



EO-3[®]

The innovative fittings system with visual assembly status recognition for tube and hose applications

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



ENGINEERING YOUR SUCCESS.



Approval and Certification requirements

Note! Customer has to specify needed certifications, classifications, testing and inspection requirements precisely when requesting quotation/placing an order.

For your safety!

Under certain circumstances, tube fittings can be subjected to extreme loadings such as vibration and uncontrolled pressure peaks.

Only by using genuine Parker components and following Parker assembly instructions can you be assured of the reliability and safety of the products and their conformity to the applicable standards.

Failure to follow this rule can adversely affect the functional safety and reliability of products, cause personal injury, property damage, and result in loss of your guarantee rights.

Subject to alteration



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A New Fittings System

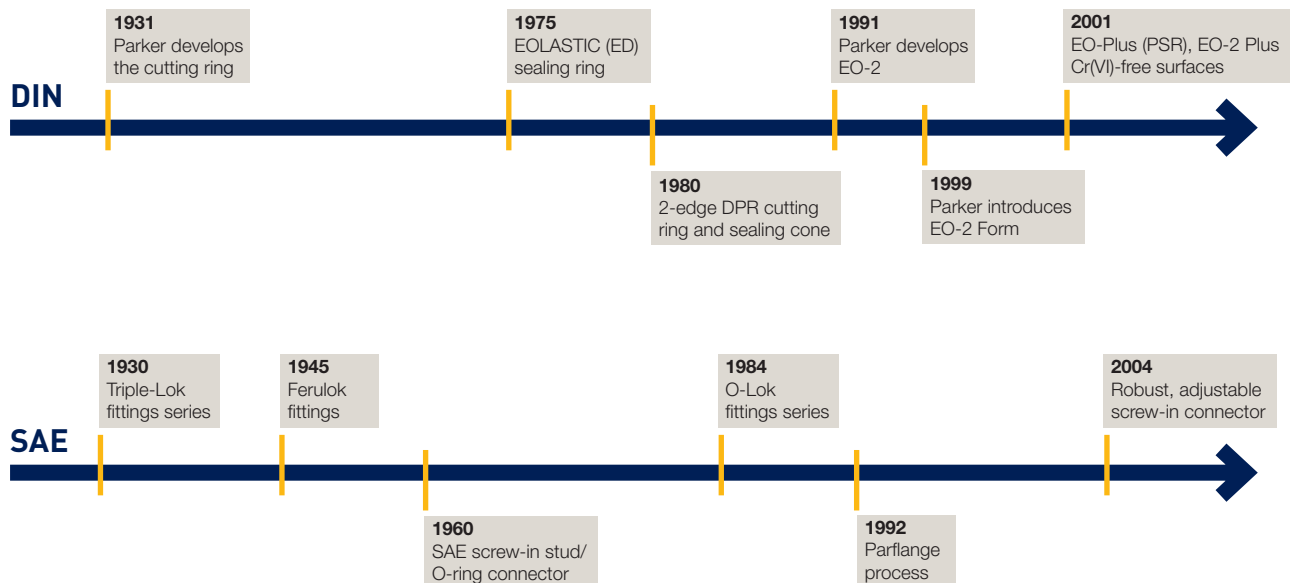
Just what the world of technology has been waiting for

As a connector component, any fitting is only as good as the effectiveness of the assembly process and therefore depends on how it has been assembled. In recent years, new geometries and material compositions have increasingly improved performance, reliability and ease of assembly. In this field Parker has constantly set new standards in the marketplace.

With the development of the EO-3° fitting, Parker now introduces another very important milestone in the history of connector technology. Our customers' practical experience provided the impetus for the development of the EO-3° system with the message that potential assembly errors, such as over- or under-tightening, should be eliminated. Practical experience often shows that fittings are in large part not expertly assembled. Changing personnel, inexperienced personnel, a shortage of skilled workers and increasingly difficult installation conditions lead to failed assemblies. The consequences are leakage, costly downtime and expensive reworking – or even accidents.

The advantages of the new fitting are clearly apparent with its greater simplicity, speed and safety. With its new thread technology, EO-3° can be assembled more easily and faster than other commercially available fittings systems and the assembly outcome of EO-3° is, for the first time ever, easily discernible from the outside; every user is now in a position to directly control work safety and machine reliability.

A tradition of one innovation after another



EO-3[®] – The Optimum System

Many applications can benefit from it

“Fit and forget” is a familiar slogan that was selected by Parker for its Ermeto connector systems. It is an expression which is still as valid as ever. Both the decades-long experience with fittings technology for high-pressure applications and also the intensive information exchange with users from a wide variety of industries, deliver the basic concept for the new EO-3[®] technology. Furthermore, the basic technical advantages of a variety of connector systems were analysed and brought together in the EO-3[®] system.

Application areas for EO-3[®]:



Users can secure a whole raft of money – saving advantages when they install EO-3[®] fittings:

- Leakage can be prevented with the help of unambiguous assembly inspection
- Distinctly increased machine performance and reliability
- EO-3[®] meets the increased safety and quality requirements now in force
- Additional costs of reworking are substantially avoided
- EO-3[®] increases the quality of the end-product
- Company image is enhanced due to better products
- No oil loss – an important contribution to environmental protection



These arguments support the immediate installation of EO-3[®] in a very wide range of operating conditions – whether energy, agriculture, paper machinery or oil and gas extraction; the EO-3[®] system will satisfy the highest requirements for quality and function. “Fit and forget” sums it all up.



ENGINEERING YOUR SUCCESS.

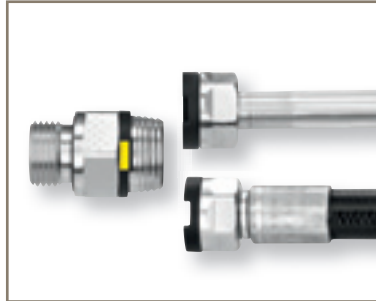
Clear to See Arguments

This is EO-3[®]



Indicator ring for unambiguous assembly outcomes

- Gives security to the assembler
- Leakage due to over- or under-tightening is prevented



A connector for tubing and hose lines

- A reliable system for many applications



Safer, more rapid assembly due to lower expenditure of energy

- A taper thread as the new thread standard
- Reduction of assembly time



Optimum safety due to tearout-proof connector technology

- Machine tube forming with EO forming technology



Compact design

- Smaller nut spanner sizes in comparison with traditional standards
- Ideal in restricted access conditions



Sealing ring cannot be lost or damaged

- Soft seal integrated in the cone
- Elastomer seal with optimum sealing behaviour, even with high dynamics in the system
- Increased safety due to the fact that loss of, or damage to, the seal is prevented



No torque spanner or extension required

- Tool costs reduced, assembly accelerated



Easy access when installation space restricted

- Octagonal instead of standard hexagonal nut from tube size 25 mm and up

EO-3® - Assembly Status Recognition

Visible target leads to good management

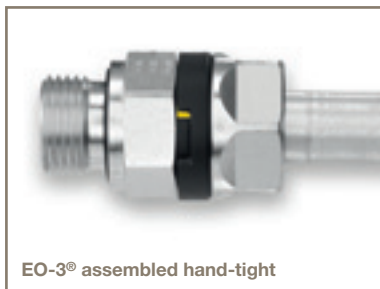
“Do you have a consistent and mandatory procedure for assembly operations in your team?”

“How do you actually operate the assembly process – do you follow a manufacturer’s recommendations?”

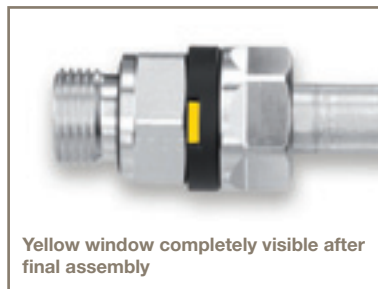
“How do you check whether the assembly operation has been correctly carried out?”

These are some of the typical questions we ask our customers during practical assembly training. The answers are many and varied – just like the assembly outcomes which we check when doing field work. In many companies assembly is by “good-feeling”. Sometimes it has a solid base of many years’ experience but often depends on how things

are on the day and on qualifications for the job. Making matters worse are awkward installation conditions due to poor access and lack of assembly space. Technical problem analysis frequently reveals the same old problem – assembly! Under- and over-tightening and even loose connections are typical assembly errors. It is even more exasperating when these problems are not discovered during final inspection and come to light only after delivery. Accurate error statistics are rarely available but the number of unreported cases here is very high.



EO-3® assembled hand-tight



Yellow window completely visible after final assembly



Contours in the indicator rings for the drag ring function



During over-tightening the yellow window remains in place through the drag ring effect

These experiences guided us to develop with EO-3® a fitting system that easily and unambiguously shows assembly status that is visible all-round from the outside. This puts every user in the position where he can assemble with precision and establish the quality of connections very rapidly; finally, he also has the possibility of visual acceptance at the end of the assembly conveyor.

EO-3® – repair and maintenance

Applicable and replaceable practically anywhere



EO-3® offers a reliable connection solution also in cases of repair or repeat assemblies. The practical technician has only to simply tighten the EO-3® connector and check whether the viewing window is full. In these cases the yellow viewing window is also a clear signal for a professionally executed assembly process.

For repair purposes it can be necessary to resort to other fittings systems available in the DIN or SAE standard ranges. In such a case an EO-3® adaptor makes up the connection.

EO-3[®] – Technology Overview

Flexible in application

- EO-3[®] system – for tube connections and hose applications
- Tube sizes – all the common tube outside diameters from 06 mm to 42 mm with the commercially available tube wall thicknesses
- Series – EO-3[®] dispenses with standard series classification of LL, L and S
- Pressure rating – uniformly 420 bar for all tube sizes. Exceptions are typical L series such as 22, 28, 35, 42 at 250 bar. Qualification of pressure ratings corresponds to ISO 8434 requirements
- Tube connector thread standard – taper thread specially developed by Parker for EO-3[®]. Flank and taper dimensions are exactly matched to assembly performance (i.e. stroke and force) and also to the tear-out and shear resistance of a tube connector
- Fitting material – steel
- Tube material – conventional hydraulic steel tube material, e.g. E235 (ST37) or E355 (ST52.4) standard to DIN EN 10305-4
- Elastomer material – NBR
- Surface treatment – Parker chromium6-free corrosion protection
- Temperature resistance – -40 °C to +120 °C (analogous to NBR)
- Media compatibility – analogous to NBR material
- Energy efficiency – via matched bores with improved flow properties



www.parker.com/eo3



EO-3[®] – Worth Knowing

Any questions? Here are the answers!

Is the viewing window always reliable, even when I over-tighten EO-3[®]?	Yes! If the viewing window is in the right position, both rings turn further in synchronisation due to the drag ring function. “Over-assembly” should not be confused here with “destroy”. It only means that more force than necessary was applied.
Can I over-assemble EO-3[®]?	See above. An “up to block position” provides a mechanical assembly stop. “Assemble till destroyed” is thereby virtually eliminated.
How does EO-3[®] behave during repeat assembly?	The repeat assembly process functions reliably. The indicator function remains in place, albeit the necessary effort and actual assembly stroke can differ, depending on the first assembly. Furthermore, there is no wear or widening of the internal cone.
Can I re-assemble a connector which has been over-tightened?	Yes, with over-assembly the indicator rings show the position of the last assembly. If the fitting is undone and then assembled again, the function of assembly indication remains intact.
Assembly is relatively easy – can EO-3[®] now also be loosened more quickly?	The loosening moments have a relationship with the assembly moments and are therefore lower. If the assembly is correct, loosening during operation cannot occur. This has been verified with dynamic testing of both tube and hose connections.
How does EO-3[®] behave when there are hose movements, especially torsion?	Hose assembly must be such that relative motion of machine components does not produce twisting.
Is the forming of EO-3[®] comparable with EO2-FORM?	Yes, both are positive-locking systems. Differences exist in the form of the seal. With EO2-FORM the sealing ring is fitted onto the tube. With EO-3 [®] an O-ring is already inserted into the fitting body.
Is the sealing ring in the fitting sufficiently protected from mechanical influences?	Yes, the O-ring is housed in the fitting body and is very well protected.
Does EO-3[®] remain leak-proof even when the O-ring is damaged?	Yes. Long-lasting hydraulic sealing with a damaged or missing O-ring can nevertheless be assured. For a permanently hostile situation the O-ring should be changed.
What are the temperature properties of the indicator ring?	The indicator rings are made from glass-reinforced polyamide. This material is suitable for temperatures from -40 °C up to +120 °C.
How media resistant are the indicator rings and the yellow viewing window?	The ozone-resistant indicator rings do not come into contact with the hydraulic medium due to the fact that they are situated on the outside of the fitting. But environmental media must be allowed for. The indicator rings are resistant to mineral oils and fats, water and popular detergents.
What can be done if the indicator ring in a manufactured hose or tube assembly is missing or destroyed?	The connector can be assembled without performance reductions like a sealing cone connector. The assembly indication function however is no longer operative.

EO-3[®] – Worth Knowing

Any questions? Here are the answers!

Is EO-3[®] compatible with existing systems?	EO-3 [®] can be connected to established DIN systems via an adaptor. In other respects EO-3 [®] has its own technical standard.
Is the indicator ring ozone-resistant?	Yes, the indicator ring is manufactured from black, ozone-resistant polyamide. Adverse effect by ozone is not critical, because the indicator ring has no primary sealing function.
What do I do in the event of a repair if no EO-3[®] is available?	Either the whole tube/hose assembly including the screw-in connector should be exchanged or an EO-3 [®] norm adaptor employed.
Do I still need a torque spanner for assembly?	No! This tool is no longer required. The fitting can be assembled by eye (or by sight).
Can I actually assemble faster?	Yes, because of the taper thread the nut can be screwed on with fewer turns.
How does EO-3[®] behave if the tube or hose line is not 100% aligned?	EO-3 [®] can better compensate for alignment errors than DIN fittings. Thanks to the taper thread, the hose or tube connector can also be assembled when small alignment errors are present.
Must I specially prepare the tube end?	Tube preparation is identical to that for DIN or SAE fittings. (See assembly instructions).
Has the port thread also changed?	No – the screw-in side follows the usual standards and norms.
How and how long should EO-3[®] be stored?	Storage capabilities: dry and dust-free. Exclusion of light and ozone because of the seal. Under optimum conditions NBR seals can be stored for 5 years and FKM for 10 years.
Which tubing can I use for EO-3[®]?	Steel tubing, seamlessly cold drawn and bright annealed to DIN EN ISO 10305-4.
Can stainless steel tubing be utilised?	EO-3 [®] is for now only available in steel.
Can EO-3[®] be over-painted?	Yes, but assembly inspection should take place before painting because the colour markings of the indicator rings would also be over-painted.
Can painted EO-3[®] connectors be repeat assembled?	Yes, with painted EO-3 [®] connectors the original assembly position can again be recognised. Assembly has been correctly carried out when the paint completely fills the viewing window and no other unpainted areas are visible.



EO[®] Ermeto Original
Performance data

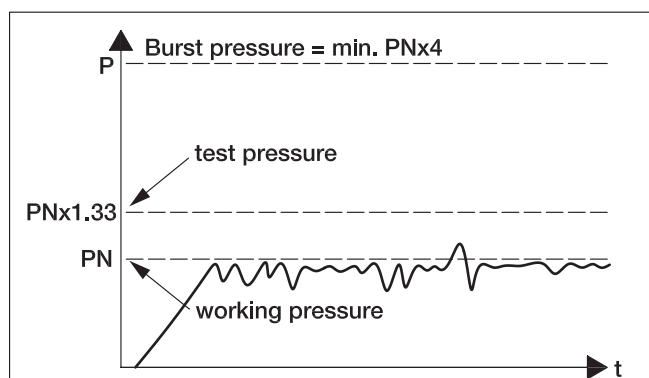
Pressure rating

Nominal pressure PN

The Nominal pressure PN is a figure relating to the pressure rating of a fluid component for continuous dynamic applications. It is rounded to correspond to internationally standardised ratings. Logical series of fittings are grouped together, with the nominal pressure of the group being that of the “lowest common denominator” within the group.

Internationally, these nominal pressures are recognised and serve to match common sizes of components together. Parker tube fittings meet or exceed common standardised pressure ratings.

To prove the long term dynamic load resistance, components are tested under pressure impulse conditions of $PN \times 1.33$, at 1Hz for 1 million cycles. Static test burst pressures are at least 4 times the PN value.



Nominal pressure EO-3® fittings

Tube O.D.	PN [bar]
6	420
8	420
10	420
12	420
15	420
16	420
18	420
20	420
25	420
30	420
38	420
22	250
28	250
35	250
42	250

Materials

Materials

Tube material*	Material Tube and nut	Sealing material	Material Indicator ring
Steel, E235N and E355N	Steel	NBR (Standard) FKM (on request)	PA (Polyamid)

*Tube specification acc. to DIN EN ISO 10305-4

Fitting material – overview

Fittings	Raw material	Designation	Material No.	Standard	US Designation	Bodies	Nuts
Steel	Barstock Free cutting steel	11SMnPb30	1.0718	DIN EN 10277-3	SAE 12L14	X	X
		11SMn30	1.0715	DIN EN 10277-3	SAE 1213	X	
		C35	1.0501	DIN EN 10277-3	SAE 1035	X	
	Forgings Free cutting steel	15S10	1.0710	DIN EN 10305-1	–	X	
		C20/C22R	1.1149	DIN EN 10083-2	SAE 1020	X	
		C35	1.0501	DIN EN 10083-2	SAE 1035	X	
		C45	1.1201	DIN EN 10083-2	SAE C45 modified	X	X
	Extrusion steel	C10C	1.0214	DIN EN 10263-2	SAE C1010		X

Surface treatment

EO-3® fittings are worldwide delivered with a first-class surface protection: Zinc plated, transparent passivated and with a special coating (short mark CF).

Why zinc plated?

The requirements for corrosion resistance of tube fittings have been increasing in the past few years. Increasingly tube systems are not painted. Higher demands are requested also for an aesthetic point of view.

The traditional black-grey surface “phosphated and oiled” (Znphr5f – DIN 50942) used for tube connections in the past does not longer meet these demands. An galvanized deposit zinc layer offers the following advantages: The corrosion resistance increases significantly due to a plating of min. 8 µ and additional sealing by chromating process. In case of scratches or nicks – which are unavoidable during assembly – zinc develops a cathodical protection of the steel fitting body against localised corrosion and abrasion.

The corrosion resistance of the CF surface is 400% above zinc plated surfaces to meet highest requirements. The CF surface is also Cr(VI)-free to avoid any contamination in the manufacturing process and meets current

regulations e.g. European “End of Life Vehicles“ directive.

The silver bright colour due to the chromating or passivation process offers an attractive appearance.

All major TFDE manufacturing locations are equipped with their own modern galvanic plants. The process control is specially orientated to the tube fitting product.

The users of Parker fittings benefit from:

- homogeneous thickness of plating (average 13 µm), measured on outside contour for good screwable threads
- high quality above-average concerning avoidance of nicks
- very good corrosion resistance

Continuous corrosion tests like salt spray tests according to ISO 9227/5% NaCl show an average resistance of 500 hr in contrast to white rust and 700 hr in contrast to red rust for CF surfaces.

Particular fitting series or fitting components and valves are delivered with other or modified surfaces for functional reasons or for better differentiation.

Material	Fitting system	Fitting type	Surface protection/Surface	
			CF Zinc plated bright passivated	CF + Glide coating start. at Tube diam. 25
Steel	EO-3®	Fitting bodies	X	
		Nuts		X

Passed tests

- Repeated assembly, 10 times, before leak test
- Leak and burst pressure test acc. DIN EN ISO 19879, security factor 4 (4x safety factor)
- Pulse test acc. ISO 6803, 500.000 cycles
- Over tightening test, 50% increased torque
- Combined pulse/vibration test with tube acc. DIN EN ISO 19879

Fluid compatibility

Both metal fitting material and elastomeric seal compound have to be selected according to the fluid used. Standard recommendations for static seals based on experience and sealing compound manufacturers specification. For use of sealing compounds that are used for dynamic seals like rotary fittings or non-return-valves, see note at end of table.

