

Brochure Oil filling machines



Version : 17-01-2022

Introduction

Filling a shock absorber (damper) with oil is a messy and time consuming job, and in the end of all that effort, the shock absorber still has quite some air left in it. Specialists fine-tune their shock absorbers constantly, changing shim settings or adjusters to achieve the maximum performance. However, they tend to forget that they already started with a badly filled shock absorber in the first place, highly limiting the shock absorber performance and durability. Filling a shock absorber by hand will always leave air inside the shock absorber, the air gets stuck within little corners and confined areas inside the shock absorber, moreover the oil itself that is poured into the shock absorber contains air. The effects of air inside a shock absorber should not be underestimated, air is compressible and because of this heavily effects damping. On top of this problem, air also causes damper fading (air expands when damper is heating up), foaming, cavitation, damper noise and oxidation (ageing) of the oil. To tackle these problems all together, DO Engineering has developed the oil filling machines XP and LT that use cycles of high vacuum and pressure, that allows you to fill a shock absorber and other suspension related products quickly, without spilling oil, and most important : without large amounts of air trapped inside the shock absorber! The oil filling process with the DO Engineering oil filling machines is fully reproducible, so no need to wonder if the change in damping is from the amount of air left in your shock absorber or the changes you made to the shim stack. The DO Engineering oil filling machines are designed to be fully compatible with virtually all shock absorber brands and shock absorber types (for further details see next pages). DO Engineering develops and builds the oil filling machines in house and sells the oil filling machines worldwide. The DO Engineering oil filling machines are used in all major racing classes including F1, Moto GP, WRC, MX1 etc. Learn more about the capabilities of the DO Engineering oil filling machines and the usage of the machines for filling your shock absorbers in this brochure. For more information see our presentation on oil filling machines at: www.youtube.com/watch?v=zYiYTryNcio

Key advantages using the DO Engineering oil filling machines :

- Saves a lot of time (filling process only ± 3 min. for medium size shock absorber)
- Increases shock absorber performance
- Increases shock absorber durability
- Decreases damper noise
- More constant damping (less damping loss under high temperatures)
- Reproducible oil filling quality
- No messing around with oil
- Professional appearance

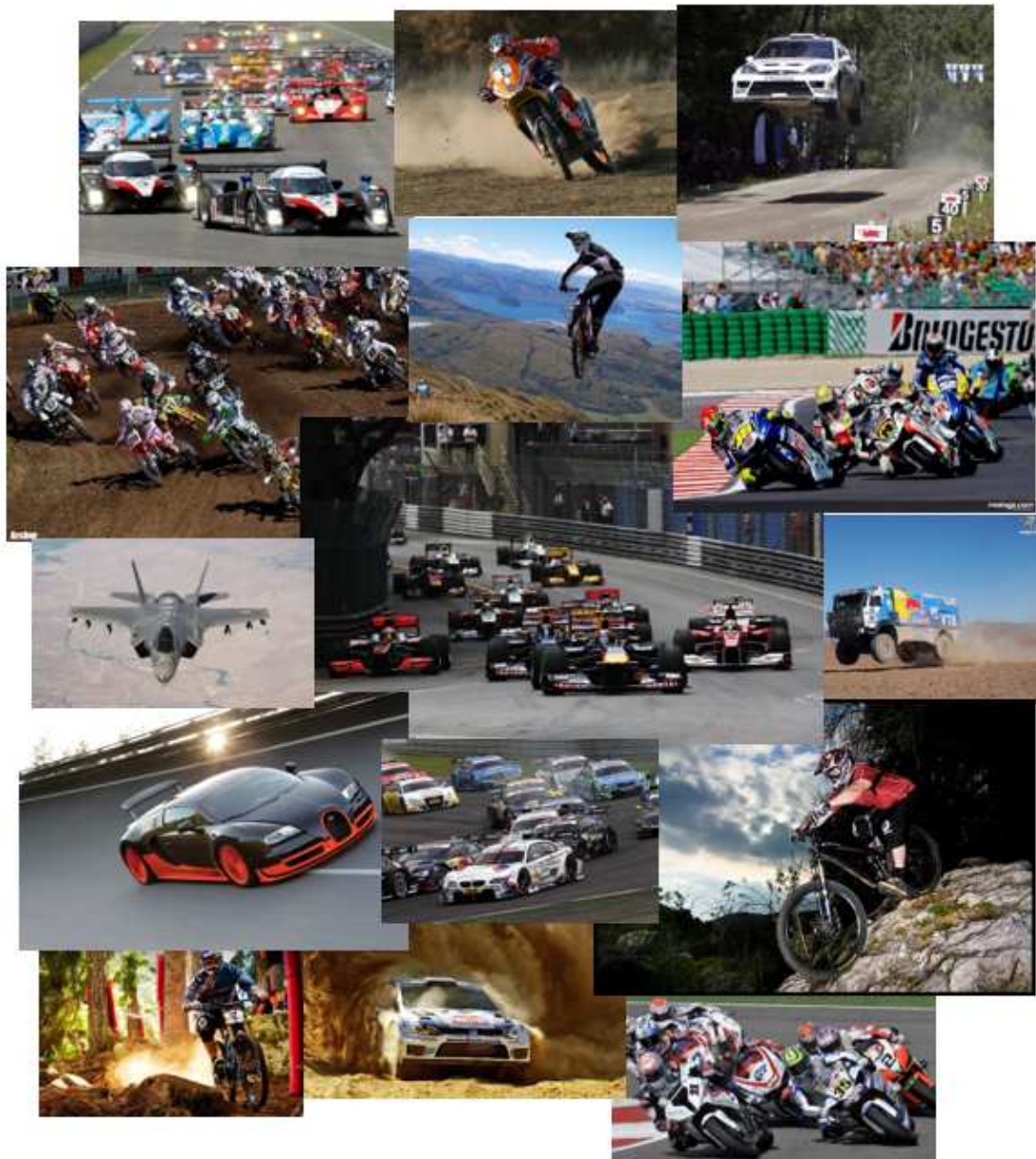
Key features of the DO Engineering oil filling machines are :

