to eliminate over-tightening.

**The EO Nut.** EO fitting nuts are either cold formed, hot formed or machined from cold drawn material. The cold forming and cold drawing operations provide a more tightly packed grain structure, thus improving the material's strength. In addition, cold forming significantly improves the fatigue properties or endurance limits of the nuts.

## Standard Material Specifications

### Steel fittings:

EO tube fittings — Materials according to DIN 3859-1

### Stainless steel fittings:

EO tube fittings — X6CrNiMoTi 17122 in accordance with DIN 17440 / EN 10088, material no. 1.4571.

### Brass fittings:

EO tube fittings — CUZN35Ni2 in accordance with DIN 17660, material no. 2.0540.

**Elastomer seals:** NBR (BUNA-N), FKM (Fluorocarbon)

### Surface Finish - Steel fittings:

Standard		
LL Series	Body, Nuts, and Rings	— Zinc clear chromate, Chromium 6 Free
L+S Series	Body and Nuts	— Zinc clear chromate, Chromium 6 Free
	Progressive Rings (PSR)	— Zinc clear chromate, Chromium 6 Free

Short codes for surface protection procedure in accordance with DIN 267 part 9 or DIN 50942.

## How EO Fittings Work: Function of Progressive Ring Fittings

The EO progressive ring fitting produces a low to high pressure, leak free connection of tubes and components in fluid systems. The basic function of the EO progressive ring is the controlled progressive bite of the ring into the tube due to a unique internal geometry.

The front cutting edge has already started cutting into the tube before the second cutting edge starts. As soon as both cutting edges have cut the tube to the designed depth further advance is limited by the stop edge.

Owing to the design of both cutting edges and stop edge all forces arising are equally distributed. This distribution along with the specially designed interior collar of the ring guarantees increased safety, particularly with regard to vibration and flexure stresses. The design and function of the progressive cutting ring ensure that service vibration loading is not present in the areas of the tubing where the bite is made.

\*The selection of LL, L or S design should be made by the user on the basis of intended system pressure. The pertinent maximum recommended working pressures are shown throughout this catalog in individual data charts of the various fitting configurations.

The stop edge causes a sharp increase in tightening forces which is clearly perceptible. After assembly, a visible collar of cut tube material must completely fill the space in front of the first cutting edge. With stainless steel tube and hose connections made from free cutting steel, the collar is less due to the harder material.

During assembly, it is absolutely essential that the tube is held firmly against the stop in the inner cone of the fitting; if not, the cutting process will not take place satisfactorily. Reassembly can be performed an unlimited number of times.

## Assembly and Installation

Please refer to [Section T](#) for the assembly and installation instructions for EO and EO-2 Metric Bite type fittings.

### Weld Nipples

EO weld nipple fittings with an O-ring seal between weld nipple and body give impressive pull out resistance and sealing integrity, and a sensible alternative to the progressive ring. Fittings bodies and nuts are fully interchangeable for weld nipple and progressive ring fittings of the same series and tube outside diameter. Weld nipples SKA conform to DIN 3865 form A, which today is represented by international standard ISO 8434-4.

### Ball Bearing Rotary Fittings

**DG Ball Bearing Rotary Fittings:** These compact, maintenance-free construction, service proven fittings combine ball and plain bearings with constant lubrication and relatively wear resistant annular piston seals. They are rated for working pressures up to 250 bar, have a low starting torque and have a suitable pressure/RPM rate.

Ball bearing rotary fittings are designed for connecting a fixed point to a rotating, swiveling or moving machine part via tubing or hoses. Thus axial torsion of tubing or hoses can be prevented. They are suitable for hydraulic oils and lubricants of mineral oil base, not suitable for water or gases. Nominal temperature range is -35°C to +80°C.

#### Fitting Instructions:

The life of rotary fitting depends considerably in a stress-free line connection. Therefore, the direct connection with tube is to be avoided. For connection to hoses the use of swivel nut fittings is recommended with short, straight lines (approx. length 5x hose O.D.). Thus shocks and vibrations can be absorbed.

Assemble tube ends in accordance with the Tube End Assembly Information on [pages T12 through T13](#). Assemble BSPP and metric stud ends in accordance with torque values on [page T5](#).

### Plain Bearing Rotary Fittings

**Plain Bearing Rotary Fittings:** These compact, maintenance-free construction, service proven fittings are rated for low pressure tube and hose with slow rotating, swiveling or moving machine parts up to 64 bar (L series) and 160 bar (S series).