Fluid	Fitting material	Sealing material	
	Steel	NBR	FKM
Acetone	2	3	3
Acetylene	2	3	3
Air (oil free)	1	1	1
Ammonia liquid	2	2	3
Ammonia gas, cold	1	1	3
Animal oils (Lard oil)	2	1	1
Aral, Vitam BAF	1	1	1
Argon	1	1	1
Asphalt	3	2	1
ASTM-Oil, no. 1	1	1	1
ASTM-Oil, no. 2	1	1	1
ASTM-Oil, no. 3	1	1	1
ASTM-Oil, no. 4	1	2	1
ATF oil	1	1	1
Automotive brake fluid	1	3	3
Benzene	1	3	1
Brine (sodium chloride)	X	1	1
Butane	1	1	1
Carbon bisulphide	1	3	1
Carbon dioxide	1	1	2
Carbon oxide	1	1	1
Castrol, Biotec HVX	1	1	1
Chlorine (dry)	3	3	1
Compressed air	1	1	1
Crude oil	2	2	1
Cutting oil	1	1	3
DEA, Econa E22	1	1	X
DEA, Econa E46	1	1	X
Diesel fuel	1	1	1
ECOOL	1	1	1
ESSO, Univis 13	1	1	1
ESSO, Univis 26	1	1	1
ESSO, Univis 32	1	1	1
ESSO, Univis 46	1	1	1
Ethanol (Ethylacohol)	1	1	3
Ether	1	3	3
FINA, Biohydran RS 38	1	1	1
Flue gas	3	3	2
FRAGOL, Hydrolub 125	1	1	X
Freon 11	X	2	2
Freon 12	1	2	1
Freon 22	3	3	2
Gasoline	2	2	1
Gas, liquid propane (LPG)	1	1	1
Glycerine	2	1	1
Glycol (Ethylenglykol)	1	1	1
Heating fuel oil	1	1	1
Helium	1	1	1
Houghton Safe 1120	1	3	1
Houghton Safe 620	1	1	2
Hydrochlorid acid	3	3	1

Fluid	Fitting material	Sealing material	
	Steel	NBR	FKM
Hydrogen	3	3	3
Hydrogen peroxide	3	3	1
Hydrolube	1	1	1
Iodine	3	2	1
Kerosene	1	1	1
Lubricating oil SAE 10,20,30,40,50	1	1	1
Methane	1	1	1
Methanol	1	1	3
MIL-F-8192 (JP-9)	1	3	1
MIL-H-5606	1	1	1
MIL-H-6083	1	1	1
MIL-H-7083	1	1	2
MIL-H-8446 (MLO-8515)	1	2	1
MIL-L-2104 & 2104B	1	1	1
MIL-L-7808	2	2	1
Mineral oil	1	1	1
Natural gas	1	1	1
Natural gas, untreated	3	3	3
Natural mineral oil	1	2	1
Neon	3	1	1
Nitric acid	3	3	2
Nitrogen	1	1	1
Oil	1	1	1
Oxygen (gas, cold)	3	3	3
Ozone	1	3	1
Petrolatum	1	1	1
Petroleum oil	1	1	1
Phosphoric acid	3	3	1
Plantohyd 32 S	1	1	X
Plantohyd 40 N	1	1	1
Propane	1	1	1
R134A	1	3	3
Sea Water	3	1	1
SHELL, Naturelle HF-E-46	1	1	1
SHELL, Tellus Oil DO 32	1	1	1
Silicone oil	1	1	1
Skydrol 500	1	3	3
Skydrol 7000	1	3	2
Soap solutions	3	1	1
Steam	2	3	3
Stoddard solvent	1	1	1
Sulphur dioxide	3	3	3
Sulphuric acid	3	3	1
Toluol	1	3	2
Transmission fluid	1	1	1
Trichlorethane	2	3	1
Turpentine	2	1	1
Water	2	1	2
Xylol	1	3	1

Applicability: 1 = satisfactory
 2 = fair
 3 = not recommended
 X = insufficient data

NBR = e.g. Perbunan (registered trademark of Bayer)
 FKM

Biodegradable oils

Due to environmental concerns and new legislation biodegradable oils are rapidly gaining importance for both mobile and stationary applications. The usage of non-inflammable fluids will remain limited to special applications like mining, steel mills and heavy machines.

Media

Biodegradable oils can be classified into 3 categories:

HEPG (Glycol based fluids)

- + Wide temperature range (–45°C ... 100°C)
- + Very stable against ageing
- + NBR and FKM seals are compatible
- + Moderate viscosity change with temperature
- + Water soluble
- Not mixable with mineral oils or HEES, HETG types
- Careful flushing recommended when changing from mineral oil
- Paints can be dissolved
- Care required with material compatibility (e.g. do not use any zinc containing materials)
- Density > 1,100 kg/m³ possible design changes
- Price?

HETG (Vegetable-based fluids)

- + Mixable with mineral oils
- + Normal sealing material are compatible (e.g. NBR or FKM)
- + Good lubricating properties
- + Paint resistant to fluid
- + Viscosity changes with temperature are moderate
- Limited temperature range (–25° C to +70°C)
- Max. temperature not to be exceeded
- Limited lifetime
- UV and ozone sensitive
- Beware of water take-up (cracking?)
- Price?

HEES (Synthetic ester based fluids)

- + Wide temperature range (–30° C ... +90° C or over 100° C with some variants)
- + Good lifetime
- + Mixable with mineral oils
- + Normal sealing materials compatible (FKM and NBR recommended)
- + Machine paints resistant to fluid
- + Viscosity changes with temperature are moderate
- + Good lubricating properties
- Danger of hydrolysis with water take-up (filters, dryer, occlusion)
- Price?

Compatibility

Generally, TFDE steel fittings with standard NBR seals are suitable for most applications.

	–20° C ... 80° C	80° C ... 120° C
HEPG Polyalkylenglycol	NBR FKM	Not suitable for Oil
HETG Vegetable Oil	NBR FKM	– FKM
HEES Synthetic ester	NBR FKM	– FKM

Suitable sealing compounds

Experience shows that media compatibility is not a critical issue for static seals used on tube fittings. In doubt please contact TFDE application engineering.

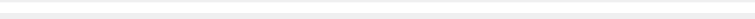
Pragmatic approach

If there is doubt about switching over to softseal fitting systems (ISO6149/Eolastic/O-Lok®/EO-2/EO-3®), it might be a good idea to have a close look on the existing hydraulic system. If NBR seals perform well on hoses, cylinders, valves or filters there is nothing to worry about standard TFDE fittings. Usually the design engineers know when special seal compounds like FKM have to be used.





Assembly



Safety instructions

Tube fittings are safe high-pressure connections



A carefully assembled Parker tube fitting will provide a sealed joint even up to tube burst. Experience has shown that break-downs, re-tightening and leaks can be avoided by following these safety instructions. Please review your fitting procedures.

General safety instructions

- Uncompleted assembly will reduce the pressure capability of a fitting. It can reduce the life cycle time of a connection and leakage can occur. In extreme cases the connection can fail due to tube shear or tube crack.
- After opening a tube connection, the unit has to be re-tightened with the same force used during prior assembly. For EO-3[®] please check, if note of indicator ring of body and nut are the same. Under tightening can result in leakage and can reduce the vibration resistance. Over tightening can reduce the possibilities of repeated assembly. In extreme cases the components can be destroyed.
- Parker tube fittings are intended solely for connections for fluid applications.
- Observe tube recommendations. Non-standard materials or tolerances lead to incorrect assembly.
- Do not use ball bearings, fitting pins or tapered pins, coins or washers instead of the correct Parker blanking plug as blanking parts for 24° cones.
- Tube connection and fitting body once assembled, should remain together. Fitting body is to be used once only for pre-assembly.
- Air bleeding of tube fittings which are under pressure can be dangerous.
- Tube under tension can lead to vibration failure. Tube length and bend angles are to be adhered to precisely. Fix tube lines with tube clamps.
- Tubes are not to be clamped to one another but to suitable fixed points. Plate brackets, cable connections and fixing elements are not suitable. Tubes are not mountings on which to integrate other components e.g. filters, ventilators or shut-off valves.
- Prevent oscillation, pressure surges and inherent strain by using flexible hoses for example.
- Under and over tightening of fittings during assembly reduces the capacity for withstanding pressure and vibration loads and therefore reduces the life of the tube fitting. Leaks from the tube can occur under these circumstances.
- When dismantling/transporting and re-assembling, make sure that no dirt enters the system, that the connection elements (threads, sealing surfaces) are not damaged, seals are not lost and tubes are not bent or flattened. We recommend the use of suitable protective caps.
- Disassembled fittings are to be checked for accuracy and damage and replaced if necessary.
- Do not use hand cutters or tube cutters.
- Dirt and metal contamination can lead to damage to the system and leaks.
- The operating parameters given (e.g. pressure, temperature, medium compatibility) are to be adhered to.
- Avoid flow rates > 8 m/s. The resulting forces are high and can destroy the tube lines.
- Relevant guidelines (e.g. CE, ISO, BG, TÜV, DIN) are to be observed.
- Weld fittings are manufactured out of weldable materials. No other fittings are suitable for welding.
- EO-NIROMONT and Parflange LUBSS are high-performance lubricants. The use of other lubricants generally leads to an increase in assembly force.
- The tools and lubricants recommended by Parker guarantee safe assembly.
- Components and tooling of different manufacturers are not necessarily compatible. For complete safety, use only Parker components.
- Fittings are to be handled with care.
- Tube lines need to be adapted tension free of the relevant connectors before assembly. An easy turning of the nut is required for the complete thread length. Otherwise leakage can occur. In extreme cases with additional vibrations tube cracks can occur.
- Vibrations have to be clamped by tube clamps. Independent vibrating units need to be separated with hoses. Otherwise tube cracks can occur.
- EO-3[®] is not compatible with fittings according DIN EN ISO 8434-1. EO-3[®] fittings cannot be assembled with components according to DIN EN ISO 8434-1.
- Intended twisting or removing the EO-3[®] indicator rings spoils the function of the assembly indication of EO-3[®]. The connection can still be mounted without indicator rings using the assembly instruction of 24° swivel nuts connections. The general performance of EO-3[®] remains unchanged.

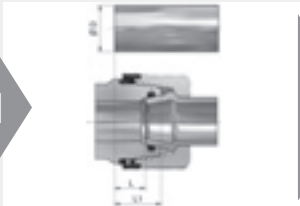
EO-3[®] assembly instructions



Tube preparation

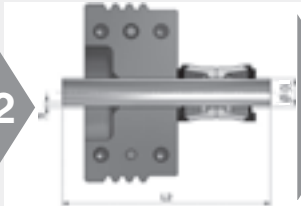
- Cut and deburr thoroughly
- Cut and bend tubes exactly

1



- Take extra length into account (see tube preparation chart)

2



- Minimum lengths L_2 of straight tubes (see chart)

3



- Minimum lengths L_3 of straight tube-ends before bend (see chart)

4



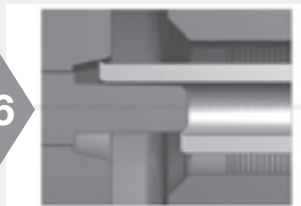
- Cut tube squarely
- max $\pm 1^\circ$ deviation
- ⚠ Do not use pipe cutters
- EO tube-cutting tool (AV) for manual cutting

5



- Remove internal and external burrs
- max. chamfer $0.3 \text{ mm} \times 45^\circ$
- Recommendation: Automatic deburring. In-Ex Tube Deburring Tool 226

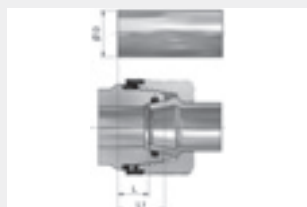
6



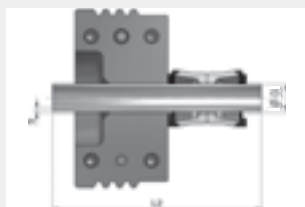
- Chips, dirt, internal or external burrs and paint prevent correct tube insertion
- ⚠ Dirty tubes result in worn-out or damaged tools

EO-3[®] assembly instructions

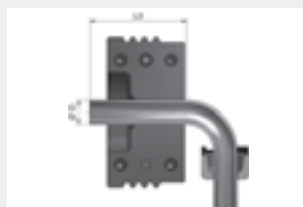
Tube preparation chart



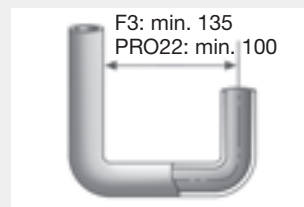
● Extra length



● Minimum tube length



● Minimum straight length before bend



● Minimum clearance of U-shape bends

D	S	L	L1	L2	L3
6	1.0	4.5	8.5	70	35
	1.5	3.5	7.5		
8	1.0	4.0	8.5	72	38
	1.5	3.5	8.0		
10	1.5	3.5	8.0	76	40
12	1.5	3.5	8.0	80	42
	2.0	3.0	7.5		
15	1.5	4.0	8.5	95	48
	2.0	4.0	8.5		
16	2.0	4.5	10.0	98	50
	2.5	4.5	10.0		
18	1.5	4.5	10.0	100	52
	2.0	4.5	10.0		
20	2.0	5.0	10.5	115	60
	2.5	5.0	10.5		
22	2.0	4.5	11.0	108	60
	2.5	5.0	10.5		
25	2.5	6.0	12.5	135	75
	3.0	6.0	12.5		
28	2.0	5.0	11.5	120	70
30	3.0	6.5	14.0	145	80
	4.0	6.5	14.0		
35	3.0	6.5	14.0	138	85
38	3.0	6.5	15.0	155	90
	4.0	6.5	15.0		
	5.0	7.0	15.5		
42	3.0	7.0	14.5	150	95

Checking instructions for EO-3[®] forming tools

Forming pin and clamping dies for WorkCenter F3 and PRO22



Use of damaged, worn or non-suitable tooling may result in fitting failure and damage of machine

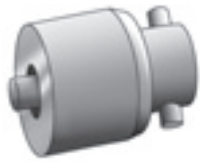
Tools must be checked regularly, at least after 50 assemblies

Worn tools must be replaced

Use only genuine Parker tools

Tools must always be kept clean and lubricated

1



- Clean forming pin for checking
- Do not disassemble

2



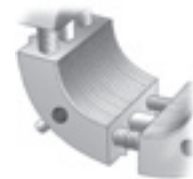
- Visual check:
Surface must be free of wear and damage
- Use air blowgun to remove chips and dirt

3



- Clean clamping pin for checking
- Do not disassemble
- Pins must not be loose or damaged

4



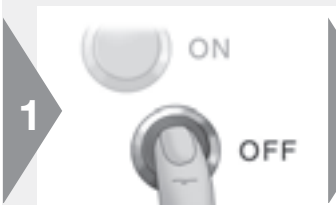
- Visual check:
Grip surface must be clean and free of wear
- Use wire-brush to remove metal particles from grip surface

EO-3[®] assembly instructions



Tube forming with WorkCenter F3 and PRO22

- Reliable forming method
- Reliable process



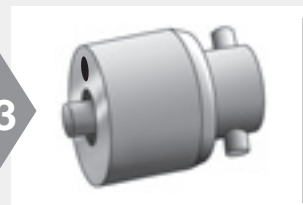
1

- ⚠ Change tool only when drive switched off (button OFF)
- ⚠ Obey safety instructions
- ⚠ Do not operate machine without tooling



2

- Open doors to access tools and handling devices
- Tool handling devices are stored in middle on top



3

- Select suitable forming pin according to outer diameter and wall thickness
- EO-3[®] forming pin. With code "P3" as part of order code. Are signed with a yellow dot



4

- Check forming pin for dirt, wear and damage



5

- Use magnetic holder to insert forming pin
- Turn clockwise to lock bayonet fixture



6

- Tilt magnetic holder to remove handle



7

- Select suitable clamping die set according to tube outer diameter
- EO-3[®] clamping dies marked with "EO2" and "P3" in the order code, are also suitable for EO2-FORM
- ⚠ Don't use old EO2-FORM clamping dies without the mark "P3" (deviations possible)



8

- Check clamping dies for dirt, wear and damage
- Use wire-brush to remove metal particles from grip surface



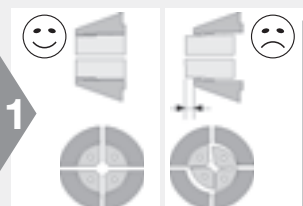
9

- Use pistol to handle clamping die set
- Pull and hold handle to grab die set



10

- Insert clamping die set until it bottoms up (twist pistol for easy insertion)
- Release handle to fix die set
- ⚠ Never operate machine while pistol is inserted



11

- ⚠ Front surfaces must be completely flat
- ⚠ Die segments must fit without gaps



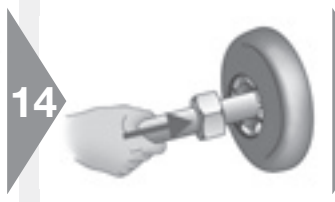
12

- Switch on drive (button ON)
- Each time the drive is switched on, the reset button (RESET) must be pressed first
- The automatic tool recognition is initiated
- ⚠ Clamping dies will close, reset button (RESET) must be held until it lights up
- Lighten of reset button (RESET) indicates "ready to start"

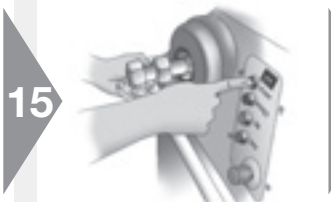
EO-3[®] assembly instructions



- ⚠ Make sure tube-end is free of burrs, chips and dirt
- ⚠ Lubricate inside and outside of tube-end
- Use EO-NIROMONT for best performance



- Insert tube-end with nut into open tool until it firmly touches the stop at the end
- ⚠ Press tube-end firmly into the tube stop
- ⚠ Do not turn tube-end anti-clockwise to prevent unlocking forming-pin



- Press and hold start button (Ⓢ START) until tube is clamped
- Instead of start-button (Ⓢ START), footswitch can be used
- ⚠ Hold tube firmly until clamping dies are closed
- Use support for long tubes
- ⚠ Do not reach into tool area while machine is working



- Tube can be taken out after the clamping dies are open
- Reset button (RESET) lights up and the machine is ready for the next operation
- Check tools regularly (approx. 50 assemblies) for dirt and wear
- Remove tools for cleaning
- Clean clamping dies with wire brush
- Clean forming die using compressed air
- Replace worn-out tooling

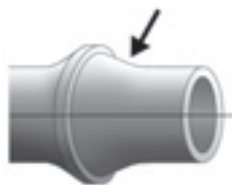
EO-3[®] assembly instructions



Assembly check

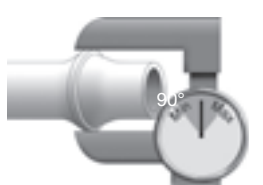
- Check assembly result
- ⚠ Incorrect assemblies must be scrapped

1



- Sealing surface (arrow) must be free of scratches and damage

2



- Check outer diameter ... (see chart)
- ⚠ Incorrect tube-ends must be scrapped. Tools must be cleaned and checked

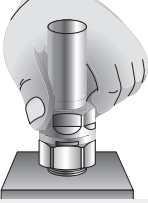
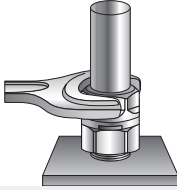
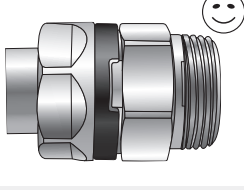
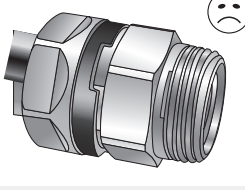
Tube O.D. check

Tube O.D.	Min. Ø	Max. Ø
6	8.3	9.3
8	10.3	11.3
10	12.5	13.5
12	14.5	15.5
15	18.0	19.0
16	19.5	20.5
18	21.0	22.6
20	24.0	25.6
22	25.5	27.1
25	29.5	31.1
28	31.5	33.1
30	34.5	36.5
35	39.0	41.0
38	42.5	44.5
42	46.0	48.0

EO-3[®] assembly instructions

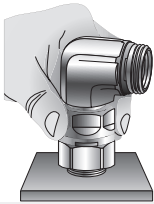
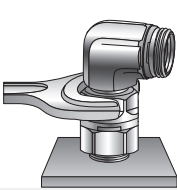
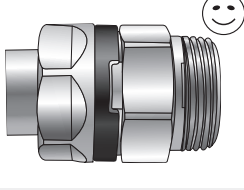
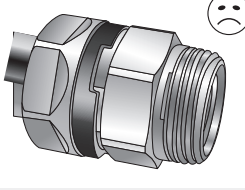
Installation of EO-3[®] tube connections

Assemble EO-3[®] tube form only with EO-3[®] tube fittings!

1		2		3		4	
	<ul style="list-style-type: none"> ● Tube must fit without tension ● Screw nut until finger-tight ⚠ Do not twist the indicator rings on the nut or stud prior to assembly 		<ul style="list-style-type: none"> ● Tighten nut with spanner 		<p>Assembly check:</p> <ul style="list-style-type: none"> ● Check, if indication marks on the indication rings of stud and nut align 		<p>Positioning of the indication ring marks do not align</p> <ul style="list-style-type: none"> ● Further tightening is required, until the marks of the indication rings of stud and nut align

Installation of EO-3[®] swivel nut fittings

Assemble EO-3[®] swivel nut fittings only with EO-3[®] tube fittings!