- Highest quality
- Excellent performance
- Compact / Low weight
- Portable
- Versatile/flexible
- Suitable for virtually all shock absorber types and brands
- Safe to use
- Simple to operate
- Fully maintainable / Oil reservoir cleanable
- Comes with extensive owners manual, full colour, in English, (± 120 pages!)
- Expandable with options
- Custom developments possible

Where can the oil filling machines be used?

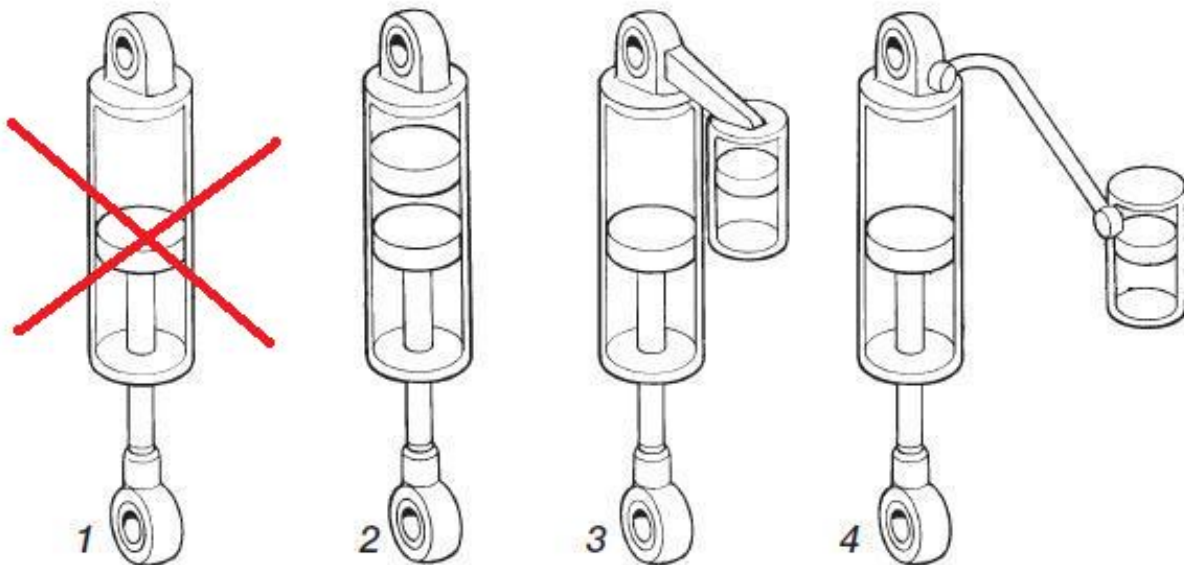
DO Engineering has more than 20 years of experience in development/production of oil filling machines, the pioneer in this field. Due to the clever design and high flexibility, DO Engineering oil filling machines are being used all over the world in many different applications and industries. Primary use is in the vehicle, motorsport and suspension technology, whether it is used for filling shock absorbers or hydraulic systems (shift systems etc.), the DO Engineering oil filling machine can do the job!

The DO Engineering oil filling machines are used in all major racing / sport classes including F1, Moto GP, WRC, LMP, MX1, MTB, Downhill etc. But our machines are also used in the drilling industry, aerospace and aircraft industry as well. Our machines are the top choice for use in factory's racing teams, repair shops, workshops, suspension specialists etc. If you want to know if our machine can also be used for your application, please contact us.