Plain bearing rotary fittings are designed for connecting a fixed point to a rotating, swiveling or moving machine part via tubing or hoses. Thus axial torsion of tubing or hoses can be prevented. They are suitable for hydraulic oils and lubricants of mineral oil base, not suitable for water or gases. Nominal temperature range is -35°C to +100°C.

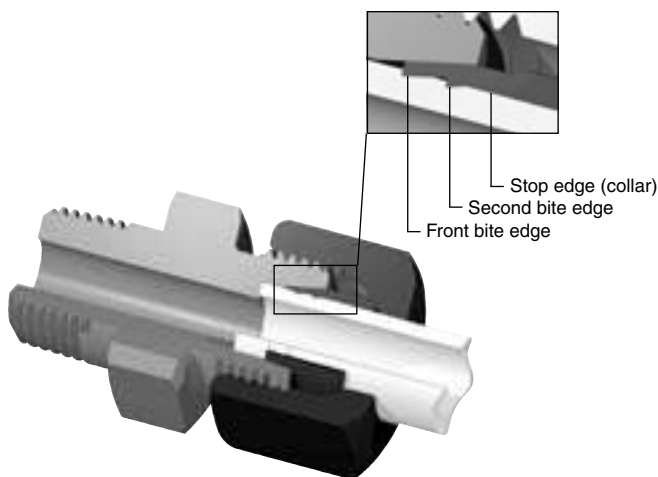


Fig. F2 — How EO fittings work

Tube O.D.	Nominal bore (mm)	Permissible number of revolutions (rpm) under a working pressure** of:					Torque at 250 bar/Nm
		25 bar	64 bar	100 bar	160 bar	250 bar	
6	4	1500	750	400	200	85	0.08
8	6						
12	10	800	400	200	100	45	0.24
16	13						
20	16	300	150	75	38	15	0.8
25	20						
30	25	200	100	50	25	10	2.0
38	30						

Table F1 — Ball Bearing Recommended RPM and Starting Torques

\*\*A minimum working pressure of 10 bar is necessary.

Series L											
Tube O.D.		6	8	10	12	15	18	22	28	35	
Permissible RPM		28	28	21	17	13	10	10	7	7	
Series S											
Tube O.D.		6	8	10	12	14	16	20	25	30	38
Permissible RPM		11	11	9	7	5	5	4	4	3	3

Table F2 — Plain Bearing Recommended RPM

**Fitting Instructions:**

The life of a rotary fitting depends considerably in a stress-free line connection. Therefore, the direct connection with tube is to be avoided. For connection to hoses, the use of swivel nut fittings is recommended with short, straight lines (approx. length 5x hose O.D.). Thus, shocks and vibrations can be absorbed.

**Non-Return Valves**

**Characteristics:** Sealing is achieved by using a 90° cone with a packing washer of synthetic material. Valve has a lift stop which provides safe free outlet, shock-absorbing, muffled opening and no reduction of cross section. Maximum flow velocity not more than 8 m/sec (for higher flow velocities special tests are required).

**Opening Pressure:** Approximately 1 bar standard (on request also 0.2, 0.5, 2, 3, 4, 5 & 6 bar are available). Please specify nonstandard opening pressures on order as follows: Tube Fitting part number, opening pressure, material. Ex: RHD12L2BCF is a RHD12LCF with 2 bar opening pressure. Tolerance of (cracking) pressure is  $\pm 20\%$ .

**Tube Recommendations****For steel fittings:**

Seamless cold drawn steel tubes made from material St. 35.4 or from conditioned base material St. 37.4 in accordance with DIN 1630, state of delivery NBK (normal annealed) with tube outer and inner diameter tolerances in accordance with DIN 2391/ISO 3304. Max. hardness: HRB 75.

**For stainless steel fittings:  
Material no. 1.4571 and 1.4541**

Seamless drawn tubes made from austenitic, stainless steel materials no. 1.4571 and 1.4541, in accordance with DIN/EN/ISO 1127. Max. hardness: HRB 90.

These tubes are particularly recommended for tube fittings, since the tube outer diameter and wall thickness, tolerances correspond to those of steel tubes in accordance with DIN 2391/ISO 3304.

**For brass fittings:**

Seamless drawn copper tube made from material with short code SF-Cu F37 in accordance with DIN 1786.

**Tube wall thicknesses:**

In order to determine the necessary tube wall thicknesses for applications, refer to the calculated pressures provided in the tables for EO metric tubing. The calculated pressures DIN 2413-I are for static and DIN 2413-III for dynamic loads.