1		2		3		4	
	<ul style="list-style-type: none"> ● Align EO-3[®] swivel fitting ● Screw nut until finger-tight ⚠ Do not twist the indicator rings on the nut or stud prior to assembly 		<ul style="list-style-type: none"> ● Tighten nut with spanner 		<p>Assembly check:</p> <ul style="list-style-type: none"> ● Check, if indication marks on the indication rings of stud and nut align 		<p>Positioning of the indication ring marks do not align</p> <ul style="list-style-type: none"> ● Further tightening is required, until the marks of the indication rings of stud and nut align

Over-assembly of EO-3[®] tube- and swivel fittings

If the assembly of EO-3[®] tube- and swivel connections is greater than required, then the indicator ring is dragged along on the nut. The marking on the indicator rings will still show a proper assembly. The indicator rings save the last assembly position of the nut. The re-assembly in this case is finished, when the marking on the indicator rings of stud and nut align again.

Re-assembly of EO-3[®] tube- and swivel nut fittings

The repeated assembly of EO-3[®] tube and swivel connections is made by the same rules as the initial installation. It is re-assembled with the same force as during the initial assembly. The installation is correct, when the markings on the indicator rings align.

Port connections

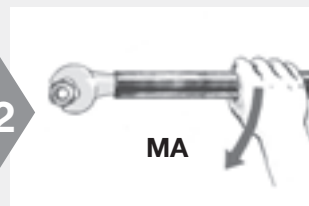


Assembly of metric straight port connections

- Metric Thread
DIN ISO 6149-2/3
- BSPP Thread G
DIN EN ISO 1179-2



- Screw in until handtight



- Then tighten according to chart

Assembly torques for EO-3[®] fittings in ports out of steel

Product	Tube O.D.	Male stud end metric	Assembly torque [Nm]	Male stud end BSPP	Assembly torque [Nm]
EO-3 [®]	6	M 10×1	18	G 1/8 A	18
	8	M 12×1.5	25	G 1/4 A	35
	10	M 14×1.5	45	G 1/4 A	35
	12	M 16×1.5	55	G 3/8 A	70
	15	M 18×1.5	70	G 1/2 A	90
	16	M 22×1.5	120	G 1/2 A	90
	18	M 22×1.5	120	G 1/2 A	90
	20	M 27×2	180	G 3/4 A	180
	22	M 27×2	180	G 3/4 A	180
	25	M 33×2	310	G 1 A	310
	28	M 33×2	310	G 1 A	310
	30	M 42×2	450	G 1 1/4 A	450
	35	M 42×2	450	G 1 1/4 A	450
	38	M 48×2	540	G 1 1/2 A	540
42	M 48×2	540	G 1 1/2 A	540	

△ Assembly in ports made of materials, which are strongly differing in strength and friction from steel, usually requires modified torques.

A reduction of torque is always required, when the turning angle from fingertight to the recommended torque is more than 30°!

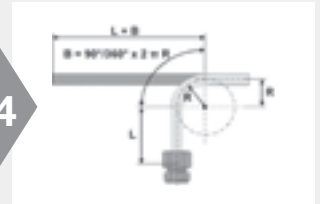
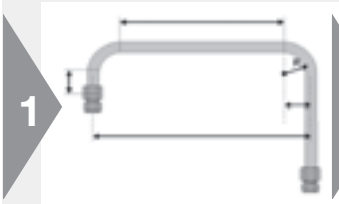
In this case it is recommended to reduce the torque:

Port material	Hardness	Torque reduction by
Steel, with use of high performance lubrication (e.g. additive to hydraulic oil)	All	10 %
Ductile cast iron (e.g. GGG 50)	All	10 %
Aluminium	HB 150	15 %
	HB 125	20 %
	HB 100	30 %
	< HB 100	35 %

Tube bending

Instructions for EO hand bending equipment

- For on-site piping jobs
- Not for mass production

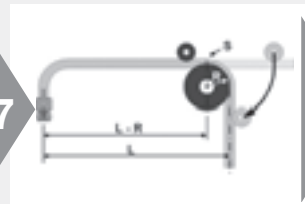
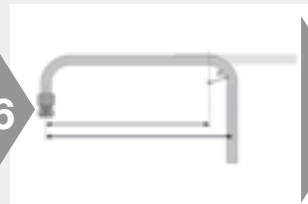
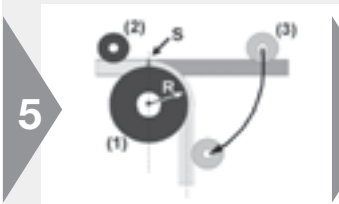


- ⚠ Think the whole process through and plan each individual step before starting
- ⚠ First bend and then cut ends to length
- Gather all dimensions like minimum straight lengths, extra length for flaring, bending radius, tube lengths for bows, etc.

- Consider steps
- Plan for clamping

- Check bending equipment specifications for limitations

- Start with first elbow
- Leave tube-end longer if in doubt



- ⚠ Mark start of bend on tube (S)
- Adjust tube between bending roll (1), clamping roll (2) and pressure roll (3)
- Bend tube by pulling lever

- Check bend angle
- Correct angle if necessary
- Gather all dimensions for next bending operation

- ⚠ Mark start of bend on tube
- Continue bending
- Check and correct each result before starting next bend

- After the last bend, check tube for angles and dimensions
- Now cut both tube-ends to correct length
- Make sure that tube fits without tension

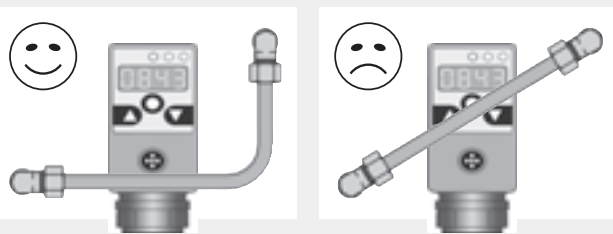
Tube line fabrication guide for leak free systems

Every hydraulic, pneumatic and lubrication system requires some form of tube fabrication and fitting installation for completion. Proper fabrication and installation are essential for the overall efficiency, leak free performance, and general appearance of any system.

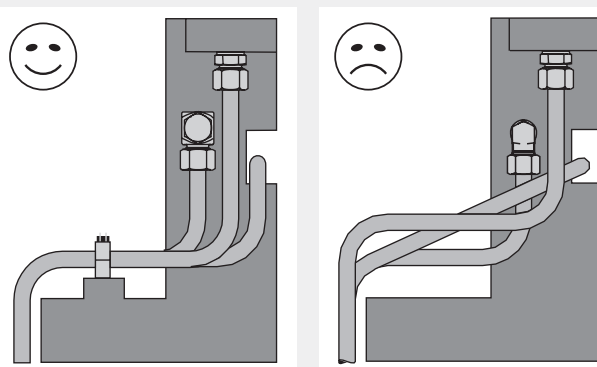
After sizing the tube lines and selecting the appropriate style of fitting, consider the following in the design of your system:

1. Accessibility of joints
2. Proper routing of lines
3. Adequate tube line supports
4. Available fabricating tools

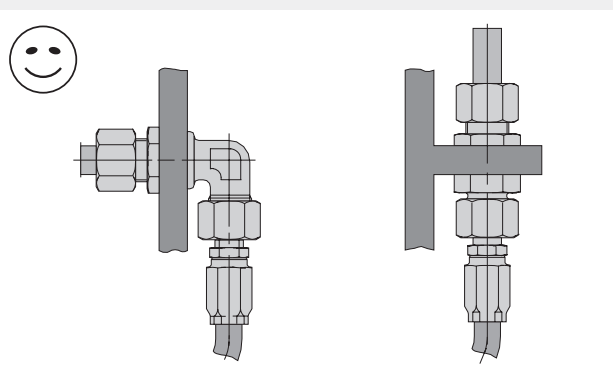
- Keep tube lines away from components that require regular maintenance:



- Right-angled – parallel – clear
- Have a neat appearance and allow for easy trouble-shooting, maintenance and repair:

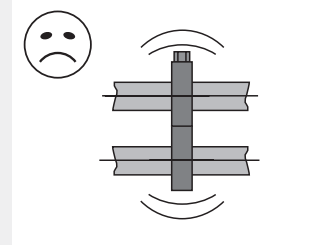
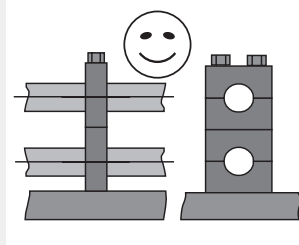


- Example for tube to hose connection:

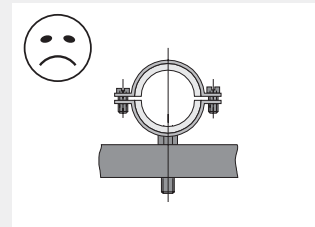
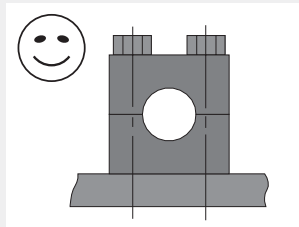


Tube line fabrication guide for leak free systems

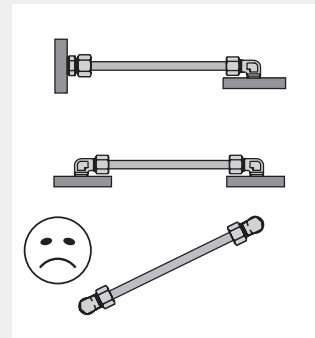
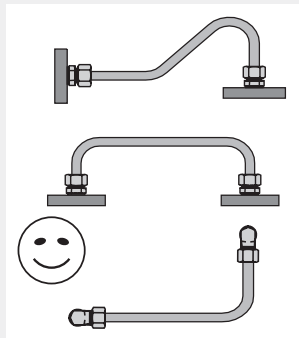
- Do not use tube lines to support other tubes
- Always fix tubes onto a rigid point with tube clamps
- Do not use cable channels to support tubes



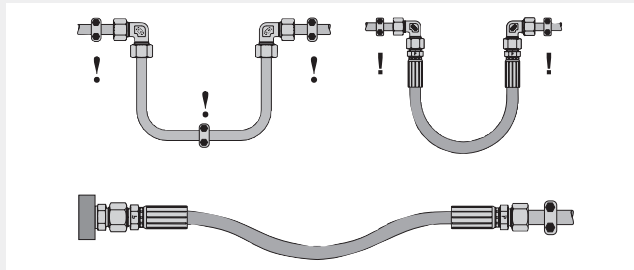
- Use appropriate tube clamps:



- Avoid excessive strain on joint:
A strained joint will eventually leak

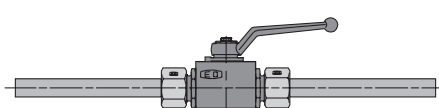
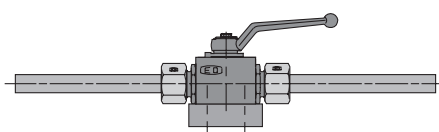


- Allow for expansion effects



Tube line fabrication guide for leak free systems

● Support against actuating forces:



Recommended tools for tube line fabrication:

Cutting:

EO Tube cutting tool AV

EO Combined tube bending and cutting tool BAV

Tube cutters:

Steel: Type Kloskut;

Stainless Steel: Type 635 B-EX,

Type 218 B-SS Tru-Kut Sawing Vice

Deburring:

Parker deburring tool no. 226 DEBURR

Bending:

EO Combined tube bending and cutting tool BAV

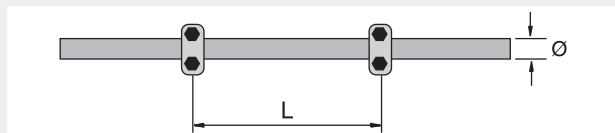
EO Tube bending tool BV 6/18, BV 20/25

EO Tube bending tool BVP (programmable)

Tube lines have to be supported in certain distances:

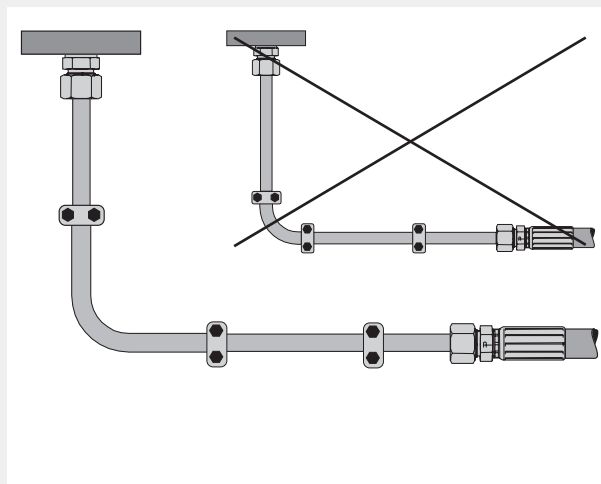
Use sufficient tube clamps to support weight

Use sufficient tube clamps to protect joints from vibration

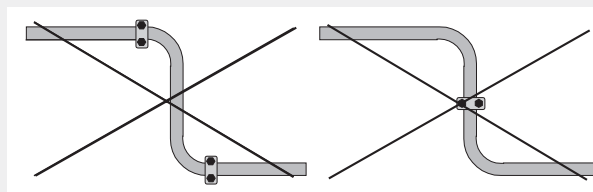
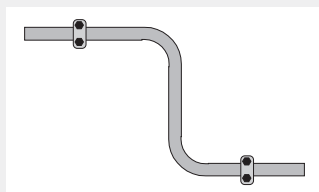


Ø [mm]	L [m]
6.0 – 12.7	1.0
12.7 – 22.0	1.2
22.0 – 32.0	1.5
32.0 – 38.0	2.0
38.0 – 57.0	2.7
57.0 – 75.0	3.0
75.0 – 76.1	3.5
76.1 – 88.9	3.7
88.9 – 102.0	4.0
102.0 – 114.0	4.5
114.0 – 168.0	5.0
168.0 – 219.0	6.0

Vibration has to be eliminated near by the connectors:

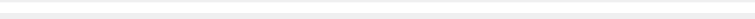


Allow expansion and contraction. Do not hamper expansion and contraction near by tube bends.





Assembly tooling



The F3 WorkCenter

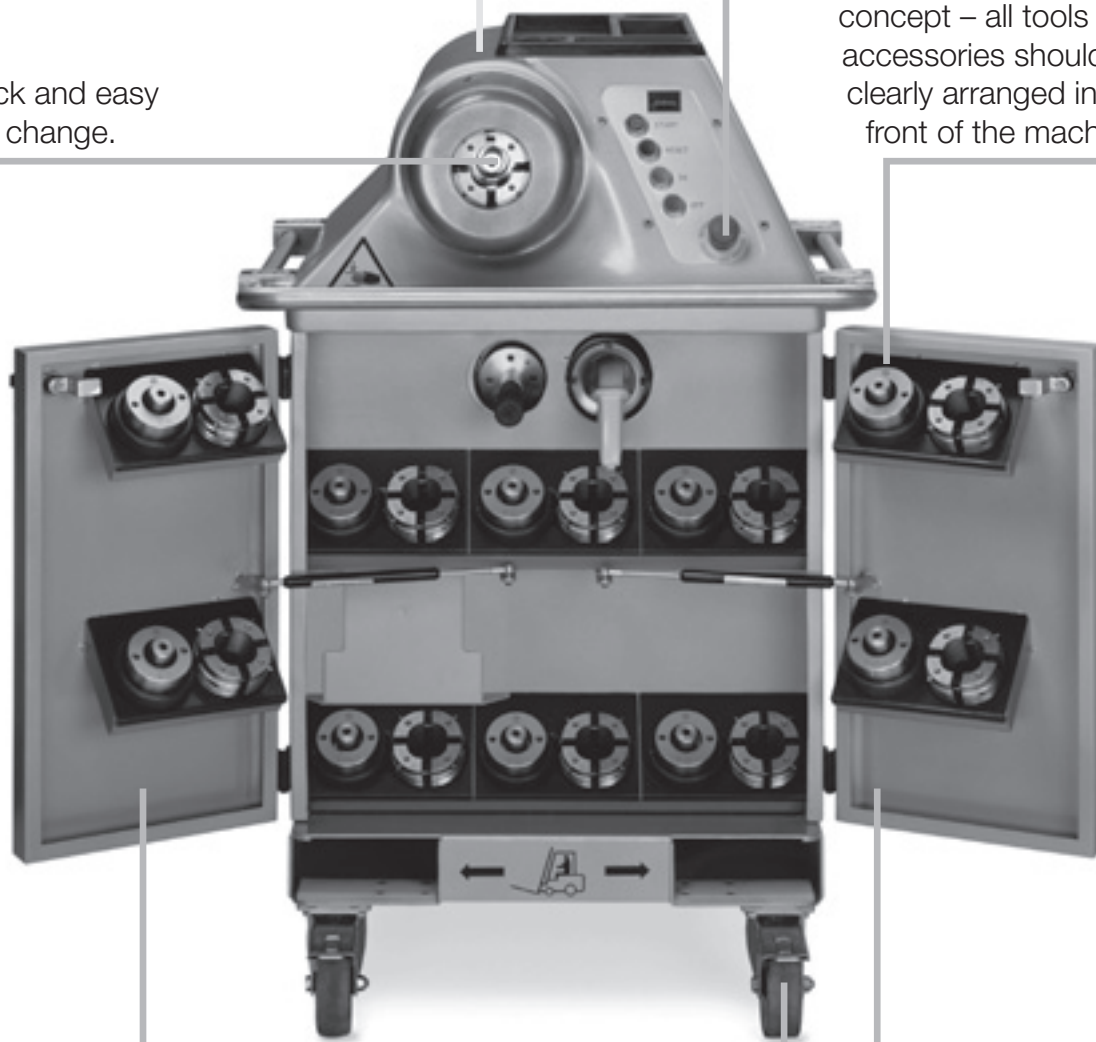
Convincing advantages in operation

Ideal for restricted space conditions. The compact clamping tool also permits the forming of short tube ends with tight bend radii.

Only press start button and the machine does the forming operation. Finish with the “zero position” or “reset” functions.

Quick and easy tool change.

The WorkCenter concept – all tools and accessories should be clearly arranged in the front of the machine.



Saves time and money compared with classical welding.

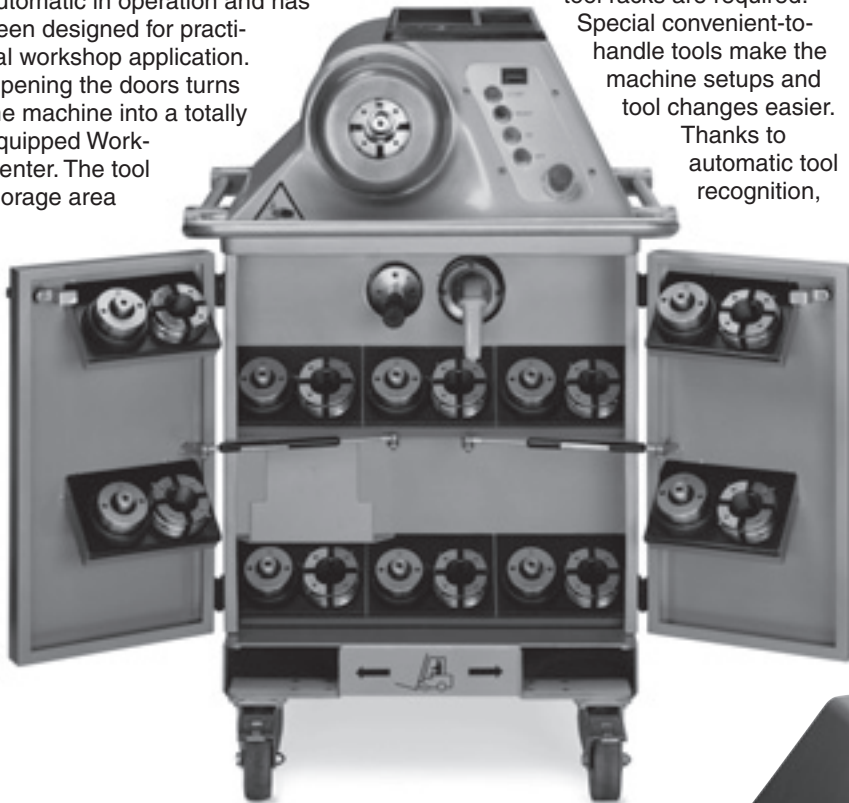
Easy and safe transportation thanks to casters and handling rail.