Types of shock absorbers that can be filled with the filling machines

For schematic purposes we only use single tube (mono tube) shock absorber to further clarify which shock absorbers can be filled using the DO Engineering oil filling machines.



Shock absorber (damper) types :

1. Emulsion
2. Internal gas reservoir
3. External gas reservoir (piggyback)
4. External gas reservoir with hose

It goes without saying that emulsion shock absorbers (no separation piston or membrane is used) cannot be filled with these machines, because this type of shock absorber always has air or nitrogen (N₂) in direct contact with the oil.

In principle all other types of shock absorbers and suspension products (including for instance steering dampers, hydraulic preload adjusters, closed front fork cartridges etc.), both single and double tube types, with internal or external gas reservoir can be filled with the oil filling machines, as long as the oil is separated from the gas by either a piston or a membrane (bladder), or if the damper does not use gas at all (for instance a hydraulic preload adjuster)

If a shock absorber has an oil filling plug, it can be filled with the DO Engineering oil filling machines. The same goes for shock absorbers that you can modify (drill and thread a hole) to install a filling plug. Filling the shock absorber through an oil filling plug always gives the best result and will always be the easiest (and cheapest) way to fill a shock absorber with oil. If a shock absorber is not an emulsion type, has no oil filling plug, no way to modify the shock absorber to install an oil filling plug, but has a compression adjuster installed, most of the time it is possible to use the filling machines with a special filling adaptor, and fill the oil through the opening for the compression adjuster. Also, in some cases it is possible to fill the damper through the gas reservoir cap, special filling adaptors can be developed by DO Engineering.

Should you have doubts if your shock absorber can be filled with our oil filling machines, please e-mail us and send us a drawing/picture of your shock absorber.

The oil filling units

The oil filling units XP and LT are specially developed for the filling of shock absorbers and form the basis. The units are designed to be high quality, compact, portable, flexible, easy and safe to use. All operation controls are situated on the front of the unit, all other, to be regularly checked, parts are freely accessible at the rear of the unit as well as the connections of the unit (power, compressed air etc.) The units use high vacuum ($\pm 100\%$!) and pressure cycles (adjustable) to achieve a unprecedented oil filling quality. The units are fully prepared for the connection of several options developed by DO Engineering. The options can be simply be connected to the unit and you're ready to use them, without the need to adapt your oil filling machine. For more information also visit our YouTube channel for a full presentation of the DO Engineering oil filling machines: www.youtube.com/watch?v=zYiYTryNcio



The oil filling unit XP

The oil filling unit XP is the top of the DO Engineering oil filling machine line. The oil filling unit XP has a very accurate vacuum gauge that allows the user to fill the shock absorbers in the shortest possible time. Also, the vacuum gauge allows the user to see if anything is wrong with the shock absorber that is being filled. The oil filling unit XP allows connection of the external tank (will be explained later in the brochure)



Technical features Oil filling unit XP :

Width : 440 mm

Depth : 255 mm

Height : 400 mm

Dry weight : 18,6 Kg

Power supply : 220/230 V, 50/60 Hz, grounded (in some country's a voltage converter and /or an adaptor may need to be used)

Compressed air supply : 3-8 bar (8 bar max)

Maximum damper oil capacity : 2,8 l

Set oil filling unit DO Engineering XP :

- Oil filling unit DO Engineering XP
- Owners manual oil filling machine XP (extensive, full colour, in English, ±120 pages!)
- Main filling adaptor
- 1 liter vacuum pump oil
- Compensation connector hose with adaptor (for oil filling of dampers with membrane or bladder)
- Funnel vacuum pump
- Oil filling can damper oil reservoir



The oil filling unit LT

The oil filling unit LT (introduced in October 2011) is the economy version of the DO Engineering oil filling machine line. The oil filling unit LT has a timer that allows the user to fill the shock absorbers in a slightly longer time compared to the XP unit. The timer can be preset by the user for the type of shock absorber that has to be filled. The oil filling machine LT has no connection for the external tank (will be explained later in the brochure) Other than the before mentioned, the oil filling machine has exactly the same quality, functionality and features as the oil filling machine XP.