The maximum wall thickness is based on the pressure holding capacity of the fitting. In some cases, the wall thickness of the tube might be too thin for reliable service and an insert must be used to prevent excessive tube collapse. See assembly section for recommended tube wall thicknesses.

**Plastic tube:**

EO fittings are suitable for use with various types of plastic tubes such as nylon, polyethylene, etc. When used with plastic tube, an insert (see [page F15](#)) must be used to prevent tube pull out due to tensile loading.

**Features, Advantages & Benefits**

- **Visible Bite** — The critical front bite of the progressive ring is clearly visible to tube fitters & inspectors. The presence of the recommended bite virtually eliminates any risk of catastrophic blow-off. This is a very important safety feature.
- **Sealing Capability** — EO fittings have demonstrated a remarkable ability to remain leak free under various service conditions ranging from sealing high vacuum and small molecules gases to high pressure hydraulic fluids.
- **Distributed Stresses** — Stresses due to service flexural loading are distributed at several points in the joint, thus stress concentration in the bite is minimized.
- **Vibration Control** — The rear bevel of the ferrule firmly grips tubing, thus dampening the effects of system vibration in the joint.
- **Progressive Ring Design** — The progressive ring design provides a second bite for improved reliability and higher working pressure capability. This design also decreases the risk of improper assembly because of the sharp, high torque rise which occurs when the fitting is properly tightened.
- **Envelope Size** — EO fittings are relatively small and compact, making it a suitable selection for plumbing in limited or tight space.
- **Temperature Rating** — EO fittings are suitable for sub-zero through elevated temperature applications. Service temperature rating is limited by the material chosen.
- **Compatibility** — Since EO fittings can be manufactured from a wide range of metals, its compatibility factor with various fluids and atmospheric conditions is virtually limitless. One simply has to select and specify EO fittings from an acceptable material that best satisfies the service conditions.
- **Tube Wall** — EO fittings are suitable for use with light wall, medium wall, heavy wall, and extra heavy wall tubing. (Light wall tube may require support sleeve (VH), as shown in Assembly/Installation Section.)
- **Re-Usability / Remakeability** — Joints can be disassembled and reassembled many times to facilitate system maintenance. This reduces the labor and material costs that would otherwise result from tube and fittings replacement.
- **Assembly** — No expensive, complicated tooling is necessary to assemble EO fittings. Assembly is simple when the procedures described in the Assembly / Installation section are followed (see [pages T28 - T33](#)).
- **Materials** — EO fittings can be manufactured from almost any metallic material. The more popular materials currently used for EO fittings are: stainless steel, carbon steel, and brass. On request, the Tube Fitting Division will machine EO fittings from other appropriate material specified by users.
- **Manufacture** — EO fittings are manufactured under tight quality control which ensures that the product routinely satisfies or surpasses the requirements of the pertinent industrial standards.
- **World Wide Popularity** — The bite type fitting design has worldwide acceptance and is especially popular in Europe.

- **Finish** — Steel EO fittings have a zinc clear Chromium-6 Free finish. This finish provides good corrosion protection.
- **Silver Plated Nuts** — Stainless steel tube nuts are pre-lubricated with silver plated threads (size 15L-42L, 12S-38S). Thread galling is eliminated and assembly torque is reduced as much as 40 percent. This increases the speed and efficiency for stainless steel fitting assembly.
- **Availability** — EO fittings are available as standard in over thirty different configurations, and as many as twenty-seven different size combinations in some configurations.
- **Configurations** — Popular configurations for EO fittings are shown in the Visual Index. Other configurations can be manufactured on request.

## EO-2 Fitting System — Introduction



Fig. F3 — EO-2: Fitting body and functional nut

The EO-2 high pressure tube fitting generation is the most recent development of the Tube Fitting Division Europe. It was introduced in an effort to eliminate leakage in all fluid systems.

The common feature of all EO-2 fittings is elastomeric seals on all joints. This assures leakfree operation without retightening — even under severe working conditions. Another breakthrough in bite-type technology is the simple assembly and cost-saving handling of the unique EO-2 Functional Nut.

EO-2 is a true metric design according to 24° bite-type standards such as: ISO 8434-1, DIN 2353 or DIN 3861. It covers all three series (LL, L and S) of the broad EO tube fitting program.

This resulted in a great acceptance with equipment manufactures that are targeting an absolute leakfree systems without sacrificing the convenience of using metric bite type fittings.