Clean – the EO-3® forming process operates cleanly and safely.

The F3 WorkCenter – also for EO-3®

All aboard

The WorkCenter F3 is completely automatic in operation and has been designed for practical workshop application. Opening the doors turns the machine into a totally equipped WorkCenter. The tool storage area



is located in the front – the tools are neatly laid out and easily viewed. No other workbenches or tool racks are required. Special convenient-to-handle tools make the machine setups and tool changes easier. Thanks to automatic tool recognition,

the operator has only to press the start button, whereupon the tube is formed into the correct shape in one pass. This means that EO-3®-connections are extremely simple to manufacture. The WorkCenter F3 is so reliable because of its powerful hydraulic drive and robust forming tools.

- Workshop machine for universal use
- 6 to 38/42 mm tube OD
- Cycle time approx. 20 seconds
- Especially advantageous for: Hydraulic presses, cranes and lifts, heavy machinery, shipbuilding, off-shore and hydraulic steelworks

The WorkCenter PRO22

Mass production without tears

Compared with the WorkCenter F3, the PRO22 production machine works considerably more efficiently and can machine tighter tube bends. Because of its powerful drive and efficient cooling, continuous mass production on a shift-work basis is provided for. In addition, the machine is especially quiet and vibration-free in operation. Small to medium tubes from 6 to 22 mm can be accommodated on the machine. The compact assembly head enables even tight tube bends to be machined.

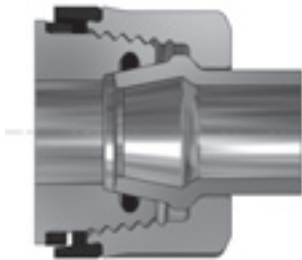
- Production machine for economical and fail-safe manufacturing
- 6 to 22 mm tube OD
- Cycle time approx. 6 seconds
- Advantageous for applications such as: manufacturers of agricultural machinery, construction machines, trucks, fork lift trucks and other mass-produced hydraulic equipment



Assembly tooling

Technical Data	
Machine	WorkCenter F3 and PRO22
Designated use	Cold forming of tube ends for tube connections
Method	Axial swaging
Suitable for	EO tube fittings to DIN EN ISO 8434-1 EO-3 [®] fittings
Tube specification	
Steel tubing	E235 / ST37.4; E355 / ST52.4
Tools	Interchangeable
Forming die sets	"MF3" single part forming die sets, one type for each tube OD
Forming pin	"BF3" forming pin with inner mandrel, one type each per tube OD, wall thickness and material
Function	
Tool change	Manual
Setting	Automatic tool recognition and pressure setting
Tube clamping	Hydraulic
Forming	Hydraulic
Controls	Automatic sequence: after pressing START button: Clamp – form – withdraw – unclamp
Environmental conditions	
Working temperature	+10 ... +50°C
Relative humidity	Msc. 90%, non-condensing

WorkCenter F3



Type	WorkCenter F3	WorkCenter PRO22
Specifications		
Type	Universal workshop machine	Powerful production machine
Design	WorkCenter	WorkCenter
Application	Alternative to welding	Efficient mass production
Weight	Approx. 330 kg	Approx. 375 kg
Dimensions (BxLxH)	800 (open: 1,300)x660x1,150	800 (open: 1,300)x1,130x1,200
Electrical supply	400 V, 50 Hz, 3 phase 230 V, 50 Hz, 3 phase 440 V, 60 Hz, 3 phase	400 V, 50 Hz, 3 phase
Electric motor drive rating	4 kW	4 kW
Oil cooler	Optional	Standard
Performance data		
Steel tube	6x1 ... 38x7/42x4	6x1 ... 20x2/22x2
Minimum width U-bend	Approx. 135 mm	Approx. 100 mm
Cycle time	15–20 sec.	Ca. 6 sec.
Economic production quantity	Max. 100 formings/hour Max. 200 forming/hour (with oil cooler)	Max. 600 formings/hour
Applications	Ideal for project and workshop tasks, small batches and on-site installations. Tubes of all sizes.	Economic mass production of small to medium tube dimensions

Features, advantages and benefits

- 1. Workcenter concept** – All tools, handling devices, lubricants and the operator manual are well organised inside the machine. Once the doors are opened, the machine turns into a stand-alone workcenter for tube preparation. On the top shelf, there are practical compartments for rules, pens, lubricant and standard EO-boxes with nuts and sealing rings. No additional workbenches or shelves for tooling are required.
- 2. Easy operation** – One single START-button is all that needs to be operated to run a forming cycle completely. No “zero position” or “reset” activities have to be performed in-between two forming cycles. For efficient mass production, a foot switch is available. A label on the machine head shows all operation steps in pictograms and all important dimensions in charts.
- 3. Easy tool change** – An ergonomic, pistol-like device allows quick and easy change of the one-piece clamping die set without opening the forming head or even touching the tools. Another handle speeds up the setup process of the forming pin in the bayonet mechanism.
- 4. Well organised** – All tools and accessories are well organised in a practical compartment inside the machine housing. Nothing gets dirty, lost or confused.
- 5. Easy transport** – The machine is equipped with heavy duty wheels so that it can be moved around by one person without hard work or additional equipment. Special attachments for crane and forklift truck transport are standard. A reeling serves as handle, protection and attachment for fixing belts when transported by truck. Tools and all accessories are safely and cleanly stored inside.
- 6. Cost saving** – Compared to welding or brazing, EO-3® is much less time consuming. Special tube preparation and finishing are not necessary. Cold forming uses only a fraction of the energy needed for brazing or welding.
- 7. Short tube ends** – The compact clamping device and special dies are suitable for machining complex tube bends.
- 8. Noise/energy loss reduction** – The process results in a smooth inner contour of the tube. Minimum pressure drop, heat and noise is created. No hidden corners allow the accumulation of air, dirt or other sources of trouble.
- 9. Clean** – The process is environmental clean and safe. As no heat is used, hazards from fumes or heat do not occur.
- 10. Zinc plated tubing** – The process allows the use of zinc-plated tubing. The costs of cleaning or painting are saved.
- 11. Quality** – Tube clamping and tool functions are fully automated. Therefore high and consistent quality is achieved without manual adjustment.

F3 and PRO22 Forming machine for EO-3[®] high pressure tube connections

Machine Type	Order code F3	Order code PRO22
EO2-FORM basic unit for forming tube ends, ready to operate with magnetic gripper, holder and operator's handbook, but without tools, packed in a special transportation box		
Universal EO2-FORM F3 machine Tube OD 6–38/42 mm 400 V, 50 Hz, 3 phase 230 V, 50 Hz, 3 phase 440 V, 60 Hz, 3 phase Rental (monthly usage) Leasing (24 leasing rate)	EO2FORMF3400V EO2FORMF3230V EO2FORMF3440V EO2FORMF3RENTFEE EO2FORMF3LEASEFEE	
Production machine EO2-FORM PRO22 Tube OD 6–20/22 mm 400 V, 50 Hz, 3 phase Rental (monthly usage) Leasing (24 leasing rate)		EO2FORM400VPRO EO2FORMPRORENTFEE EO2FORMPROLEASEFEE
Accessories Type	Order code F3	Order code PRO22
Lubrication for forming pin: 0.25 L bottle EO-NIROMONT 1L re-fill pack EO-NIROMONT	EONIROMONTFLUESSX LUBSS	EONIROMONTFLUESSX LUBSS
Oil cooler kit	F3/COOLERKIT	included
Foot switch	F3/FOOTSWITCH	F3/FOOTSWITCH
Magnetic gripper for forming pin	F3/PINHOLDER	F3/PINHOLDER
Holder for forming die set	F3/DIEHOLDER	F3/DIEHOLDER
Clamping segments for die set	F3/DIECLAMP	F3/DIECLAMP
Clamping segment spring \varnothing 8 mm	F3/DIECLAMPSRING8	F3/DIECLAMPSRING8
Clamping segment spring \varnothing 12 mm	F3/DIECLAMPSRING12	F3/DIECLAMPSRING12
Operation manual: UK, DE, FR, IT, SWE	4033	EO2FORMPRO/MANUAL
Standard preventive maintenance	EO2FORMF3/INSPECTION	EO2FORMF3/INSPECTION

WorkCenter F3 machines are shipped in special containers which should be kept for future transports to avoid damage. Please don't dispose the transport boxes!

Machine housing Type	Order code F3	Order code PRO22
Top machine cover	F3/HEADCOVER	F3PRO/08836014
Top tray	F3/TOPTRAY	F3/TOPTRAY
Door lock for tool compartment	F3/DOORLOCK	F3/DOORLOCK
Door hinge	F3/DOORHINGE	F3/DOORHINGE
Shock absorber for doors	F3/DOORSRING	F3/DOORSRING
Tool tray for inner tool compartment (top), 6x	F3/TOOLTRAYIN	F3/TOOLTRAYIN
Tool tray for inner tool compartment (bottom), 6x	F3/0883611	F3/0883611
Tool tray for tool compartment in doors, 2x	F3/TOOLTRAYDOOR	F3/TOOLTRAYDOOR
Die insert for tool tray (use screw M6)	F3/TOOLTRAYDIE	F3/TOOLTRAYDIE
Holder for magnetic gripper	F3/PINHOLDERTRAY	F3/PINHOLDERTRAY
Holder for holder	F3/DIEHOLDERTRAY	F3/DIEHOLDERTRAY
Plastic guide for forklift (use screw M6)	F3/FORKGUIDE	F3/FORKGUIDE
Front wheel with lock	F3/FRONTWHEEL	F3/FRONTWHEEL
Rear wheel	F3/BACKWHEEL	F3/BACKWHEEL



Foot switch



Magnetic gripper for forming pin



Holder for forming die set



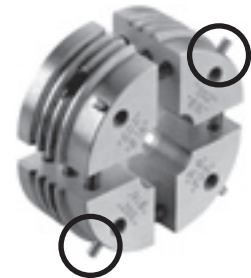
Oil cooler kit

Sticker Type	Order code F3	Order code PRO22
EO2-FORM door label	F3/STICKERPARKER	F3PRO/STICKERPARKER
Short instructions on side	F3/STICKERINSTRUC	F3PRO/STICKERINSTRUC
Lubrication on front	F3/STICKERLUB	F3/STICKERLUB
Crane attachment (1 piece)	F3/STICKERCRANE	F3/STICKERCRANE
Forklift on front	F3/STICKERFORK	F3/STICKERFORK



Pin for forming pin

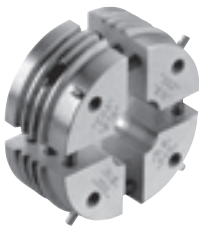


Operation panel Type	Order code F3	Order code PRO22
Front panel counter	F3/FRONTCOUNTER	F3/FRONTCOUNTER
“START” switch (black with symbol)	F3/STARTSWITCH	F3/STARTSWITCH
“RESET” switch (blue)	F3/RESETSWITCH	F3/RESETSWITCH
“ON” switch (green)	F3/ONSWITCH	F3/ONSWITCH
“OFF” switch (red)	F3/OFFSWITCH	F3/OFFSWITCH
Emergency stop switch (red)	F3/STOPSWITCH	F3/STOPSWITCH



Pin for clamping die set

Tool Components Type	Order code F3	Order code PRO22
Bayonet bolt for forming pin	F2/PINBOLT	F2/PINBOLT
Screw for clamping die segments	F3/DIESCREW	F3/DIESCREW
Spare part kit for clamping die set (4x Pin Ø4, 4x Spring Ø8, 4x Spring Ø12, 4x Screws)	F3/DIEKIT	F3/DIEKIT

F3 Forming machine for EO-3® high pressure tube connections

 <p>Clamping die set MF3EO2P3</p> <p>Usable for EO2-FORM and EO-3®</p>				 <p>Forming pin BF3P3</p> <p>With yellow dot as identification for EO-3®</p>	
Tube O.D.	Order code clamping die	Tube O.D. × S	Order code forming pin		
6	MF3EO2P306	06×1.0	BF3P306X1		
		06×1.5	BF3P306X1.5		
8	MF3EO2P308	08×1.0	BF3P308X1		
		08×1.5	BF3P308X1.5		
10	MF3EO2P310	10×1.5	BF3P310X1.5		
12	MF3EO2P312	12×1.5	BF3P312X1.5		
		12×2.0	BF3P312X2		
15	MF3EO2P315	15×1.5	BF3P315X1.5		
		15×2.0	BF3P315X2		
16	MF3EO2P316	16×2.0	BF3P16X2		
		16×2.5	BF3P316X2.5		
18	MF3EO2P318	18×1.5	BF3P318X1.5		
		18×2.0	BF3P318X2		
20	MF3EO2P320	20×2.0	BF3P320X2		
		20×2.5	BF3P320X2.5		

Assembly tooling

Tube O.D.	Order code clamping die	Tube O.D. × S	Order code forming pin
22	MF3EO2P322	22×2.0	BF3P322X2
25	MF3EO2P325	25×2.5	BF3P325X2.5
		25×3.0	BF3P325X3
28	MF3EO2P328	28×2.0	BF3P328X2
30	MF3EO2P330	30×2.5	BF3P330X2.5
		30×3.0	BF3P330X3
		30×4.0	BF3P330X4
35	MF3EO2P335	35×2.5	BF3P335X2.5
		35×3.0	BF3P335X3
38	MF3EO2P338	38×3.0	BF3P338X3
		38×4.0	BF3P338X4
		38×5.0	BF3P338X5
42	MF3EO2P342	42×3.0	BF3P342X3

Please select clamping die and forming pin according to tube dimension and material.
1) All forming pins for EO-3® are marked with a yellow dot on front surface.

Tool lifetime

Assembly tools are subject of wear and must be regularly (max. 50 assemblies) cleaned and checked. Worn out tools can cause dangerous assembly failures and must be replaced in time. Average tool lifetime is approx. 5000 cycles when properly used. Maximum lifetime can be achieved by following factors:

- Regular cleaning and checking
- Clean and corrosion-protected storage
- Proper de-burring and cleaning of tube end
- Proper tool selection and operation
- Use of specified lubricant

Lubricants

EO-NIROMONT lubricant for fitting assembly

EO-NIROMONT lubricant for flaring and forming tools

EO-NIROMONT are high performance lubricants specifically designed for the assembly of tube connections. They facilitate tightening using a low-torque when assembling joints by hand. In machine assembly, the use of EO-NIROMONT ensures that maximum tool-life is achieved. In forming processes, such as EO-3®, smooth and error-free sealing surfaces can be produced. Special additives prevent cold welding when working with stainless steel.

As opposed to when using Parker high performance lubricants, experience shows that the use of standard commercially available lubricants tend to lead to problems such as cold welding of forming tools, particularly when processing stainless steel tube.

Parker high performance lubricants – EO-NIROMONT – are offered in different containers and viscosities so that you can purchase the appropriate product in a suitable container to meet your needs:

Liquid lubricant, plastic bottle (item: EONIROMONTFLUOSSX)

Parker high performance lubricant for the lubrication of threads, progressive rings and for all cold forming processes like EO-3®. The handy plastic bottle means that it can be applied directly where the lubrication is needed. EO-NIROMONT liquid should always be available at every assembly point where hydraulic connections are being made.



EO-NIROMONT

Ordering

Type	Order code
EO-NIROMONT Assembly lubricant liquid (250 cc)	EONIROMONTFLUOSSX

Cutting and bending tools

AV 6/42 – Tube saw square

Provides a neat and quick method of cutting tube at right angles. The exact cut is achieved by hardened guides. We recommend using deeper-section sawblades that cut in both directions for best results. The AV 6/42 can be used in a vice or just be clamped onto the tube for cutting.

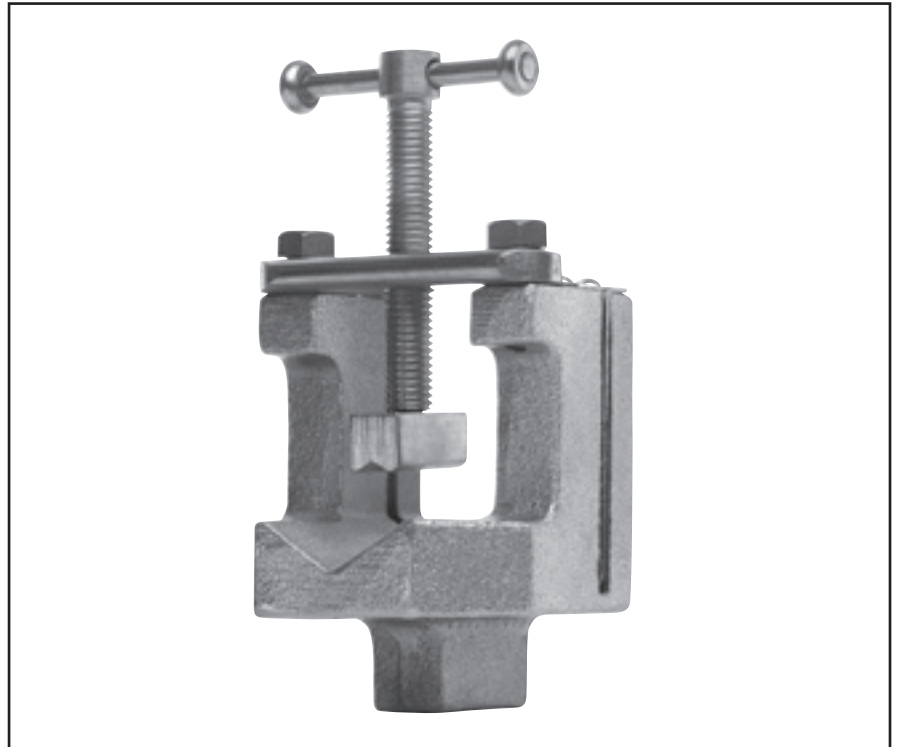
Specifications:

Tube. O.D.: 6–42 mm
Weight: approx. 0.7 kg

Type	Order code
Tube cutting tool without saw	AV06/42KPLX
Spare hardened guides	AV06/4208X

Features, advantages and benefits of tube saw square:

1. **Square cut** – Exact tube preparation greatly reduces leakage caused by assembly failures.
2. **Contour clamping** – Tube is not distorted by clamping.
3. **No vice required** – For workshop application AV 6/42 can simply be clamped onto the tube without using a vice or other attachment.
4. **Replaceable guides** – Worn out guides can easily be replaced to maintain neat cutting result.
5. **Light** – At only 0.7 kg, the AV 6/42 should be carried in the toolbox of every hydraulic tube fitter.



Cutting and bending tools

BAV 6/12 – Combined tube bending and cutting tool

The BAV 6/12 is a workshop device for neat tube cutting and simple but exact bending of small dimension EO-tube. Relatively small bending radii can be achieved.

The exact cut is achieved with hardened guides and using sawblades which are notched on both sides. The BAV 6/12 can be used in a vice or just be clamped onto a workbench.

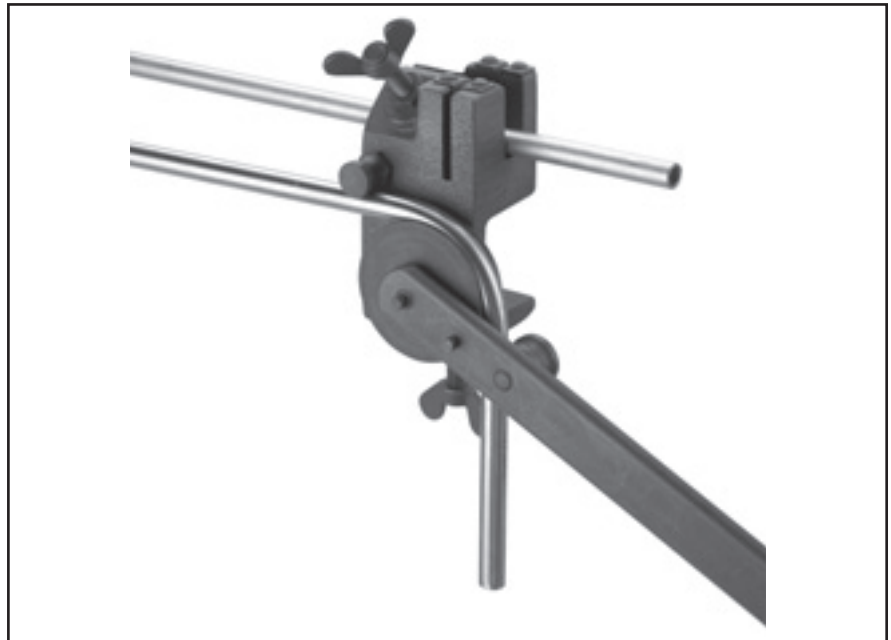
Specifications:

Tube-O.D.: 6–12 mm

Weight: approx. 2 kg

Type	Order code
Combined tube bending and cutting tool including 3 bending rolls for 6 to 12 mm tube and bending lever	BAV06/12KPLX
Spare Parts	
Spare hardened guide	BAV06/1206X
Bending roll 6/8 mm	BAV06/1209X
Bending roll 10 mm	BAV06/1210X
Bending roll 12 mm	BAV06/1211X
Bending pin	BAV06/1207X
Lever complete	BAV06/1220KPLX

Bending dimensions in mm			
Rolls for tube O.D.	6/8	10	12
Bending radius	19/20	25	26



Features, advantages and benefits of combined tube bending and cutting tool:

1. **Bending and cutting** – The BAV 6/12 is a light multi-purpose tool for all small dimension tube assemblies.
2. **Square cut** – Exact tube preparation greatly reduces leakage caused by assembly failures.