Technical features Oil filling unit LT :

Width : 440 mm

Depth : 255 mm

Height : 400 mm

Dry weight : 17,8 Kg

Power supply : 220/230 V, 50/60 Hz, grounded (in some country's a voltage converter and /or an adaptor may need to be used)

Compressed air supply : 3-8 bar (8 bar max)

Maximum damper oil capacity : 2,8 l

Set oil filling unit DO Engineering LT :

- Oil filling unit DO Engineering LT
- Owners manual oil filling machine LT (extensive, full colour, in English, ±105 pages!)
- Main filling adaptor
- 1 liter vacuum pump oil
- Compensation connector hose with adaptor (for oil filling of dampers with membrane or bladder)
- Funnel vacuum pump
- Oil filling can damper oil reservoir



Comparison oil filling unit XP and LT

As mentioned before, the main differences between the XP and LT version are :
 The XP has an accurate vacuum gauge and has a connection for the external tank (will be explained later in the brochure). The LT uses a timer and has no connection for the external tank. The fact that the LT has no vacuum gauge, but a timer, gives a slightly longer filling time needed when compared to the XP. Also, the vacuum gauge in the XP unit gives the user the possibility to see if something is wrong with the shock that is being filled, because the LT has no vacuum gauge this is not possible with the LT unit. Other than the before mentioned, the oil filling machines have exactly the same quality, functionality and features. The following table will give an overview of the differences.

	Unit XP	Unit LT
Filling time	+	-
Diagnostic capabilities	+	-
Price	-	+
External tank connection	S	N
Owners manual	S	S
Main filling adaptor	S	S
1 liter vacuum pump oil	S	S
Compensation connector hose with adaptor	S	S
Funnel vacuum pump	S	S
Oil filling can damper oil reservoir	S	S
Filling nose	O	O
Set external tank	O	N
Set separate oil reservoir	O	O
Flightcase oil filling machine	O	O
Flighthcase for external tank	O	N
Flightcase for oil filling unit and separate oil reservoir	O	O
Filling splitter	O	N
Voltage convertor 110V to 220V	O	O
Maintenance kit oil filling unit	O	O
1 liter vacuum pump oil (extra)	O	O
Set oil type cards	O	O
Main filling adaptor (extra)	O	O

O = Optional
 S = Standard
 N = Not available
 + = Good score
 - = Lesser score

Set external tank (optional for XP)

Depending on the type and construction of the shock absorber that has to be filled, an external tank has to be used in combination with the oil filling unit. The shock absorber has to be hung inside the tank which has to be connected to the oil filling unit. The tank is large enough for most shock absorbers, however if you should need a bigger tank for your shock absorber, DO Engineering can custom develop these for your application. The tank can always be ordered separately and can be connected to the DO Engineering oil filling unit XP, the DO Engineering oil filling unit XP has connections for the external tank fitted standard.

Technical features Tank (std.) :

Width : 220 mm

Depth : 220 mm

Height : 700 mm

Weight : 9,6 Kg

Internal sizes : Ø 200mm, height ± 540 mm



The set external tank DO Engineering is supplied with the following parts :

- Tank
- Connecting hose (oil filling unit to tank)
- Main filling adaptor external tank

Main filling adaptor external tank (for use with external tank)

This filling adaptor consists of a special coupling and a connection part where you can screw in a filling nose. This main filling adaptor has to be used when you are filling a damper using the external tank. Because of the wide variety of filling noses, you only have to attach another type of filling nose to the main filling adaptor external tank to fill another type of shock absorber or damper. If you use a certain filling nose a lot, you could order more main filling adaptors external tank, this way you don't have to unscrew the filling nose each time you want to fill another type of damper.



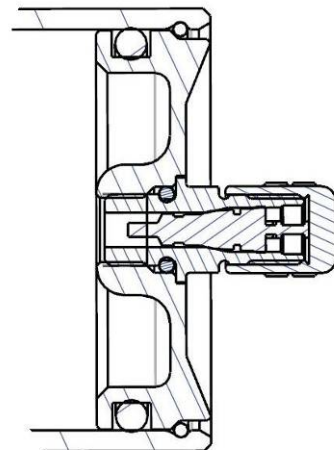
When do you need to use a tank

There are 2 situations where you need to use a tank together with the oil filling unit :

1. Some shock absorbers, mostly older shocks and shock absorbers with Quadring or O-ring shaft/spindle seals (especially without back-up ring), do not seal well under vacuum. This causes air from outside to be sucked into the shock absorber through the seal when using just the oil filling unit. By using a tank together with the oil filling machine, this problem is solved.

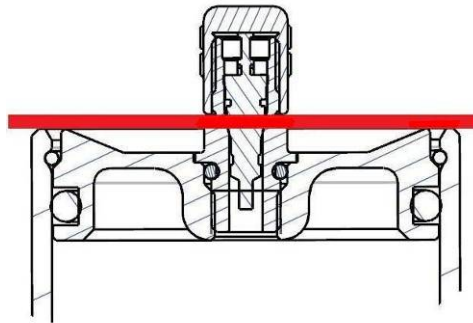


2. If a shock absorber has parts that are not fixed with screw thread, but for instance with a clip-ring, spring-ring or cir-clip (for examples see pictures), these parts can be sucked into the shock absorber under vacuum. Such clip-ring constructions are mostly used on adjusters, on the lids of gas reservoirs, and on seal caps. The rule is : if you can move (these) parts when pushing them after you have released the gas pressure, the shock absorber has to be filled using the tank together with the DO Engineering oil filling machine XP.