## Design and Construction

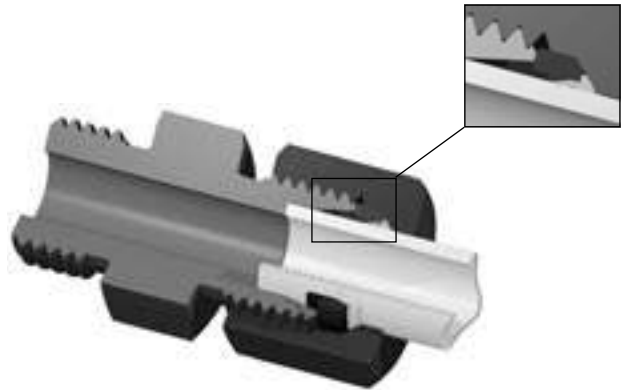


Fig. F4 — EO-2: The metallic support of the sealing ring acts just like an integrated preassembly tool.

### Elastomeric Sealing

The elastomeric seal assures a hermetically sealed tube joint. It is located in between the inner cone of the fitting body and the tube surface, thus blocking the only possible leak path. Due to its large cross-section, the seal effectively compensates for all manufacturing tolerances on tube and fitting cone.

The sealing effect is pressure supported which makes the EO-2 fitting suitable for high pressure applications. The static compression also eliminates air-ingress into the fluid system at underpressure conditions.

Elastomerically sealed EO-2 fittings do not require any retightening even in heavy-duty applications. Seal extrusion is prevented by proper housing without gaps or dead volume. The sealing lip is bonded to a metallic support ring.

## Standard Material Specifications

### Steel fittings:

EO-2 tube fittings — Materials according to DIN 3859-1

### Stainless steel fittings:

EO-2 tube fittings — X6CrNiMoTi 17122 in accordance with DIN 17440 / EN 10088, material no. 1.4571.

### Brass fittings:

EO-2 tube fittings — CUZN35Ni2 in accordance with DIN 17660, material no. 2.0540.

**Elastomer seals:** NBR (BUNA-N), FPM (Fluorocarbon)

### Surface Finish - Steel fittings:

Standard

LL Series	Body, Nuts, and Rings	- Zinc clear chromate, Chromium 6 Free
L+S Series	Body and Nuts	- Zinc clear chromate, Chromium 6 Free

Short codes for surface protection procedure in accordance with DIN 267 part 9 or DIN 50942.



## How EO-2 Fittings Work

The retaining ring bites into the tube in accordance to the proven bite ring principle. The elastomeric seal reduces the danger of over- or underassembly by a special EO-2 design feature: Before assembly there is a gap in between the flat surfaces of the retaining ring and the metallic support ring of the seal. As soon as the retaining ring has reached the proper incision depth, the gap closes, resulting in a sharp increase of assembly torque. This results in uniform and reliable fitting assemblies. The assembly result can easily be inspected by just checking if the gap is closed.

The separation of sealing and holding functions to two separate elements finally allows a more effective solution of the over- and undertightening problems typically associated with bite type fittings.

## Assembly and Installation

Please refer to [Section T](#) for the assembly and installation instructions for EO and EO-2 Metric Bite type fittings.

### Integrated Assembly Tool

The metallic support ring of the seal is made of a specially designed material and heat-treatment to act as an assembly tool. This makes sure that the retaining ring securely cuts into the tube surface without damaging the sensitive inner cone of the fitting body.

This unique feature of EO-2 fittings even allows direct assembly of tube without any additional pre-assembly process. An EOMAT machine (or other hydraulic tool) is strongly recommended to allow easy assembly of large dimension tube and drastically save total assembly time, effort and costs. The integrated assembly tool of EO-2 fittings even helps to save further costs and trouble when using an EOMAT-type presetting machine: As the presetting cone is only in contact with the elastomeric sealing lip, it cannot be worn out or damaged even after thousands of assemblies. This not only saves replacement costs but also avoids leakage problems caused by worn presetting tools.

### The Functional Nut



**Fig. F5 — The unique Functional Nut allows easy handling and quick assembly.**

The unique Functional Nut simplifies handling of fitting components and helps to minimize storage and procurement costs.

The sealing and retaining rings are combined as a pair and are inserted into the internal thread of the nut in such a manner that they cannot fall out, so that these three parts form one functional element.

Individual components such as seal or retaining ring cannot be forgotten, confused or assembled in the wrong orientation. Time and cost are saved by eliminating searching and arranging the components to make up individual joints.

Functional Nuts are completely interchangeable with the full range of EO tube fitting ends.