3. **No vice required** – For workshop application BAV 6/12 can simply be clamped onto a workbench.
4. **Small bending radii** – Compact tube bends allow tight assemblies.
5. **Light** – At only 2 kg, the BAV 6/12 can be easily brought to the assembly site.
6. **Optimised bending roller contour** – Special shape of bending roller allows small bends without tube flattening.

In-Ex tube deburring tool 226

Material: Aluminum with hardened steel blades

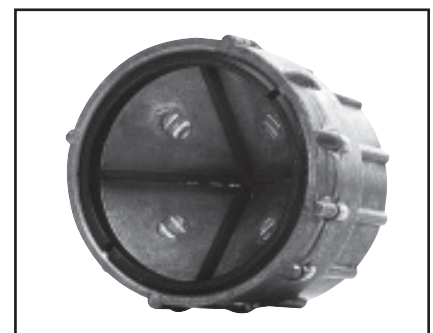
Tube-O.D.: 4 to 42 mm

Weight: 0.12 kg

Type	Order code
Tube deburrer	226A
Replacement blades	226A Blades

Features, advantages and benefits of In-Ex tube deburring tool 226:

1. **Proper deburring** – Exact tube preparation greatly reduces leakage caused by assembly failures.
2. **Replaceable blades** – Worn out blades can easily be replaced to maintain neat deburring result.
3. **Light** – At only 0.12 kg, the In-Ex tube deburring tool should be carried in the toolbox of every hydraulic tube fitter.



Cutting and bending tools

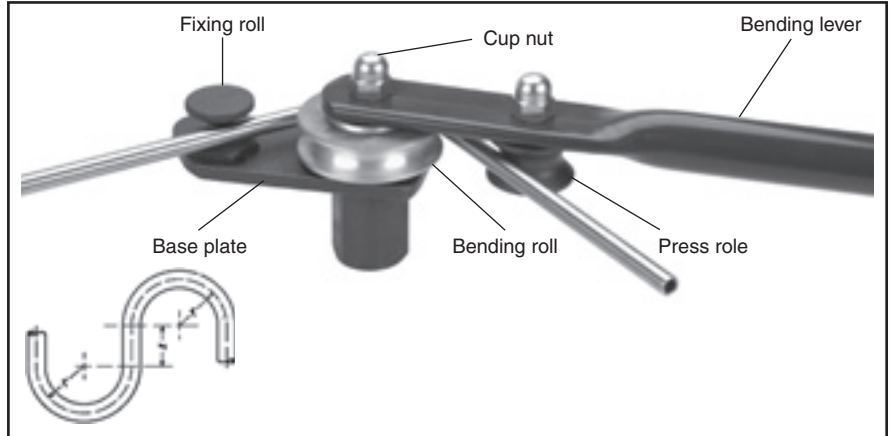
BV 6/18 – Tube bending tool

The BV 6/18 is a flexible bending device for simple but exact bending of EO-tube up to 18 mm tube O.D. The high quality bending results are achieved by 6 interchangeable bending rollers.

The fixing roller can be individually adjusted to produce a precise bend transition.

Specifications:

Tube-O.D.: 6–18 mm
Weight: approx. 4 kg



Type	Order code
Tube bending tool complete device including 6 bending rolls for 6 to 18 mm tube and bending lever	BV06/18KPLX
Spare Parts	
Bending roll 6/8 mm	BV06/1812X
Bending roll 10/12 mm	BV06/1803X
Bending roll 14 mm	BV06/1804X
Bending roll 15 mm	BV06/1805X
Bending roll 16 mm	BV06/1806X
Bending roll 18 mm	BV06/1807X
Fixing roll	BV06/1802X
Lever complete	BV06/1808KPLX

Bending dimensions in mm		
Rolls for tube O.D.	r	≈ X
6	33.0	35
8	34.0	35
10	35.5	35
12	36.5	35
14	36.5	35
15	44.0	38
16	44.0	38
18	51.5	42

Features, advantages and benefits of tube-bending tool:

- Vice mounted** – For easy workshop use, the BV can be clamped into a vice.
- Small bending radii** – Compact tube bends allow tight assemblies.
- Light** – At only 4 kg, the BV 6/18 can be easily brought to each assembly site.
- Optimised bending roller contour** – Special shape of bending roller allows small bends without tube flattening.

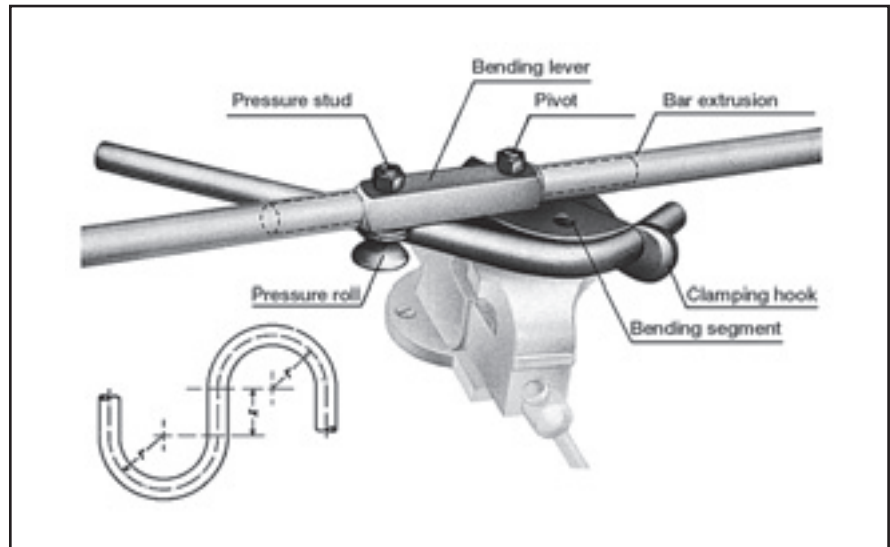
BV 20/25 – Tube bending tool

The BV 20/25 allows bending of medium size tube at the assembly site. The bending lever shows two universal studs. A bar extension can either be ordered or locally made.

Specifications:

Tube-O.D.: 20–25 mm
 3 bending segments: 20, 22, 25 mm
 Bending radius: $r = 86,5$ mm
 $x = 52$ mm
 Weight: approx. 15 kg (without bar extension)

Type	Order code
BV 20/25 Tube bending tool bending device including 3 bending segments for tube O.D. 20 to 25 mm including bending lever without bar extension tube	BV20/25KPLX
Spare Parts	
Bending segment 20 mm	BV20/2501X
Bending segment 22 mm	BV20/2502X
Bending segment 25 mm	BV20/2503X
Fixing arm	BV20/2505X
Lever complete	BV20/2506KPLX
Bar extension tube	BV20/2510X



Features, advantages and benefits of tube-bending tool:

- Rigid design** – The solid design and the bar extension allow manual bending without heating the tube.
- Optimised bending roller contour** – Special shape of bending roller allows small bends without tube flattening.
- Shaped clamping** – Tube is not distorted by clamping.
- Small bending radii** – Compact tube bends allow for compact assemblies.
- Vice mounted** – For easy workshop use, the BV can be clamped into a vice.

WZK – Tool boxes

Tools which are regularly used for tube preparation and bending are available in organized tool boxes. Two sets are available:

Features, advantages and benefits:

1. **Well organised** – Nothing gets dirty, damaged, lost or forgotten.
2. **Practical** – In one box you take everything to the assembly site.
3. **Rigid** – The solid metal box is suitable for daily workshop use.



Type	Content	Order code
Toolbox WZK1	BV6/18 tube bending tool	WZK1KOMPLX
Toolbox WZK2	BV6/18 tube Bending tool, AV6/42 tube saw square, Hacksaw, Flat file, Deburring tool, fixture for assembly cones VOMO and cone-template KONU	WZK2KOMPLX

Port cutting tools

Counterbore tools and thread taps for metric ports

For manufacturing metric ports to ISO 6149.

These tools allow correct manufacturing of metric port connections. Counterbore tools and thread taps are made of high speed tool steel (HSS).

Ordering counterbore tools



ISO 6149 Port size	Order code	
	Large Spot face ¹⁾	Small Spot face ²⁾
M 08×1.0	R1449A	R1449B
M 10×1.0	R1450A	R1450B
M 12×1.5	R1451A	R1451B
M 14×1.5	R1452A	R1452B
M 16×1.5	R1453A	R1453B
M 18×1.5	R1454A	R1454B
M 22×1.5	R1455A	R1455B
M 27×2.0	R1456A	R1456B
M 33×2.0	R1457A	R1457B
M 42×2.0	R1458A	R1458B
M 48×2.0	R1459A	R1459B

1) with ID-groove

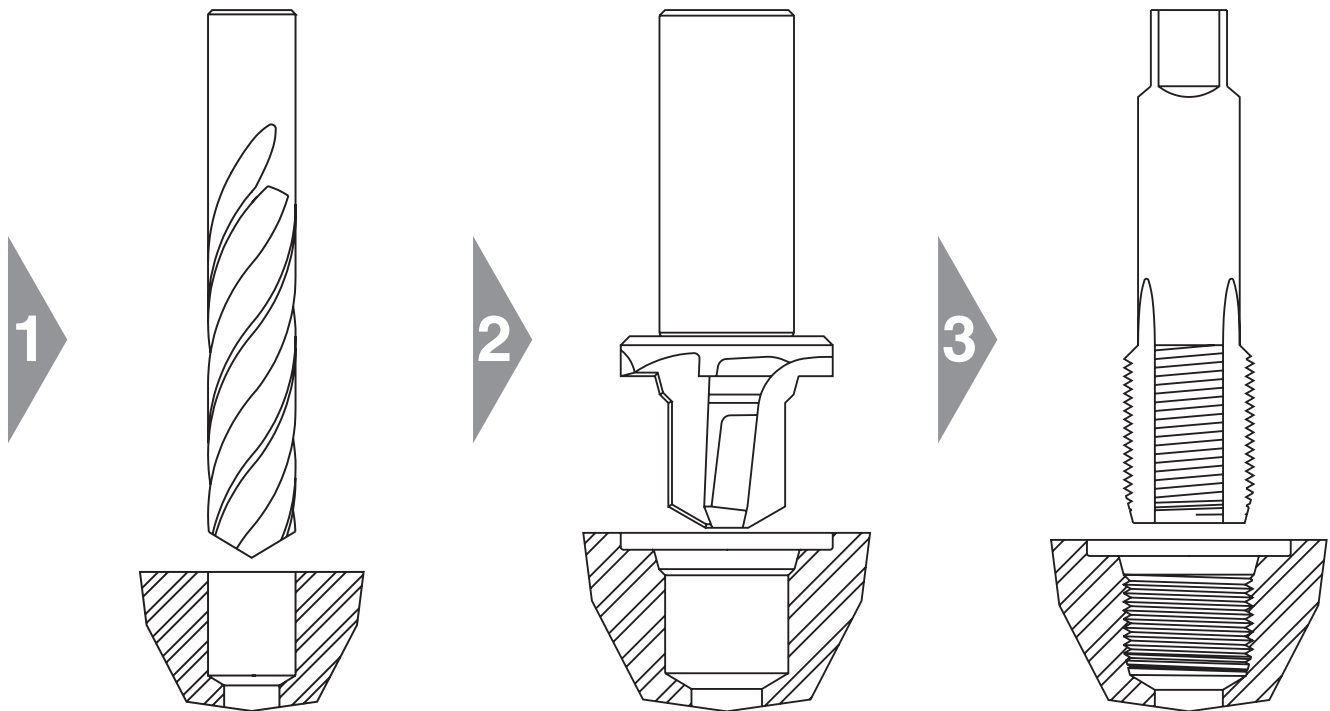
2) without ID-groove

Ordering thread taps



ISO 6149 Port size	Order code
M08	M08×1-6H-TAP
M10	M10×1-6H-TAP
M12	M12×1.5-6H-TAP
M14	M14×1.5-6H-TAP
M16	M16×1.5-6H-TAP
M18	M18×1.5-6H-TAP
M22	M22×1.5-6H-TAP
M27	M27×2-6H-TAP
M33	M33×2-6H-TAP
M42	M42×2-6H-TAP
M48	M48×2-6H-TAP

Operation of port cutting tools



1. Pilot hole drilling

2. Port counterboring

3. Thread tapping

Note:

All dimensions must be according to relevant standards.

It is necessary to create a spotface surface which is flat and perpendicular to the port. Smooth finish to prevent leakage or O-ring extrusion.

Parker counterbore tools are made from high speed tool steel (HSS). Regular HSS port tapping tools are intended for workshop use and repair.

Maximum lifetime of Parker counterbores can be achieved by:

- use for cutting mild steel or aluminium only
- staying within recommended cutting speed for HSS / port material
- sufficient lubrication and cooling
- workshop use and repair only

For serial production of hydraulic ports, these Parker workshop tools are not suitable.

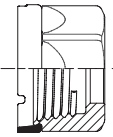
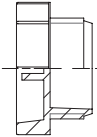
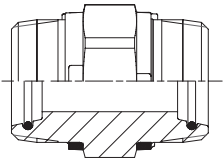
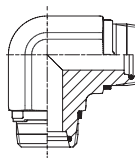
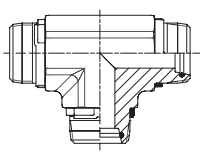
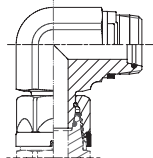
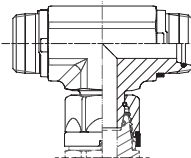
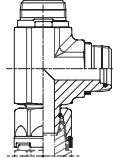
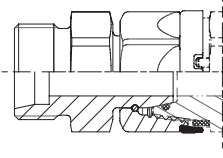
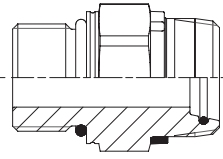
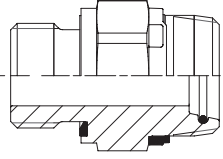
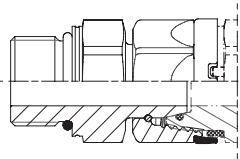
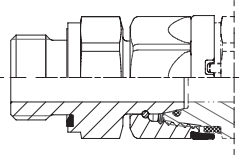
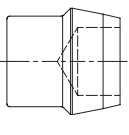
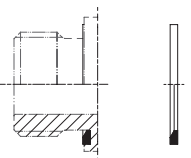
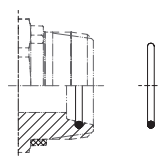
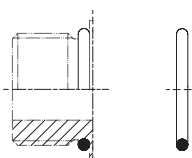
For production, Parker generally recommends to use hard carbide alloy.



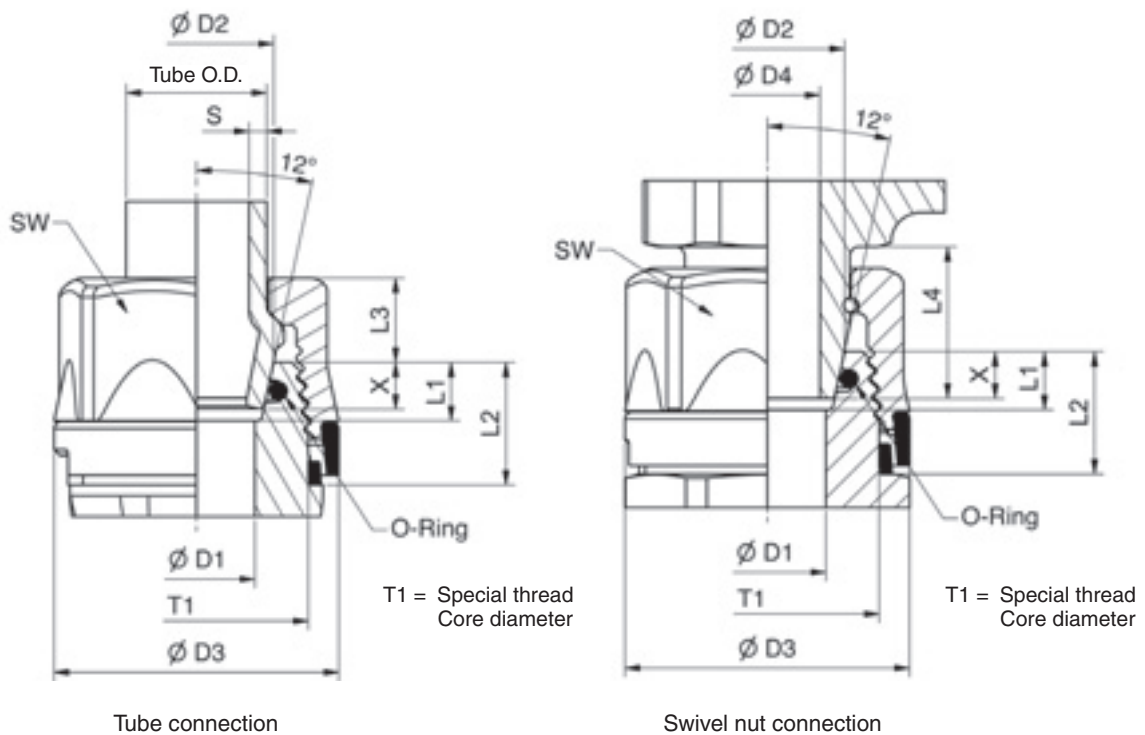
EO[®] Ermeto Original
EO-3[®] Tube fittings

EO-3®-Tube fittings

Visual index (extract)

Fitting components	 <p>M p. 54</p>	 <p>SCHU p. 54</p>			
Tube/Tube	 <p>G p. 55</p>	 <p>W p. 56</p>	 <p>T p. 57</p>		
Tube/Swivel	 <p>EW p. 58</p>	 <p>ET p. 59</p>	 <p>EL p. 60</p>		
Adapter	 <p>AD p. 61</p>				
Male Stud connector	 <p>GE-OR p. 62</p>	 <p>GE-ED p. 63</p>	 <p>EGE-OR p. 64</p>	 <p>EGE-ED p. 65</p>	
Plug	 <p>VKA p. 66</p>				
Components	 <p>ED p. 67</p>	 <p>OR-EO3 p. 68</p>	 <p>OR p. 69</p>		

EO-3® connection measurements



Tube O.D.	SW	D1	D2	D3	D4	T1	L1	L2	L3	L4	X	O-Ring
6	14	4	7.05	16.0	3.5	11.5	4.5	9.5	5.0	11.0	4.0	06x1.2
8	17	6	9.20	19.5	5.0	14.5	5.0	9.5	6.0	12.0	4.5	08x1.5
10	19	8	11.20	21.0	7.0	16.5	5.0	9.5	6.5	12.5	4.5	10.5x1.5
12	22	10	13.20	24.5	9.0	19	5.0	10.5	6.5	13.0	4.5	12.5x1.5
15	27	12	16.10	30.5	11.0	24	5.0	14.0	8.0	14.0	4.5	15x1.5
16	27	12	17.50	30.5	12.0	24	6.0	14.0	8.0	15.0	5.5	16x1.5
18	30	15	19.50	32.0	14.0	26	6.0	14.0	8.0	15.0	5.5	18x1.5
20	32	16	21.35	35.0	15.0	29.5	6.0	16.0	9.5	18.0	5.5	20x1.5
22	32	18	23.35	35.0	17.0	29.5	6.0	12.0	8.5	17.0	5.5	22x1.5
25	41	20	26.80	43.5	19.0	37	7.0	18.0	10.0	20.5	6.5	25.12x1.78
28	41	24	29.60	43.5	23.0	37	7.0	14.0	8.5	18.5	6.5	28.3x1.78
30	50	25	32.10	51.5	23.0	43.5	8.0	20.0	12.0	23.0	7.5	29.87x1.78
35	50	30	37.10	51.5	29.0	45	8.0	16.0	10.0	20.5	7.5	34.65x1.78
38	60	32	40.60	58.5	30.0	52	9.0	22.0	13.0	25.0	8.0	37.82x1.78
42	60	36	44.10	58.5	36.0	52	8.0	18.0	10.0	21.5	7.5	42.5x1.78

M EO-3® Nut

X1) Indication-ring



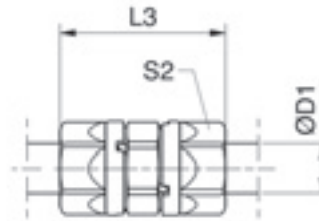
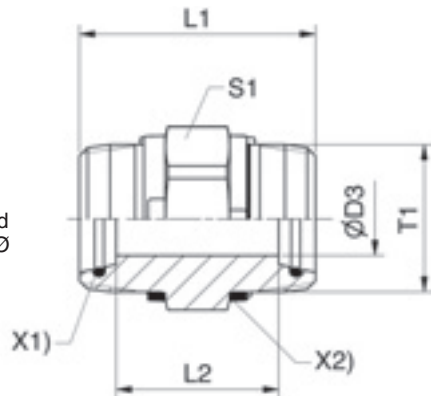
Tube A.D.	D1	D2	L1	S1	Weight g/1 piece	Order code	Order code protection cap	PN
6	6.5	16	14	14	8	M06P3CF	SCHU06P3X	420
8	8.5	19.5	15	17	12	M08P3CF	SCHU08P3X	420
10	10.5	21	15	19	14	M10P3CF	SCHU10P3X	420
12	12.5	24.5	17	22	21	M12P3CF	SCHU12P3X	420
15	15.5	30.5	20.5	27	36	M15P3CF	SCHU15-16P3X	420
16	16.5	30.5	20.5	27	35	M16P3CF	SCHU15-16P3X	420
18	18.5	32	20.5	30	44	M18P3CF	SCHU18P3X	420
20	20.5	35	24.5	32	59	M20P3CF	SCHU20-22P3X	420
22	22.5	35	20	32	42	M22P3CF	SCHU20-22P3X	250
25	25.5	43.5	28.5	41	104	M25P3CF	SCHU25-28P3X	420
28	28.5	43.5	22.5	41	71	M28P3CF	SCHU25-28P3X	250
30	30.5	51.5	31.5	50	179	M30P3CF	SCHU30P3X	420
35	35.5	51.5	25.5	50	107	M35P3CF	SCHU35P3X	250
38	38.5	58.5	34.5	60	268	M38P3CF	SCHU38-42P3X	420
42	42.5	58.5	27.5	60	178	M42P3CF	SCHU38-42P3X	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

Protection caps SCHU for EO-3® nuts for ready-for-use tube and hose lines. The caps keep the nut in position, prevent the lines from dirt and save the indicator ring while handling with the lines.