If a shock absorber has parts with a spring-ring or clip-ring construction (like described above), sometimes the shock absorber can be filled without the external tank. If a shock absorber has parts that are not fixed with screw thread, but for instance with a clip-ring, spring-ring or cir-clip (for examples see pictures), these parts have to be blocked so they cannot be sucked into the shock absorber during the filling process. Clip-ring constructions are mostly used on the lids of gas reservoirs, and on seal caps. With dampers that have a membrane (bladder) construction, it is especially important to prevent the cap/lid (together with the membrane) from being sucked into the shock during the filling process. This can best be done by placing a large diameter ring over for

instance the Schrader valve and then using the cap or gas filling tool of the Schrader valve to keep the cap/lid and membrane in a fixed position (see red indicated ring in the picture below). If the end cap is not blocked, the membrane (bladder) may come into contact with sharp objects within the shock absorber or may block the oil flow and thus disrupts the oil filling process. This gives a considerable risk of a bad oil filling and possible damage to the membrane (bladder). So, if parts can be blocked, it is possible to fill a shock absorber without the external tank.



Main filling adaptor (Standard for XP and LT)

Filling adaptors have a special hydraulic coupling that connects to the oil filling machine, and the other side can be connected to a filling nose (G1/4 thread). The filling nose can be connected to the shock absorber. Because of the wide variety of sizes and ways to connect the shock absorber to the oil filling unit, the filling noses have to be ordered separately. DO Engineering, at this moment, has designed several filling noses. The next picture shows the main filling adaptor and an example of a filling nose.



Main filling adaptor with filling nose


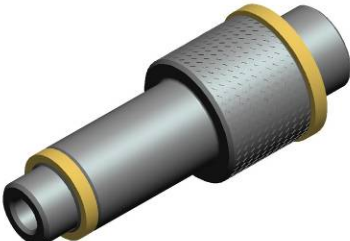



Main filling adaptor (for use without external tank)


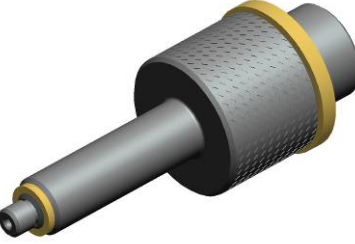
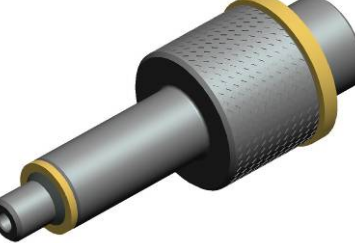
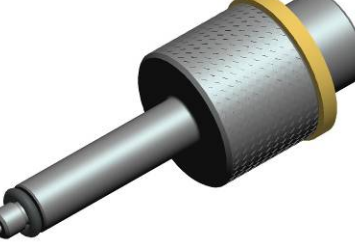

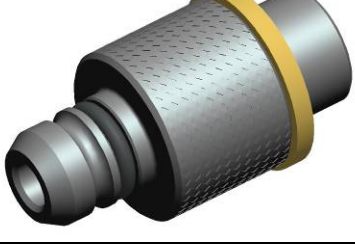
This filling adaptor consists of a special coupling where you can screw in a filling nose (G1/4 thread). Because of the wide variety of filling noses, you only have to attach another type of filling nose to the main filling adaptor to fill another type of shock absorber or damper. If you use a certain filling nose a lot, you could order more main filling adaptors, this way you don't have to unscrew the filling nose each time you want to fill another type of damper.


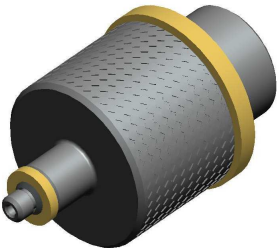

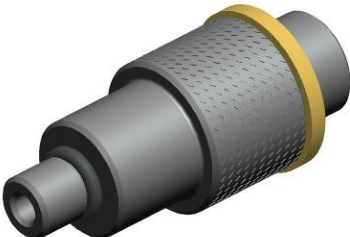







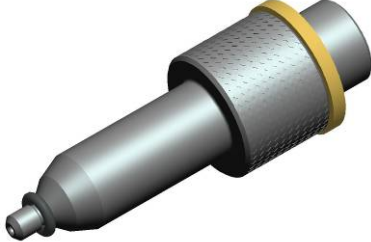
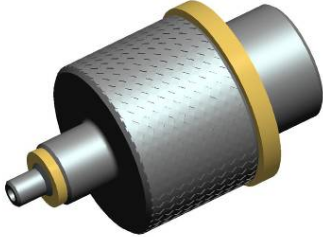