After assembly and disassembly, the sealing ring can be replaced individually without cutting off the tube end.

## Tube Recommendations

### For steel fittings:

Seamless cold drawn steel tubes made from material St. 35.4 or from conditioned base material St. 37.4 in accordance with DIN 1630, state of delivery NBK (normal annealed) with tube outer and inner diameter tolerances in accordance with DIN 2391/ISO 3304. Max. hardness: HRB 75.

### For stainless steel fittings:

#### Material no. 1.4571 and 1.4541

Seamless drawn tubes made from austenitic, stainless steel materials no. 1.4571 and 1.4541, in accordance with DIN/EN/ISO 1127. Max. hardness: HRB 90.

These tubes are particularly recommended for tube fittings, since the tube outer diameter and wall thickness, tolerances correspond to those of steel tubes in accordance with DIN 2391/ISO 3304.

### Tube wall thicknesses:

In order to determine the necessary tube wall thicknesses for applications, refer to the calculated pressures provided in the tables for EO metric tubing. The calculated pressures DIN 2413-I are for static and DIN 2413-III for dynamic loads.

The maximum wall thickness is based on the pressure holding capacity of the fitting. In some cases, the wall thickness of the tube might be too thin for reliable service and an insert must be used to prevent excessive tube collapse. See assembly section for recommended tube wall thicknesses.

### Plastic tube:

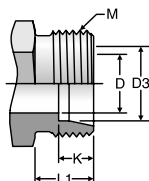
EO-2 fittings are suitable for use with various types of plastic tubes such as nylon, polyethylene, etc. When used with plastic tube, an insert (see [page F15](#)) must be used to prevent tube pull out due to tensile loading.

## Features, Advantages and Benefits of the EO-2 Fitting System

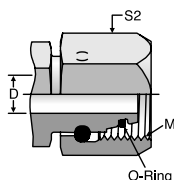
In addition to the general advantages of the EO tube fitting system, the unique EO-2 fitting features offer even more specific benefits:

- **Sealing Capability** — An elastomeric seal forms the primary sealing element, thus assuring leak-free sealing. Even low-viscosity media such as water or gas are hermetically sealed. Hydraulic systems, therefore, do not “sweat” at fittings.
- **High Pressure Resistance** — EO-2 fittings are rated up to Pmax 900 bar. Sealing lip and seal arrangements have both been designed so that the sealing effect is supported by system pressure. The interaction of the retaining ring and the integrated preassembly tool results in uniform and reliable fitting assembly.
- **Durability** — The elastomeric seal does not require any retightening even after years of operation under severe working conditions.
- **Bite Control** — The ideal bite depth is controlled by the fitting design rather than by the fitters force. Closing the gap at the end of the manual assembly, the fitter gets clear signal that setting is completed and the joint is ready for inspection.
- **Functional Nut** — Individual components such as the retaining ring or seal cannot be lost, forgotten, confused or assembled in the wrong orientation. This dramatically saves assembly cost and helps to avoid dangerous assembly errors.
- **Assembly Cost** — With less than 10 seconds cycle time on the EOMAT III/A (actual presetting process: 1.4 seconds), the cost of presetting EO-2 is extremely low.
- **Integrated Preassembly Tool** — Each EO-2 Functional Nut comes assembled with an integrated assembly tool that makes sure that the retaining ring securely cuts into the tube surface without damaging the sensitive inner cone of the fitting body. This greatly reduces the danger of tube blow-off, even when using stainless steel tube.
- **Unlimited Presetting Tool Lifetime** — When EOMAT machines are used for cost-efficient presetting, the preassembly tools do not wear out as they are only in contact with the rubber seal. This avoids dangerous blow-off which can result when traditional bite-type fittings are assembled using worn presetting tools.
- **Make-up** — From the wrench-tight position of the preset EO-2 joint, one short pull on the wrench (approx. 1/6 to 1/4 turn) gives the assembly a quick high rise to required torque. EO-2 fittings have a solid “hit-home-feel” and excellent over-torque resistance.
- **Visible Inspection** — There is no doubt if an EO-2 Functional Nut has been preset correctly or not. Inspection is as simple as checking if the gap between retaining ring and sealing ring is completely closed. The tube end does not have to be disassembled out of the fitting for bite inspection.
- **No Phantom Leaks** — Lubrication is not mandatory for the assembly of steel EO-2 fittings. The machine operator will not be irritated about lubricant coming out of the fittings once the hydraulic system gets hot.
- **Re-Usability/Remakeability** — EO-2 fittings can be disassembled and reassembled many times. There is no wear or widening of the vulnerable inner cone. Damaged seals can easily be replaced. All spare DOZ-seals are marked by size-code (e.g.: 12-L).
- **On-Site Maintenance** — For the maintenance and replacement of EO-2 fittings a set of wrenches is sufficient. Additional in line components, such as test points (GMA), ball valves (KH) or T-fittings can be added to an existing assembly within minutes.
- **Interchangeability** — The EO-2 Functional Nut can be used for the whole variety of the broad range of more than 50 configurations in some 25 sizes of standard EO LL, L and S-series fittings. Changeover from Progressive ring or weld nipple is easy by the simple use of EO-2 Functional Nuts.
- **Reliability** — Millions of EO-2 fittings are working trouble-free in applications like: Mobile construction equipment, stationary machine tools, hydraulic presses, plastic injection molding machines, shipbuilding, offshore exploration, submarines, railway trains and military equipment. Leakage does not occur on EO-2 pipework.
- **Trouble-Free** — Regular bite type fittings allow typical assembly-errors such as: confusion of bite type ring material and size. Also, the use of worn-out preassembly tool may result in fitting failure. The clever EO-2 design eliminates most of these mistakes without making the assembly process more complicated.
- **Popularity** — EO-2 fittings are as easy to assemble as traditional bite type fittings, but they eliminate most of their typical assembly problems. EO-2 fittings are therefore appreciated by an increasing number of original equipment manufacturers. EO-2 also has become the fitting of choice of end-users that appreciate the leakfree performance, the easy maintenance and the global availability of the metric soft-seal bite type system.