G EO-3® Union

X1) O-ring
 X2) Indication-ring
 T1 = Special thread characteristic-Ø



D1	D3	T1	L1	L2	L3	S1	S2	Weight g/1 piece	Order code*	PN
6	4	11.5	25	16	35	14	14	19	G06P3OMDCF	420
8	6	14.5	25.5	15.5	37.5	17	17	28	G08P3OMDCF	420
10	8	16.5	26.5	16.5	39.5	19	19	35	G10P3OMDCF	420
12	10	19	29.5	19.5	42.5	22	22	51	G12P3OMDCF	420
15	12	24	38.5	28.5	54.5	27	27	108	G15P3OMDCF	420
16	12	24	38.5	26.5	54.5	27	27	104	G16P3OMDCF	420
18	15	26	39.5	27.5	55.5	30	30	119	G18P3OMDCF	420
20	16	29.5	44.5	32.5	63.5	32	32	166	G20P3OMDCF	420
22	18	29.5	36.5	24.5	53.5	32	32	124	G22P3OMDCF	250
25	20	37	51	37	71	41	41	309	G25P3OMDCF	420
28	24	37	43	29	60	41	41	225	G28P3OMDCF	250
30	25	43.5	57	41	81	50	50	488	G30P3OMDCF	420
35	30	45	49	33	69	50	50	370	G35P3OMDCF	250
38	32	52	62	44	88	55	60	624	G38P3OMDCF	420
42	36	52	54	38	74	55	60	467	G42P3OMDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

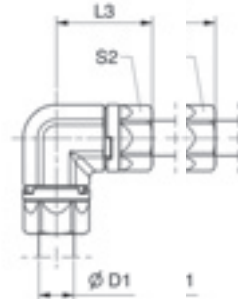
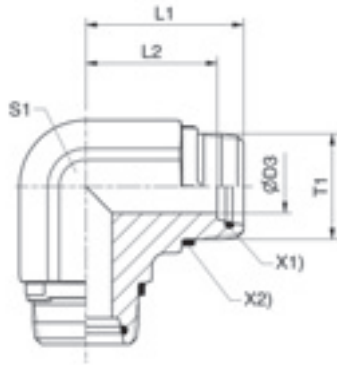
Delivery without nuts

* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

W EO-3® Union elbow

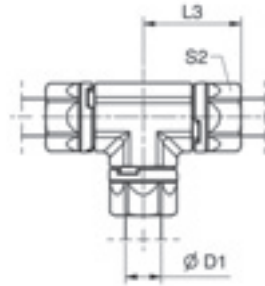
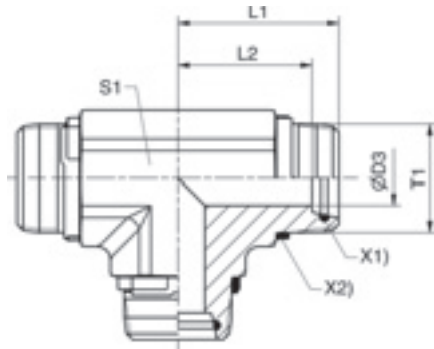


X1) O-ring
 X2) Indication-ring
 T1 = Special thread characteristic-Ø

D1	D3	T1	L1	L2	L3	S1	S2	Weight g/1 piece	Order code*	PN
6	4	11.5	21.5	17	26.5	13	14	36	W06P3OMDCF	420
8	6	14.5	25.5	20.5	31.5	14	17	54	W08P3OMDCF	420
10	8	16.5	25	20	31.5	19	19	81	W10P3OMDCF	420
12	10	19	29	24	35.5	19	22	97	W12P3OMDCF	420
15	12	24	36	31	44	27	27	236	W15P3OMDCF	420
16	12	24	36	30	44	27	27	235	W16P3OMDCF	420
18	15	26	39	33	47	27	30	242	W18P3OMDCF	420
20	16	29.5	42	36	51.5	33	32	385	W20P3OMDCF	420
22	18	29.5	38	32	46.5	33	32	333	W22P3OMDCF	250
25	20	37	49	42	59	41	41	706	W25P3OMDCF	420
28	24	37	45	38	53.5	41	41	575	W28P3OMDCF	250
30	25	43.5	55.5	47.5	67.5	48	50	1075	W30P3OMDCF	420
35	30	45	51.5	43.5	61.5	48	50	873	W35P3OMDCF	250
38	32	52	60	51	73	50	60	1170	W38P3OMDCF	420
42	36	52	56	48	66	50	60	925	W42P3OMDCF	250

$$\frac{PN \text{ (bar)}}{10} = PN \text{ (MPa)}$$

Delivery without nuts
 * Please add the **suffixes** below according to the sealing material required
 NBR = Standard, no suffix required
 FKM = on request

T EO-3® Union Tee


X1) O-ring
 X2) Indication-ring
 T1 = Special thread
 characteristic-Ø

D1	D3	T1	L1	L2	L3	S1	S2	Weight g/1 piece	Order code*	PN
6	4	11.5	21.5	17	26.5	13	14	57	T06P3OMDCF	420
8	6	14.5	25.5	20.5	31.5	14	17	84	T08P3OMDCF	420
10	8	16.5	25	20	31.5	19	19	118	T10P3OMDCF	420
12	10	19	29	24	35.5	19	22	149	T12P3OMDCF	420
15	12	24	36	31	44	27	27	342	T15P3OMDCF	420
16	12	24	36	30	44	27	27	339	T16P3OMDCF	420
18	15	26	39	33	47	27	30	361	T18P3OMDCF	420
20	16	29.5	42	36	51.5	33	32	550	T20P3OMDCF	420
22	18	29.5	38	32	46.5	33	32	451	T22P3OMDCF	250
25	20	37	49	42	59	41	41	998	T25P3OMDCF	420
28	24	37	45	38	53.5	41	41	779	T28P3OMDCF	250
30	25	43.5	55.5	47.5	67.5	41	50	1249	T30P3OMDCF	420
35	30	45	51.5	43.5	61.5	41	50	893	T35P3OMDCF	250
38	32	52	60	51	73	50	60	1751	T38P3OMDCF	420
42	36	52	56	48	66	50	60	1416	T42P3OMDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

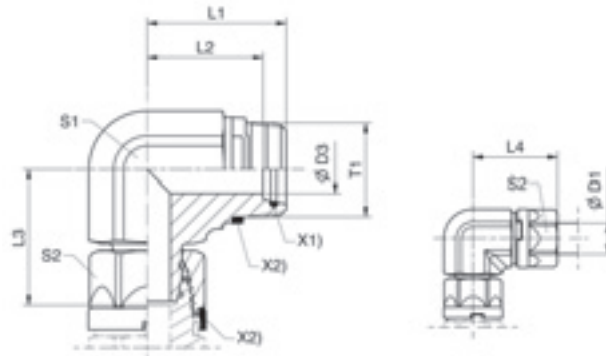
Delivery without nuts

* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

EW EO-3® Adjustable swivel Elbow



X1) O-ring
 X2) Indication-ring
 T1 = Special thread
 characteristic-Ø

D1	D3	T1	L1	L2	L3	L4	S1	S2	Weight g/1 piece	Order code*	PN
6	4	11,5	21,5	17	21,5	26,5	13	14	39	EW06P3OMDCF	420
8	6	14,5	25,5	20,5	25	31,5	14	17	56	EW08P3OMDCF	420
10	8	16,5	25	20	26,5	31,5	19	19	87	EW10P3OMDCF	420
12	10	19	29	24	27	35,5	19	22	101	EW12P3OMDCF	420
15	12	24	36	31	34,5	44	27	27	247	EW15P3OMDCF	420
16	12	24	36	30	34,5	44	27	27	239	EW16P3OMDCF	420
18	15	26	39	33	34,5	47	27	30	249	EW18P3OMDCF	420
20	16	29,5	42	36	41,5	51,5	33	32	407	EW20P3OMDCF	420
22	18	29,5	38	32	40,5	46,5	33	32	354	EW22P3OMDCF	250
25	20	37	49	42	49,5	59	41	41	747	EW25P3OMDCF	420
28	24	37	45	38	47,5	53,5	41	41	616	EW28POMD3CF	250
30	25	43,5	55,5	47,5	55,5	67,5	48	50	1146	EW30P3OMDCF	420
35	30	45	51,5	43,5	53	61,5	48	50	925	EW35P3OMDCF	250
38	32	52	60	51	60	73	50	60	1328	EW38P3OMDCF	420
42	36	52	56	48	56	66	50	60	1018	EW42P3OMDCF	250

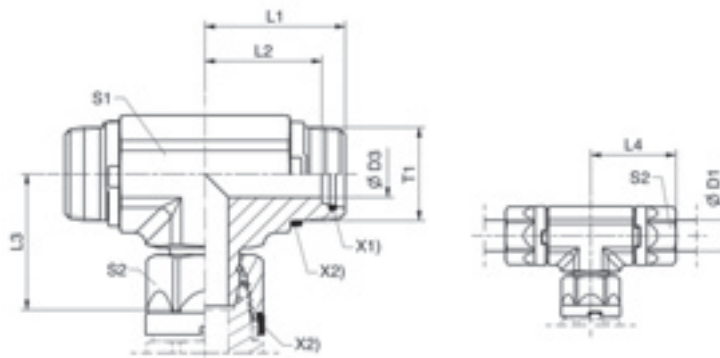
$$\frac{PN \text{ (bar)}}{10} = PN \text{ (MPa)}$$

Delivery without nut at tube side

* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

ET EO-3® Adjustable swivel branch tee


X1) O-ring
 X2) Indication-ring
 T1 = Special thread
 characteristic-Ø

D1	D3	T1	L1	L2	L3	L4	S1	S2	Weight g/1 piece	Order code*	PN
6	4	11.5	21.5	17	21.5	26.5	13	14	52	ET06P3OMDCF	420
8	6	14.5	25.5	20.5	25	31.5	14	17	76	ET08P3OMDCF	420
10	8	16.5	25	20	26.5	31.5	19	19	111	ET10P3OMDCF	420
12	10	19	29	24	27	35.5	19	22	134	ET12P3OMDCF	420
15	12	24	36	31	34.5	44	27	27	318	ET15P3OMDCF	420
16	12	24	36	30	34.5	44	27	27	310	ET16P3OMDCF	420
18	15	26	39	33	34.5	47	27	30	324	ET18P3OMDCF	420
20	16	29.5	42	36	41.5	51.5	33	32	515	ET20P3OMDCF	420
22	18	29.5	38	32	40.5	46.5	33	32	436	ET22P3OMDCF	250
25	20	37	49	42	49.5	59	41	41	941	ET25P3OMDCF	420
28	24	37	45	38	47.5	53.5	41	41	753	ET28P3OMDCF	250
30	25	43.5	55.5	47.5	55.5	67.5	41	50	1158	ET30P3OMDCF	420
35	30	45	51.5	43.5	53	61.5	41	50	838	ET35P3OMDCF	250
38	32	52	60	51	60	73	50	60	1648	ET38P3OMDCF	420
42	36	52	56	48	56	66	50	60	1240	ET42P3OMDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

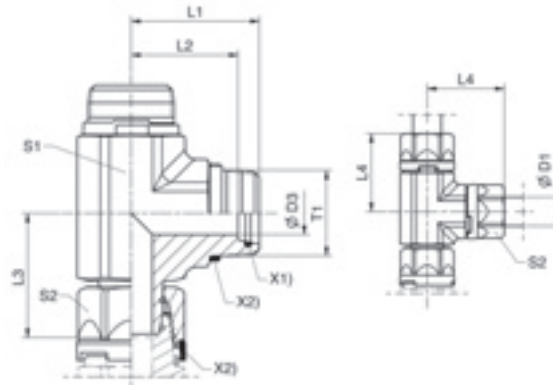
Delivery without nut at tube side

* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

EL EO-3® Adjustable swivel run tee



X1) O-ring
 X2) Indication-ring
 T1 = Special thread
 characteristic-Ø

D1	D3	T1	L1	L2	L3	L4	S1	S2	Weight g/1 piece	Order code*	PN
6	4	11.5	21.5	17	21.5	26.5	13	14	51	EL06P3OMDCF	420
8	6	14.5	25.5	20.5	25	31.5	14	17	76	EL08P3OMDCF	420
10	8	16.5	25	20	26.5	31.5	19	19	111	EL10P3OMDCF	420
12	10	19	29	24	27	35.5	19	22	134	EL12P3OMDCF	420
15	12	24	36	31	34.5	44	27	27	317	EL15P3OMDCF	420
16	12	24	36	30	34.5	44	27	27	310	EL16P3OMDCF	420
18	15	26	39	33	34.5	47	27	30	324	EL18P3OMDCF	420
20	16	29.5	42	36	41.5	51.5	33	32	514	EL20P3OMDCF	420
22	18	29.5	38	32	40.5	46.5	33	32	435	EL22P3OMDCF	250
25	20	37	49	42	49.5	59	41	41	940	EL25P3OMDCF	420
28	24	37	45	38	47.5	53.5	41	41	751	EL28P3OMDCF	250
30	25	43.5	55.5	47.5	55.5	67.5	41	50	1163	EL30P3OMDCF	420
35	30	45	51.5	43.5	53	61.5	41	50	836	EL35P3OMDCF	250
38	32	52	60	51	60	73	50	60	1644	EL38P3OMDCF	420
42	36	52	56	48	56	66	50	60	1240	EL42P3OMDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

Delivery without nut at tube side

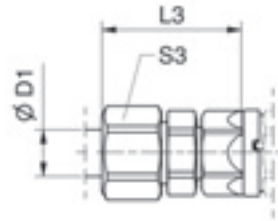
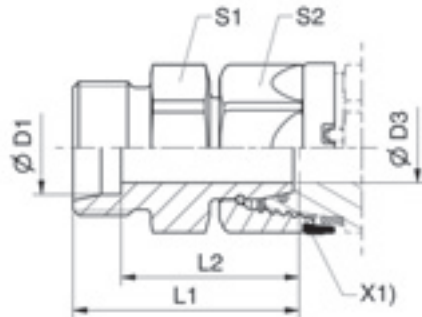
* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

AD EO-3® DIN-Adapter

EO 24° connection (ISO 8434-1)



X1) Indication-ring
X2) O-ring

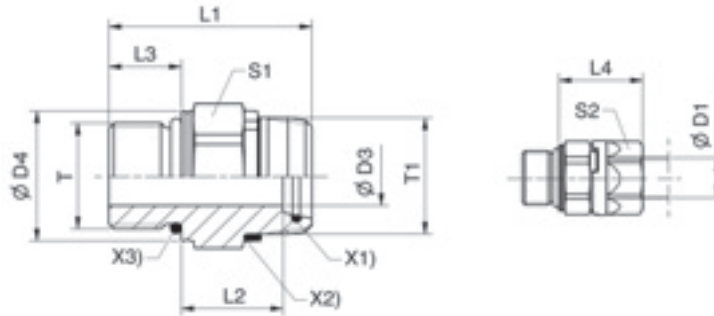
D1	Series	D3	L1	L2	L3	S1	S2	S3	Weight g/1 piece	Order code	PN
6	L	3.5	27	20	35	14	14	14	21	AD06P306LOMDCF	420
8	L	5	28.5	21.5	36.5	19	17	17	29	AD08P308LOMDCF	420
10	L	7	30.5	23.5	28.5	19	19	19	38	AD10P310LOMDCF	420
12	L	9	32	25	40	22	22	22	52	AD12P312LOMDCF	420
15	L	11	34	27	42	27	27	27	95	AD15P315LOMDCF	420
16	S	12	40	31.5	49.5	27	27	30	117	AD16P316SOMDCF	420
18	L	14	38	30.5	46.5	27	30	32	123	AD18P318LOMDCF	420
20	S	15	47	36.5	58.5	32	32	36	197	AD20P320SOMDCF	420
22	L	17	44	36.5	52.5	32	32	36	165	AD22P322LOMDCF	250
25	S	19	54	42	66	41	41	46	353	AD25P325SOMDCF	420
28	L	23	48	39	57.5	41	41	41	272	AD28P328LOMDCF	250
30	S	24	59.5	46	73	50	50	50	515	AD30P330SOMDCF	420
35	L	29	54	43.5	65.5	50	50	50	441	AD35P335LOMDCF	250
38	S	30	66	50	81	55	60	60	797	AD38P338SOMDCF	420
42	L	36	56	45	68	55	60	60	565	AD42P342LOMDCF	250

$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$

Delivery without nut at tube side

GE-OR Male stud EO-3® connector

Metric male stud end - O-ring (ISO 6149-2/-3)



X1) O-ring
 X2) Indication-ring
 X3) O-ring
 T1 = Special thread characteristic-Ø

D1	T	D3	D4	T1	L1	L2	L3	L4	S1	S2	Weight g/1 piece	Order code*	PN
6	M10X1	4	14	11.5	25.5	12.5	8.5	22	14	14	18	GE06P3MOROMDCF	420
8	M12X1.5	6	17	14.5	29.5	13.5	11	24.5	17	17	29	GE08P3MOROMDCF	420
10	M14X1.5	7	19	16.5	30.5	14.5	11	26	19	19	39	GE10P3MOROMDCF	420
12	M16X1.5	9	22	19	33	16.5	11.5	28	22	22	53	GE12P3MOROMDCF	420
15	M18X1.5	11	24	24	39.5	22	12.5	35	27	27	95	GE15P3MOROMDCF	420
16	M22X1.5	12	27	24	42	21	15	35	27	27	110	GE16P3MOROMDCF	420
18	M22X1.5	14	27	26	41	22	13	36	30	30	115	GE18P3MOROMDCF	420
20	M27X2	15	32	29.5	49.5	25	18.5	40.5	32	32	180	GE20P3MOROMDCF	420
22	M27X2	18	32	29.5	43	21	16	35.5	32	32	137	GE22P3MOROMDCF	250
25	M33X2	20	41	37	54.5	29	18.5	46	41	41	315	GE25P3MOROMDCF	420
28	M33X2	23	41	37	48	25	16	40.5	41	41	241	GE28P3MOROMDCF	250
30	M42X2	25	50	43.5	59	32	19	52	50	50	512	GE30P3MOROMDCF	420
35	M42X2	30	50	45	52	28	16	46	50	50	386	GE35P3MOROMDCF	250
38	M48X2	32	55	52	64.5	34	21.5	56	55	60	633	GE38P3MOROMDCF	420
42	M48X2	36	55	52	56.5	31	17.5	49	55	60	474	GE42P3MOROMDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