Filling noses (Optional for XP and LT)






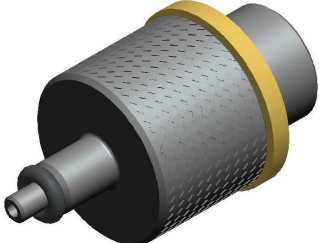
The filling nose fits the main filling adaptor. The filling nose is currently available in several sizes to fit different shock absorbers and dampers (see table below). Should these filling noses not fit your specific shock absorber, DO Engineering will develop one for your specific application. The filling noses are typically made from stainless steel for the highest possible quality and durability, supplied complete with seals. When you are not sure what filling noses are most common or suitable for the shock absorbers that you service most, please contact DO Engineering. (PC = Price Code)



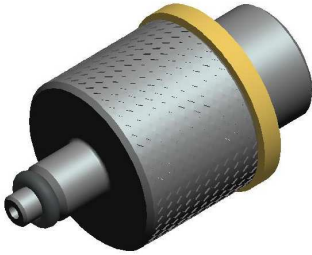
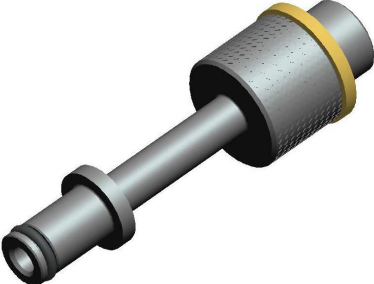


Filling nose image	Description	PC	Part number
	Filling nose with bonded seal G 1/8	A	E0001-A0023-A0
	Filling nose with bonded seal M10x1	A	E0001-A0024-A0
	Filling nose with O-ring M4	A	E0001-A0025-A0
	Filling nose with O-ring M5	C	E0001-A0026-A0
	Filling nose with O-ring M6	C	E0001-A0027-A0

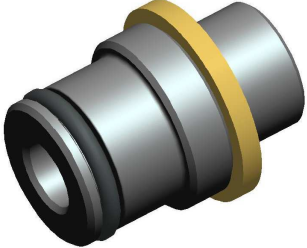



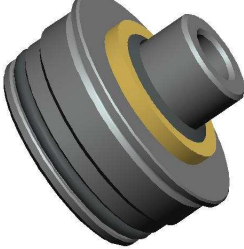
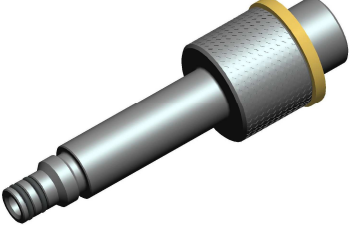
Filling nose image	Description		Part number
	Filling nose with O-ring M10x1	A	E0001-A0028-A0
	Filling nose with bonded seal M4	A	E0001-A0033-A0
	Filling nose with bonded seal M6	A	E0001-A0034-A0
	Filling nose with O-ring (for closed cartridge fork) M4	A	E0001-A0035-A0
	Filling nose with O-ring M6	A	E0001-A0036-A0
	Filling nose with O-ring M11x1	A	E0001-A0038-A0


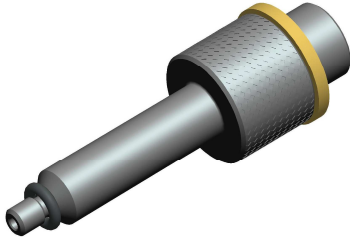




Filling nose image	Description	PC	Part number
	Filling nose with O-ring M20x1	A	E0001-A0039-A0
	Filling nose with bonded seal M3	B	E0001-A0040-A0
	Filling nose with O-ring M8x1	A	E0001-A0041-A0
	Filling nose with O-ring M8	A	E0001-A0042-A0
	Filling nose with O-ring (for filling trough needle) M10x1	C	E0001-A0043-A0
	Filling nose with O-ring (for filling trough needle) M6x0,75	C	E0001-A0044-A0

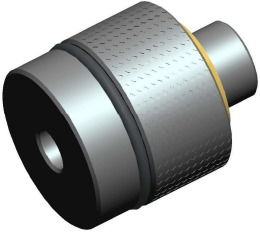
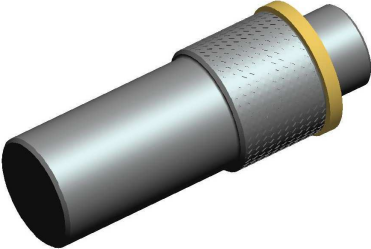
Filling nose image	Description		Part number
	Filling nose with O-ring M27x1	B	E0001-A0047-A0
	Filling nose with O-ring M28x1	B	E0001-A0048-A0
	Filling nose with O-ring M34x1	B	E0001-A0049-A0
	Filling nose with O-ring M4	A	E0001-A0051-A0
	Filling nose with bonded seal M3	B	E0001-A0059-A0
	Filling nose with O-ring M5 (short version)	A	E0001-A0060-A0