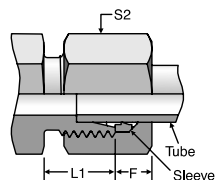
## EO and EO-2 Metric Tube Ends



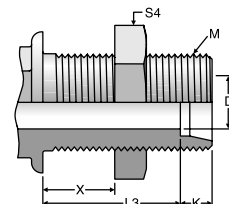
**EO/EO-2 Male  
Tube End**



**EO/EO-2 Swivel**



**EO/EO-2 Assembly**



**EO/EO-2 Bulkhead**

	End Size	Thread	Drill	Tube Nut Assembled Allowance	Tube Depth	Male Turn Back	Bulkhead Length	Tube/Swivel Nut Hex	Bulkhead Nut Hex	Max Bulkhead Thickness
Size	D3 (mm)	M Metric	D (mm)	F (mm)	K (mm)	L1 (mm)	L3 (mm)	S2 (mm)	S4 (mm)	X (mm)
4LL	4	M8x1	3	5.5	4.0	8	—	10	—	—
6LL	6	M10x1	4.5	6	5.5	8	—	12	—	—
8LL	8	M12x1	6	6	5.5	9	—	14	—	—
10LL	10	M14x1	8	6	5.5	9	—	17	—	—
12LL	12	M16x1	10	6	6.0	9	—	19	—	—
6L	6	M12x1.5	4	8	7.0	10	34	14	17	16
8L	8	M14x1.5	6	8	7.0	10	34	17	19	16
10L	10	M16x1.5	8	8	7.0	11	35	19	22	16
12L	12	M18x1.5	10	8	7.0	11	36	22	24	16
15L	15	M22x1.5	12	8	7.0	12	38	27	30	16
18L	18	M26x1.5	15	9	7.5	12	40	32	36	16
22L	22	M30x2	19	9	7.5	14	42	36	41	16
28L	28	M36x2	24	9	7.5	14	43	41	46	16
35L	35	M45x2	30	11	10.5	16	47	50	55	16
42L	42	M52x2	36	12	11.0	16	47	60	65	16
6S	6	M14x1.5	4	8	7.0	12	36	17	19	16
8S	8	M16x1.5	5	8	7.0	12	36	19	22	16
10S	10	M18x1.5	7	9	7.5	12	37	22	24	16
12S	12	M20x1.5	8	9	7.5	12	38	24	27	16
14S	14	M22x1.5	10	10	8.0	14	40	27	30	16
16S	16	M24x1.5	12	10	8.5	14	41	30	32	16
20S	20	M30x2	16	11	10.5	16	44	36	41	16
25S	25	M36x2	20	12	12.0	18	47	46	46	16
30S	30	M42x2	25	13	13.5	20	51	50	50	16
38S	38	M52x2	32	15	16.0	22	53	60	65	16

Dimensions and pressures for reference only, subject to change.