Delivery without nut

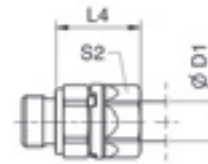
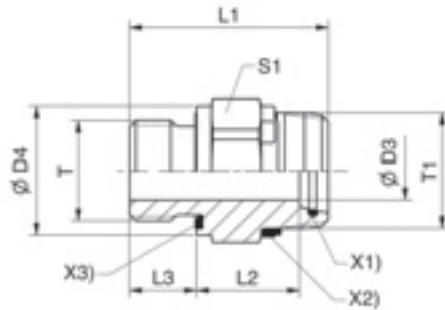
* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

GE-R-ED Male stud EO-3® connector

Inch male stud end - ED (ISO 1179-2)



X1) O-ring
 X2) Indication-ring
 X3) Eolastic-sealing ED
 T1 = Special thread characteristic-Ø

D1	T	D3	D4	T1	L1	L2	L3	L4	S1	S2	Weight g/1 piece	Order code*	PN
6	G 1/8 A	4	14	11.5	25	12.5	8	22	14	14	18	GE06P3REDOMDCF	420
8	G 1/4 A	6	19	14.5	31	14	12	25	19	17	36	GE08P3REDOMDCF	420
10	G 1/4 A	6	19	16.5	31	14	12	25.5	19	19	37	GE10P3REDOMDCF	420
12	G 3/8 A	9	22	19	33.5	16.5	12	28	22	22	55	GE12P3REDOMDCF	420
15	G 1/2 A	12	27	24	41.5	22.5	14	35.5	27	27	105	GE15P3REDOMDCF	420
16	G 1/2 A	12	27	24	41.5	21.5	14	35.5	27	27	103	GE16P3REDOMDCF	420
18	G 1/2 A	14	27	26	42.5	22.5	14	36.5	30	30	111	GE18P3REDOMDCF	420
20	G 3/4 A	16	32	29.5	47.5	25.5	16	41	32	32	166	GE20P3REDOMDCF	420
22	G 3/4 A	18	32	29.5	43.5	21.5	16	36	32	32	135	GE22P3REDOMDCF	250
25	G 1 A	20	40	37	54	29	18	46	41	41	307	GE25P3REDOMDCF	420
28	G 1 A	23	40	37	50	25	18	40.5	41	41	242	GE28P3REDOMDCF	250
30	G 1 1/4 A	25	50	43.5	60	32	20	52	50	50	510	GE30P3REDOMDCF	420
35	G 1 1/4 A	30	50	45	56	28	20	46	50	50	397	GE35P3REDOMDCF	250
38	G 1 1/2 A	32	55	52	65	34	22	56	55	60	626	GE38P3REDOMDCF	420
42	G 1 1/2 A	36	55	52	61	31	22	49	55	60	490	GE42P3REDOMDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

Delivery without nut

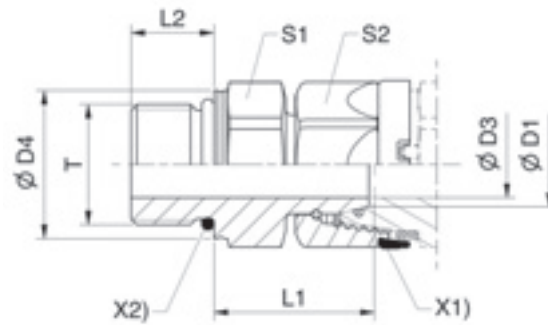
* Please add the **suffixes** below according to the sealing material required

NBR = Standard, no suffix required

FKM = on request

EGE-OR Swivel EO-3® connector

Metric male stud end - O-ring (ISO 6149-2/-3)



X1) Indication-ring
X2) O-ring

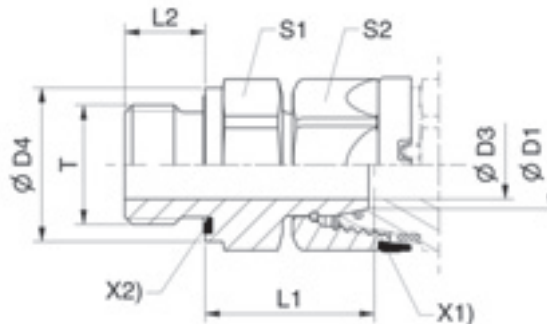
D1	T	D3	D4	L1	L2	S1	S2	Weight g/1 piece	Order code*	PN
6	M10X1	3,5	14	19	8,5	14	14	23	EGE06P3MORCF	420
8	M12X1,5	5	17	21,5	11	17	17	36	EGE08P3MORCF	420
10	M14X1,5	7	19	23	11	19	19	47	EGE10P3MORCF	420
12	M16X1,6	9	22	24,5	11,5	22	22	67	EGE12P3MORCF	420
15	M18X1,5	11	24	26,5	12,5	24	27	98	EGE15P3MORCF	420
16	M22X1,5	12	27	28,5	15	27	27	127	EGE16P3MORCF	420
18	M22X1,5	14	27	28,5	13	27	30	126	EGE18P3MORCF	420
20	M27X2	15	32	33,5	18,5	32	32	215	EGE20P3MORCF	420
22	M27X2	17	32	32,5	16	32	32	178	EGE22P3MORCF	250
25	M33X2	19	41	39	18,5	41	41	381	EGE25P3MORCF	420
28	M33X2	23	41	37	16	41	41	297	EGE28P3MORCF	250
30	M42X2	23	50	43,5	19	50	50	630	EGE30P3MORCF	420
35	M42X2	29	50	41	16	50	50	477	EGE35P3MORCF	250
38	M48X2	30	55	46,5	21,5	55	60	823	EGE38P3MORCF	420
42	M48X2	36	55	43	17,5	55	60	606	EGE42P3MORCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

* Please add the **suffixes** below according to the sealing material required
NBR = Standard, no suffix required
FKM = on request

EGE-R-ED EO-3® Swivel connector

Inch male stud end - ED (ISO 1179-2)

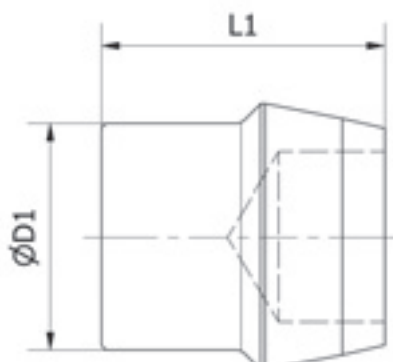

 X1) Indication-ring
 X3) Eolastic-sealing

D1	T	D3	D4	L1	L2	S1	S2	Weight g/1 piece	Order code*	PN
6	G 1/8 A	3,5	14	19	8	14	14	23	EGE06P3REDCF	420
8	G 1/4 A	5	19	22	12	19	17	43	EGE08P3REDCF	420
10	G 1/4 A	6	19	22.5	12	19	19	47	EGE10P3REDCF	420
12	G 3/8 A	9	22	24.5	12	22	22	69	EGE12P3REDCF	420
15	G 1/2 A	11	27	28	14	27	27	121	EGE15P3REDCF	420
16	G 1/2 A	12	27	29	14	27	27	121	EGE16P3REDCF	420
18	G 1/2 A	14	27	29	14	27	30	130	EGE18P3REDCF	420
20	G 3/4 A	15	32	34	16	32	32	250	EGE20P3REDCF	420
22	G 3/4 A	17	32	33	16	32	32	177	EGE22P3REDCF	250
25	G 1 A	19	40	39	18	41	41	372	EGE25P3REDCF	420
28	G 1 A	23	40	37	18	41	41	298	EGE28P3REDCF	250
30	G 1 1/4 A	23	50	43.5	20	50	50	627	EGE30P3REDCF	420
35	G 1 1/4 A	29	50	41	20	50	50	490	EGE35P3REDCF	250
38	G 1 1/2 A	30	55	47	22	55	60	816	EGE38P3REDCF	420
42	G 1 1/2 A	36	55	43	22	55	60	622	EGE42P3REDCF	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

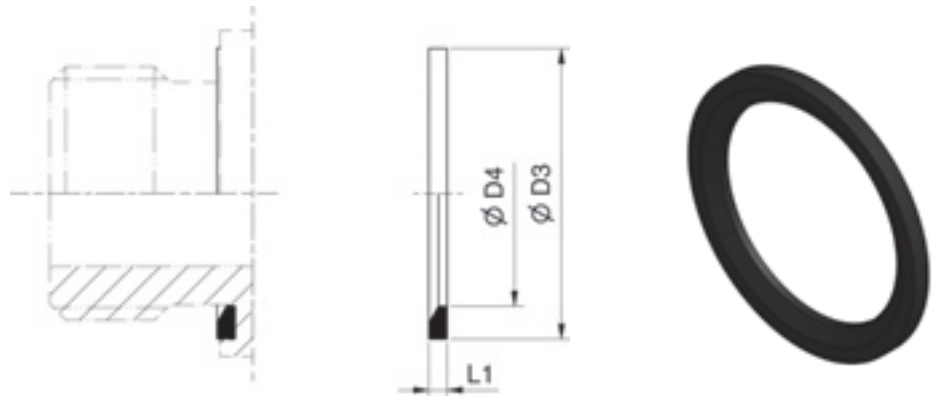
* Please add the **suffixes** below according to the sealing material required
 NBR = Standard, no suffix required
 FKM = on request

VKA EO-3® Blanking plug for cones



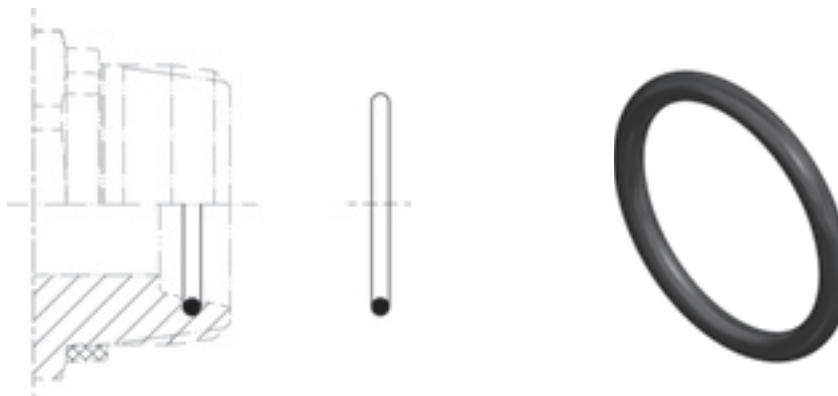
D1	L1	Weight g/1 piece	Order code	PN
6	13,5	3	VKA06P3CFX	420
8	14.5	6	VKA08P3CFX	420
10	16	9	VKA10P3CFX	420
12	16.5	12	VKA12P3CFX	420
15	18	21	VKA15P3CFX	420
16	20	26	VKA16P3CFX	420
18	20	32	VKA18P3CFX	420
20	23	47	VKA20P3CFX	420
22	21,5	50	VKA22P3CFX	250
25	25	78	VKA25P3CFX	420
28	23	81	VKA28P3CFX	250
30	28	117	VKA30P3CFX	420
35	26,5	143	VKA35P3CFX	250
38	31	208	VKA38P3CFX	420
42	28	207	VKA42P3CFX	250

$$\frac{\text{PN (bar)}}{10} = \text{PN (MPa)}$$

ED soft seal (for parallel threads)


Male stud BSP thread T	D3	D4	L1	Weight g/1 piece	Order code NBR
G 1/8 A	11.9	8.4	1.0	0.1	ED10X1X
G 1/4 A	16.5	11.6	1.5	0.2	ED14X1.5X
G 3/8 A	18.9	14.7	1.5	0.2	ED3/8X
G 1/2 A	23.9	18.5	1.5	0.3	ED1/2X
G 3/4 A	29.2	23.9	1.5	0.4	ED26X1.5X
G 1 A	35.7	29.7	2.0	0.7	ED33X2X
G 1 1/4 A	45.8	38.8	2.0	0.9	ED42X2X
G 1 1/2 A	50.7	44.7	2.0	1.0	ED48X2X

OR O-rings for EO-3[®] connection



Tube OD	Order code NBR
6	OR06X1.2X
8	OR08X1.5X
10	OR10.5X1.5X
12	OR12.5X1.5X
15	OR15X1.5X
16	OR16X1.5X
18	OR18X1.5X
20	OR20X1.5X
22	OR22X1.5X
25	OR25.12X1.78X
28	OR28.3X1.78X
30	OR29.87X1.78X
35	OR34.65X1.78X
38	OR37.82X1.78X
42	OR42.5X1.78X

OR O-rings for male stud ends

Male metric thread -O-ring (ISO 6149)

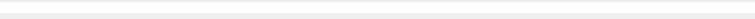


Thread T	Order Code NBR
M10X1	OR8.1X1.6X
M12X1,5	OR9.3X2.2X
M14X1,5	OR11.3X2.2X
M16X1,5	OR13.3X2.2X
M18X1,5	OR15.3X2.2X
M22X1,5	OR19.3X2.2X
M27X2	OR23.6X2.9X
M33X2	OR29.6X2.9X
M42X2	OR38.6X2.9X
M48X2	OR44.6X2.9X



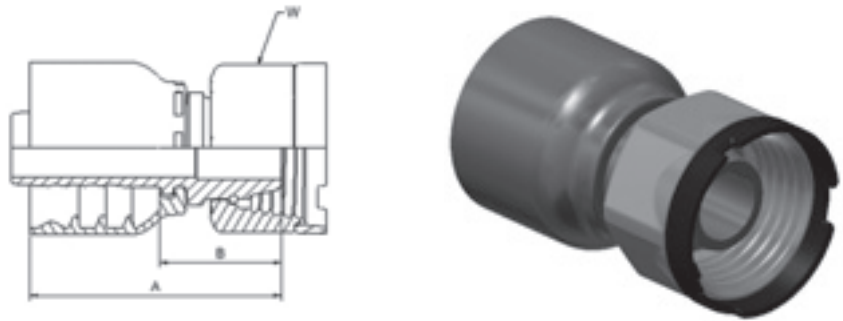




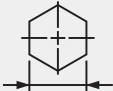
EO-3[®] Hose fittings



VZ – Straight

Female Fitting with “Assembly Indication Ring” (Swivel Connection)



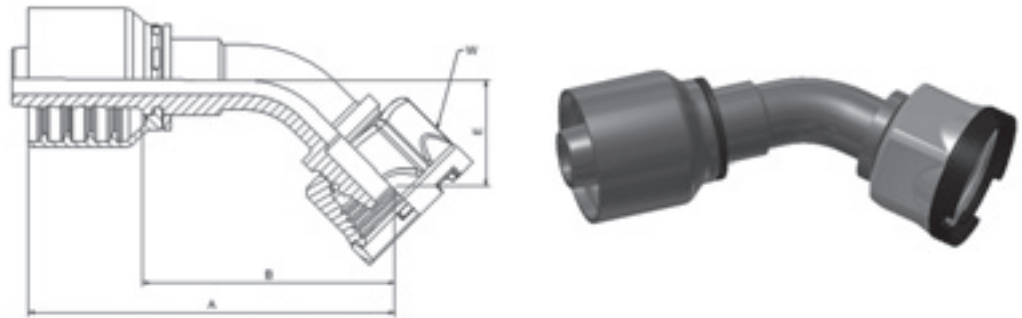
								XXXXX-XX-XX
Inner DN	Inner Inch	Inner Size	Inner MM	Tube OD	A	B	W mm	Order code
6	1/4	-4	6.3	6	41	18	14	1VZ48-6-4
6	1/4	-4	6.3	8	44	21	17	1VZ48-8-4
10	3/8	-6	9.5	10	43	20	19	1VZ48-10-6
10	3/8	-6	9.5	12	43	21	22	1VZ48-12-6
12	1/2	-8	12.7	15	45	22	27	1VZ48-15-8
16	5/8	-10	15.9	18	48	20	30	1VZ48-18-10
20	3/4	-12	19.1	22	51	25	32	1VZ48-22-12
25	1	-16	25.4	28	57	28	41	1VZ48-28-16
32	1-1/4	-20	31.8	35	79	32	50	1VZ48-35-20
40	1-1/2	-24	38.1	42	73	35	60	1VZ48-42-24

Approved **fitting series** for **hose types**:

48	301SN	301TC	302	304	351TC	421RH	421SN	421WC	422	426	436	441	441RH	451	451TC
48	461LT	462	462ST	471TC	472TC	477	477ST	493	811	881					

VP – 45° elbow

Female Fitting with “Assembly Indication Ring” (Swivel Connection)



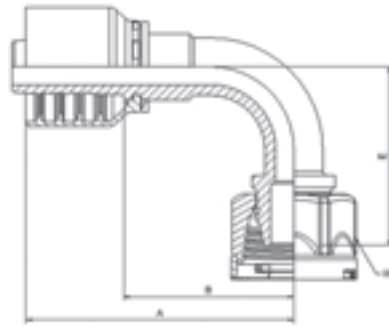
									XXXXX-XX-XX
Inner DN	Inner Inch	Inner Size	Inner MM	Tube OD	A	B	E	W mm	Order code
6	1/4	-4	6.3	6	70	45	19	14	1VP48-6-4
6	1/4	-4	6.3	8	59	35	16	17	1VP48-8-4
10	3/8	-6	9.5	10	68	45	20	19	1VP48-10-6
10	3/8	-6	9.5	12	70	45	19	22	1VP48-12-6
12	1/2	-8	12.7	15	71	47	22	27	1VP48-15-8
16	5/8	-10	15.9	18	75	50	23	30	1VP48-18-10
20	3/4	-12	19.1	22	88	62	26	32	1VP48-22-12
25	1	-16	25.4	28	113	83	33	41	1VP48-28-16
32	1-1/4	-20	31.8	35	141	94	37	50	1VP48-35-20
40	1-1/2	-24	38.1	42	155	117	49	60	1VP48-42-24

Approved **fitting series** for **hose types**:

48	301SN	301TC	302	304	351TC	421RH	421SN	421WC	422	426	436	441	441RH	451	451TC
48	461LT	462	462ST	471TC	472TC	477	477ST	493	811	881					

VR – 90° elbow

Female Fitting with “Assembly Indication Ring” (Swivel Connection)



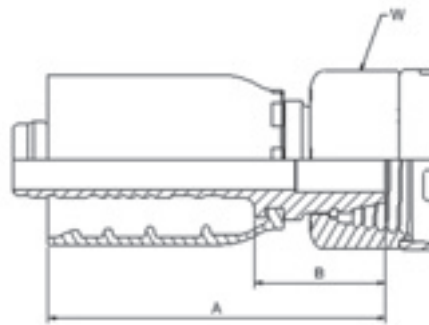
										XXXXX-XX-XX
Inner DN	Inner Inch	Inner Size	Inner MM	Tube OD	A	B	E	W mm	Order code	
6	1/4	-4	6.3	6	57	33	33	14	1VR48-6-4	
6	1/4	-4	6.3	8	59	36	29	17	1VR48-8-4	
10	3/8	-6	9.5	10	65	42	37	19	1VR48-10-6	
10	3/8	-6	9.5	12	62	37	35	22	1VR48-12-6	
12	1/2	-8	12.7	15	64	40	43	27	1VR48-15-8	
16	5/8	-10	15.9	18	69	44	45	30	1VR48-18-10	
20	3/4	-12	19.1	22	80	54	55	32	1VR48-22-12	
25	1	-16	25.4	28	101	72	71	41	1VR48-28-16	
32	1-1/4	-20	31.8	35	130	83	79	50	1VR48-35-20	
40	1-1/2	-24	38.1	42	139	101	101	60	1VR48-42-24	



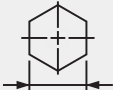
Approved **fitting series** for **hose types**:

48	301SN	301TC	302	304	351TC	421RH	421SN	421WC	422	426	436	441	441RH	451	451TC
48	461LT	462	462ST	471TC	472TC	477	477ST	493	811	881					

VZ – Straight

Female Fitting with "Assembly Indication Ring" (Swivel Connection)