Filling nose image	Description	PC	Part number
	Filling nose with O-ring M6 (short version)	A	E0001-A0061-A0
	Filling nose with O-ring M8	A	E0001-A0062-A0
	Filling nose with O-ring M22x1	B	E0001-A0063-A0
	Filling nose with bonded seal M8x1	A	E0001-A0067-A0
	Filling nose with O-ring M5,3 x 0,706	A	E0001-A0080-A0
	Filling nose with O-ring M3	B	E0001-A0081-A0

Filling nose image	Description	PC	Part number
	Filling nose with O-ring M13 x 0,7	A	E0001-A0082-A0
	Filling nose with O-ring M6,25 x 0,5	A	E0001-A0083-A0
	Filling nose with O-ring M3,5 x 0,6	B	E0001-A0084-A0
	Filling nose clip ring construction OD Ø13,85	C	E0001-A0085-A0
	Filling nose with O-ring M19x1	A	E0001-A0087-A0
	Filling nose with O-ring M18x1	A	E0001-A0088-A0

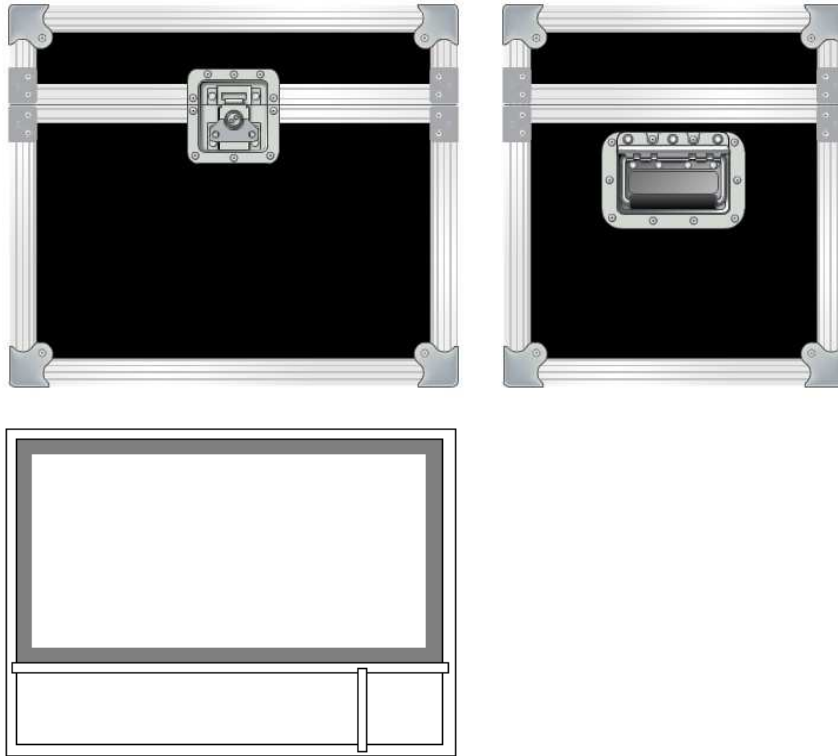
Filling nose image	Description	PC	Part number
	Filling nose with O-ring M18x1	A	E0001-A0089-A0
	Filling nose with bonded seal M5	A	E0001-A0092-A0
	Filling nose with O-ring M10x1 double starts	A	E0001-A0093-A0
	Filling nose with bonded seal M5 (long)	C	E0001-A0095-A0
	Filling nose with O-ring M30x1	B	E0001-A0096-A0
	Filling nose with O-ring M9 x 1	A	E0001-A0097-A0

Filling nose image	Description	PC	Part number
	Blocking sleeve separation piston (Used in combination with E0001-A0099-A0 to prevent separation piston from being pushed out of the reservoir)	A	E0001-A0098-A0
	Filling nose with O-ring UNC nr. 10 - 24 (Depending on application used in combination with E0001-A0098-A0)	A	E0001-A0099-A0
	Filling nose clipring construction OD Ø41,2	B	E0001-A0100-A0
	Filling nose with O-ring 5/16" x 24 UNF	A	E0001-A0101-A0
	Filling nose with O-ring M18 x 1	A	E0001-A0103-A0
	Filling nose with O-ring M27 x 0,8	B	E0001-A0104-A0