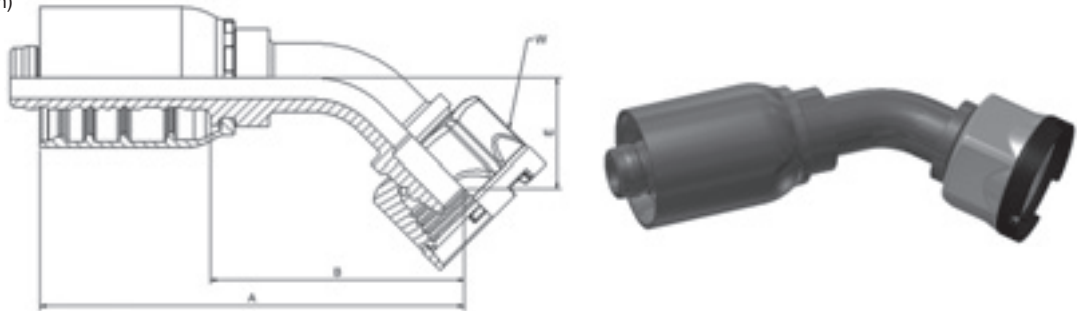
								XXXXX-XX-XX
Inner DN	Inner Inch	Inner Size	Inner MM	Tube OD	A	B	W mm	Order code
12	1/2	-8	12.7	15	58	23	27	1VZ77-16-8
20	3/4	-12	19.1	22	75	29	32	1VZ77-20-12
25	1	-16	25.4	28	87	33	41	1VZ77-25-16
32	1-1/4	-20	31.8	35	102	38	60	1VZ77-38-20

Approved **fitting series** for hose types:

77 787TC 797TC

VP – 45° elbow

Female Fitting with "Assembly Indication Ring" (Swivel Connection)



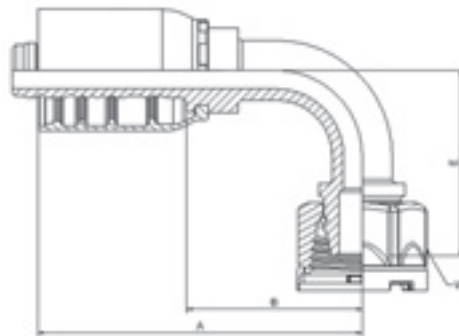
										XXXXX-XX-XX
Inner DN	Inner Inch	Inner Size	Inner MM	Tube OD	A	B	E	W mm	Order code	
12	1/2	-8	12.7	15	83	49	24	27	1VP77-16-8	
20	3/4	-12	19.1	22	120	74	30	32	1VP77-20-12	
25	1	-16	25.4	28	142	88	33	41	1VP77-25-16	
32	1-1/4	-20	31.8	35	161	97	37	60	1VP77-38-20	

Approved **fitting series** for hose types:

77 787TC 797TC

VR – 90° elbow

Female Fitting with "Assembly Indication Ring" (Swivel Connection)



										XXXXX-XX-XX
Inner DN	Inner Inch	Inner Size	Inner MM	Tube OD	A	B	E	W mm	Order code	
12	1/2	-8	12.7	15	77	42	45	27	1VR77-16-8	
20	3/4	-12	19.1	22	108	62	60	32	1VR77-20-12	
25	1	-16	25.4	28	131	77	69	41	1VR77-25-16	
32	1-1/4	-20	31.8	35	151	87	78	60	1VR77-38-20	

Approved **fitting series** for hose types:

77 787TC 797TC



 **Ermeto Original**
Tubes

General recommendations for tubes

1. Steel types, mechanical properties, conditions

Steel types, mechanical properties and conditions of EO steel tubes

Steel type	Tensile strength Rm	Yield point ReH	Ductile yield A5 (longit.)	Condition
Fine grain E235N acc. to EN 10305-4 (St. 37.4 acc. to DIN 1630/DIN 2391 old designation)	340 N/mm ² min. 49,000 lb/in ²	235 N/mm ² min. 34,000 lb/in ²	25% min.	Seamless, cold drawn, normal annealed, DIN EN 10305-1 and -4

2. Tests and certifications

All tubes are subjected to a non-destructive leak test and marked accordingly as proof. This marking replaces a works certificate DIN EN 10204-2.2.

3. Recommended bend radius

A bend radius of 3x the external tube diameter is recommended for cold bending of tubes with tube benders or by hand.

4. Welding suitability and weldability

Tubes of E235N are weldable according to usual techniques. The welding filler should be selected in accordance with DIN EN 1600 and DIN EN 12072 part 1 taking into account the type of application and the welding technique.

5. Approximate calculation of the flow resistance in straight tubelines

The flow resistance and thus the tubeline efficiency is influenced by the tube inside diameter, the volume flow (measured or calculated) and the properties of the medium. Laminar flow should be considered in order to keep losses in the system down to a minimum. The transition from laminar to turbulent flow, which brings an increase in the flow resistance is generally defined by the Reynolds number Re 2320. Since the transition cannot be pinpointed exactly, the transition range can only be determined by measuring. If, for simplified calculation, transition at Re 2320 and a "technically smooth" tube inner surface are assumed, the limit speeds $w_{crit.}$ and the laminar to turbulent flow volume flow $\dot{v}_{crit.}$ when transition takes place, can be estimated according to the following formulas:

$$w_{crit.} = \frac{2.32 \cdot \nu}{d_i} \text{ [m/s]}$$

$$\dot{v}_{crit.} = 0.109 \cdot d_i \cdot \nu \text{ [l/min]}$$

$$d_i = \text{tube bore } \varnothing \text{ in mm}$$

$$\nu = \text{kinematic viscosity in mm}^2/\text{s.}$$

For approximate calculation of the pressure drop in bar/1 m tube length, the following formulas can be used:

1. Laminar range:

$$\rho_v = \frac{0.32 \cdot w \cdot \nu \cdot \rho}{d_i^2 \cdot 10^3} = \frac{6.79 \cdot \dot{v} \cdot \nu \cdot \rho}{d_i^4 \cdot 10^3} \text{ [bar/1 m]}$$

2. Turbulent range:

$$\rho_v = \frac{0.281 \cdot w^{1.75} \cdot \nu^{0.25} \cdot \rho}{d_i^{1.25} \cdot 10^3}$$

$$= \frac{59 \cdot \dot{v}^{1.75} \cdot \nu^{0.25} \cdot \rho}{d_i^{4.75} \cdot 10^3} \text{ [bar/1 m]}$$

w = flow speed in m/s; ν = kinetic viscosity in mm²/s; \dot{v} = volume flow in l/min.; ρ = density of the medium in kg/m³; d_i = pipe internal diameter in mm.

Detailed calculations of the flow resistance require an exact knowledge of the tubeline system and the operating conditions. Refer to the relevant literature for other methods of calculations.

Seamless EO steel tubes Material E235N (St. 37.4)

Tolerances DIN EN 10305-4

Order code		Tube O.D. (mm)	Tolerance	Wall thickness (mm)	Tube I.D. (mm)	Design pressure bar		Burst pressure bar	Weight kg/m
Phosphated and oiled	Cr(VI)-free					DIN 2413 I Static	DIN 2413 III Dynamic		
R04X0.5	R04X0.5CF	4	±0.08	0.50	3.0	313	273	1160	0.047
	R04X0.75CF	4		0.75	2.5	470	391	1820	0.063
R04X1	R04X1CF	4	±0.08	1.00	2.0	627	500	2700	0.074
	R05X1CF	5		1.00	3.0	501	416	2120	0.099
R06X1 R06X1.5	R06X0.75CF	6	±0.08	0.75	4.5	333	288	1150	0.103
	R06X1CF	6		1.00	4.0	444	372	1650	0.123
	R06X1.5CF	6		1.50	3.0	666	526	2550	0.166
	R06X2CF	6		2.00	2.0	692	662	>3500	0.197
	R06X2.25CF	6		2.25	1.5	757	725	>3500	0.208
R08X1 R08X1.5 R08X2	R08X1CF	8	±0.08	1.00	6.0	333	288	1175	0.173
	R08X1.5CF	8		1.50	5.0	499	412	1925	0.240
	R08X2CF	8		2.00	4.0	666	526	2500	0.296
	R08X2.5CF	8		2.50	3.0	658	630	2650	0.339
R10X1 R10X1.5 R10X2	R10X1CF	10	±0.08	1.00	8.0	282	248	900	0.222
	R10X1.5CF	10		1.50	7.0	423	357	1450	0.314
	R10X2CF	10		2.00	6.0	564	458	2025	0.395
	R10X2.5CF	10		2.50	5.0	705	551	2675	0.462
	R10X3CF	10		3.00	4.0	666	638	>3500	0.518
R12X1 R12X1.5 R12X2	R12X1CF	12	±0.08	1.00	10.0	235	209	750	0.271
	R12X1.5CF	12		1.50	9.0	353	303	1150	0.388
	R12X2CF	12		2.00	8.0	470	391	1600	0.493
	R12X2.5CF	12		2.50	7.0	588	474	2025	0.586
	R12X3CF	12		3.00	6.0	705	551	2600	0.666
	R12X3.5CF	12		3.50	5.0	651	624		0.734
R14X2 R14X3	R14X1.5CF	14	±0.08	1.50	11.0	302	264	975	0.462
	R14X2CF	14		2.00	10.0	403	342	1325	0.592
	R14X2.5CF	14		2.50	9.0	504	415	1650	0.709
	R14X3CF	14		3.00	8.0	604	485	2200	0.814
		14		3.50	7.0	705	551	2625	0.906
R15X1 R15X1.5 R15X2	R15X1CF	15	±0.08	1.00	13.0	188	170	575	0.345
	R15X1.5CF	15		1.50	12.0	282	248	950	0.499
	R15X2CF	15		2.00	11.0	376	321	1275	0.641
		15		3.00	9.0	564	458	2000	0.888
R16X1.5 R16X2 R16X2.5 R16X3	R16X1.5CF	16	±0.08	1.50	13.0	264	233	850	0.536
	R16X2CF	16		2.00	12.0	353	303	1175	0.691
	R16X2.5CF	16		2.50	11.0	441	370	1500	0.832
	R16X3CF	16		3.00	10.0	529	433	1850	0.962
R18X1 R18X1.5 R18X2 R18X2.5	R18X1CF	18	±0.08	1.00	16.0	157	143	450	0.419
	R18X1.5CF	18		1.50	15.0	235	209	700	0.610
	R18X2CF	18		2.00	14.0	313	273	975	0.789
	R18X2.5CF	18		2.50	13.0	392	333	1300	0.956
	R18X3CF	18		3.00	12.0	470	391	1575	1.111

Surface finish:

- Phosphated and oiled:
- Tubes with I.D. 1.5–5 mm: outside and inside oiled.
- Tubes from 6 mm I.D.: outside and inside phosphated and oiled.

• Cr(VI)-free:

These dimensions are externally thick coat passivated (thickness of coat 8–12 µm), inside oiled.

Calculation pressures:

Calculation pressures given are according to DIN 2413 part I for **static stress**

$$P = \frac{20 \cdot K \cdot s \cdot c}{S \cdot d_a} \text{ (bar)}$$

Material characteristic value $K = 235 \text{ N/mm}^2$ and DIN 2413 part III for **dynamic stress**

$$P = \frac{20 \cdot K \cdot s \cdot c}{S \cdot (d_a + s \cdot c)} \text{ (bar)}$$

Material characteristic value $K = 226 \text{ N/mm}^2$ (permanent fatigue strength)

Safety correction value $S = 1.5$ for static and dynamic stress, $S = \text{wallthickness}$.

Factor c for consideration of wall thickness divergence **for static and dynamic stress** = 0.8 for tube O.D. 4 and 5; 0.85 for tube o.d. 6 and 8; 0.9 for larger tube O.D.

Seamless EO steel tubes (Continued) Material E235N (St. 37.4)

Tolerances DIN EN 10305-4

Order code		Tube O.D. (mm)	Tolerance	Wall thickness (mm)	Tube I.D. (mm)	Design pressure bar		Burst pressure bar	Weight kg/m
Phosphated and oiled	Cr(VI)-free					DIN 2413 I Static	DIN 2413 III Dynamic		
R20X2 R20X2.5 R20X3	R20X1.5CF	20	±0.08	1.50	17.0	212	190	675	0.684
	R20X2CF	20		2.00	16.0	282	248	900	0.888
	R20X2.5CF	20		2.50	15.0	353	303	1100	1.079
	R20X3CF	20		3.00	14.0	423	357	1400	1.258
	R20X3.5CF	20		3.50	13.0	494	408	1650	1.424
	R20X4CF	20		4.00	12.0	564	458	2000	1.578
R22X1.5 R22X2 R22X2.5	R22X1.5CF	22	±0.08	1.50	19.0	192	173	550	0.758
	R22X2CF	22		2.00	18.0	256	227	775	0.986
	R22X2.5CF	22		2.50	17.0	320	278	1025	1.202
	R22X3CF	22		3.00	16.0	385	328	1175	1.406
R25X2 R25X2.5 R25X3 R25X4 R25X4.5	R25X2CF	25	±0.08	2.00	21.0	226	201	725	1.134
	R25X2.5CF	25		2.50	20.0	282	248	850	1.387
	R25X3CF	25		3.00	19.0	338	292	1025	1.628
	R25X4CF	25		4.00	17.0	451	378	1500	2.072
	R25X4.5CF	25		4.50	16.0	508	418	1625	2.275
R28X1.5 R28X2 R28X2.5 R28X3	R28X1.5CF	28	±0.08	1.50	25.0	151	138	425	0.980
	R28X2CF	28		2.00	24.0	201	181	600	1.282
	R28X2.5CF	28		2.50	23.0	252	223	750	1.572
	R28X3CF	28		3.00	22.0	302	264	900	1.850
R30X2.5 R30X3 R30X4 R30X5	R30X2CF	30	±0.08	2.00	26.0	188	170	575	1.381
	R30X2.5CF	30		2.50	25.0	235	209	725	1.695
	R30X3CF	30		3.00	24.0	282	248	850	1.998
	R30X4CF	30		4.00	22.0	376	321	1175	2.565
	R30X5CF	30		5.00	20.0	470	391	1600	3.083
R35X2 R35X2.5 R35X3	R35X2CF	35	±0.15	2.00	31.0	161	147	450	1.628
	R35X2.5CF	35		2.50	30.0	201	181	600	2.004
	R35X3CF	35		3.00	29.0	242	215	700	2.367
	R35X4CF	35		4.00	27.0	322	280	960	3.058
R38X3 R38X4 R38X5	R38X2.5CF	38	±0.15	2.50	33.0	186	168	550	2.189
	R38X3CF	38		3.00	32.0	223	199	675	2.589
	R38X4CF	38		4.00	30.0	297	260	900	3.354
	R38X5CF	38		5.00	28.0	371	318	1150	4.069
	R38X6CF	38		6.00	26.0	445	373	1425	4.735
	R38X7CF	38		7.00	24.0	519	427	1700	5.352
R42X2 R42X3 R42X4	R42X2CF	42	±0.2	2.00	38.0	134	123	375	1.973
	R42X3CF	42		3.00	36.0	201	181	575	2.885
	R42X4CF	42		4.00	34.0	269	237	850	3.749
R50X6		50	±0.2	6.00	38.0	338	292		6.511
R65X8		65	±0.3	8.00	49.0	347	299		11.246

Remarks:

Corrosion – additional allowances are not considered for the calculation of pressures. Tube with a diameter ratio of

$\frac{d_a}{d_{i_{max}}} > 2$ are calculated for static stress in

accordance with DIN 2413 coverage III, but with $K = 235 \text{ N/mm}^2$.

When a specific factor of safety is required, calculations should be based upon the burst pressures shown in the above tables.

Temperature range: –40° up to 120°C without pressure reductions.

For increased temperatures:

control calculation according to DIN 2413 required (static application above 120°C).

$$P = \frac{20 \cdot K \cdot s \cdot c}{S (d_a - s \cdot c)}$$

Material strength K for increased temperatures:

Temperature in °C	K (N/mm ²)
up to 200	185
up to 250	165



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Aerospace

Key Markets

Aftermarket services
Commercial transports
Engines
General & business aviation
Helicopters
Launch vehicles
Military aircraft
Missiles
Power generation
Regional transports
Unmanned aerial vehicles

Key Products

Control systems & actuation products
Engine systems & components
Fluid conveyance systems & components
Fluid metering, delivery & atomization devices
Fuel systems & components
Fuel tank inerting systems
Hydraulic systems & components
Thermal management
Wheels & brakes



Climate Control

Key Markets

Agriculture
Air conditioning
Construction Machinery
Food & beverage
Industrial machinery
Life sciences
Oil & gas
Precision cooling
Process
Refrigeration
Transportation

Key Products

Accumulators
Advanced actuators
CO₂ controls
Electronic controllers
Filter driers
Hand shut-off valves
Heat exchangers
Hose & fittings
Pressure regulating valves
Refrigerant distributors
Safety relief valves
Smart pumps
Solenoid valves
Thermostatic expansion valves



Electromechanical

Key Markets

Aerospace
Factory automation
Life science & medical
Machine tools
Packaging machinery
Paper machinery
Oil & gas
Primary metals
Semiconductor & electronics
Textile
Wire & cable

Key Products

AC/DC drives & systems
Electric actuators, gantry robots & slides
Electrohydraulic actuation systems
Electromechanical actuation systems
Human machine interface
Linear motors
Stepper motors, servo motors, drives & controls
Structural extrusions



Filtration

Key Markets

Aerospace
Food & beverage
Industrial plant & equipment
Life sciences
Marine
Mobile equipment
Oil & gas
Power generation & renewable energy
Process
Transportation
Water Purification

Key Products

Analytical gas generators
Compressed air filters & driers
Engine air, coolant, fuel & oil filtration systems
Fluid condition monitoring systems
Hydraulic & lubrication filters
Hydrogen, nitrogen & zero air generators
Instrumentation filters
Membrane & fiber filters
Microfiltration
Sterile air filtration
Water desalination & purification filters & systems



Fluid & Gas Handling

Key Markets

Aerial lift
Agriculture
Bulk chemical handling
Construction machinery
Food & beverage
Fuel & gas delivery
Industrial machinery
Life sciences
Marine
Mining
Mobile
Oil & gas
Renewable energy
Transportation

Key Products

Check valves
Connectors for low pressure fluid conveyance
Deep sea umbilicals
Diagnostic equipment
Hose couplings
Industrial hose
Mooring systems & power cables
PTFE hose & tubing
Quick couplings
Rubber & thermoplastic hose
Tube fittings & adapters
Tubing & plastic fittings



Hydraulics

Key Markets

Aerial lift
Agriculture
Alternative energy
Construction machinery
Forestry
Industrial machinery
Machine tools
Marine
Material handling
Mining
Oil & gas
Power generation
Refuse vehicles
Renewable energy
Truck hydraulics
Turf equipment

Key Products

Accumulators
Cartridge valves
Electrohydraulic actuators
Human machine interfaces
Hybrid drives
Hydraulic cylinders
Hydraulic motors & pumps
Hydraulic systems
Hydraulic valves & controls
Hydrostatic steering
Integrated hydraulic circuits
Power take-offs
Power units
Rotary actuators
Sensors



Pneumatics

Key Markets

Aerospace
Conveyor & material handling
Factory automation
Life science & medical
Machine tools
Packaging machinery
Transportation & automotive

Key Products

Air preparation
Brass fittings & valves
Manifolds
Pneumatic accessories
Pneumatic actuators & grippers
Pneumatic valves & controls
Quick disconnects
Rotary actuators
Rubber & thermoplastic hose & couplings
Structural extrusions
Thermoplastic tubing & fittings
Vacuum generators, cups & sensors



Process Control

Key Markets

Alternative fuels
Biopharmaceuticals
Chemical & refining
Food & beverage
Marine & shipbuilding
Medical & dental
Microelectronics
Nuclear Power
Offshore oil exploration
Oil & gas
Pharmaceuticals
Power generation
Pulp & paper
Steel
Water/wastewater

Key Products

Analytical Instruments
Analytical sample conditioning products & systems
Chemical injection fittings & valves
Fluoropolymer chemical delivery fittings, valves & pumps
High purity gas delivery fittings, valves, regulators & digital flow controllers
Industrial mass flow meters/controllers
Permanent no-weld tube fittings
Precision industrial regulators & flow controllers
Process control double block & bleeds
Process control fittings, valves, regulators & manifold valves



Sealing & Shielding

Key Markets

Aerospace
Chemical processing
Consumer
Fluid power
General industrial
Information technology
Life sciences
Microelectronics
Military
Oil & gas
Power generation
Renewable energy
Telecommunications
Transportation

Key Products

Dynamic seals
Elastomeric o-rings
Electro-medical instrument design & assembly
EMI shielding
Extruded & precision-cut, fabricated elastomeric seals
High temperature metal seals
Homogeneous & inserted elastomeric shapes
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