Filling nose image	Description	PC	Part number
	Filling nose with O-ring M28 x 1	B	E0001-A0105-A0
	<p>Filling nose basic version</p> <p>This filling nose is only machined to connect the main filling adaptor. The side which connects to the item which needs to be filled is free to machine as desired.</p> <p>The diameter is Ø17,5 mm</p>	A	E0001-A0037-A0
	<p>More filling noses coming soon!</p> <p>Other filling noses can be custom developed by DO Engineering</p>		

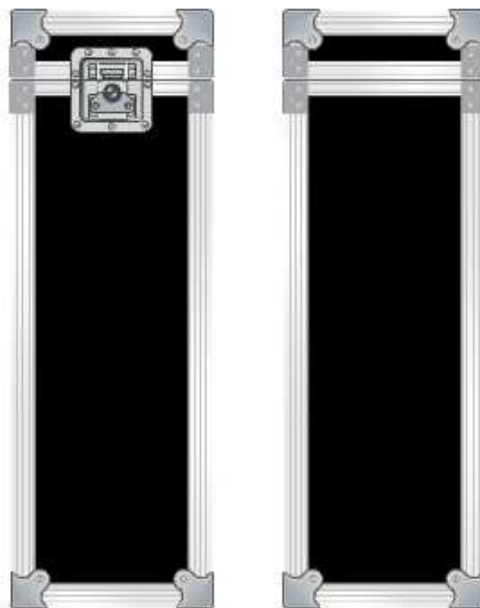
Flightcase for oil filling unit (optional for XP and LT)

The flightcase for the oil filling unit protects your oil filling unit from damages during transport.



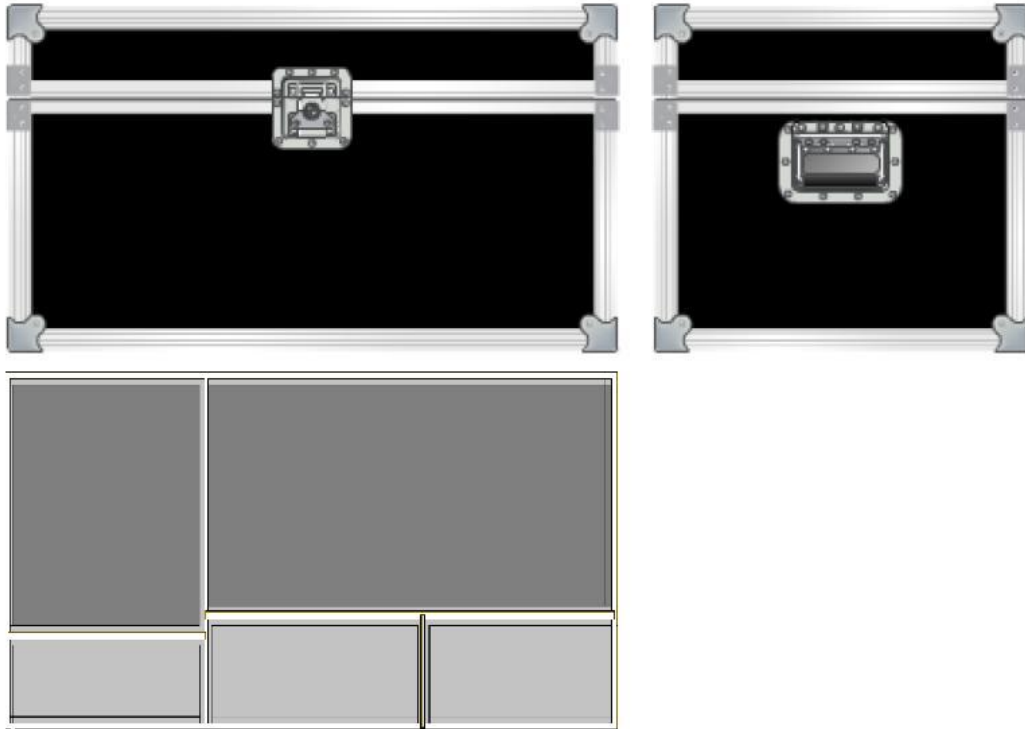
Flightcase for external tank (optional for XP)

The flightcase for the external tank protects your tank from damages during transport.



Flightcase for oil filling unit and separate oil reservoir (optional XP and LT)

In this flightcase you can transport both your oil filling unit and separate oil reservoir without any risk of damages during transport.



Set separate oil reservoir (optional XP and LT)

The separate oil reservoir is for use of different types of oil without emptying the oil reservoir in the oil filling unit and can be connected to the oil filling unit. This allows you to fill components with different oils / oil specifications easily and flexible. The DO Engineering oil filling unit (both XP and LT) has connections for the separate oil reservoir fitted standard.

The set separate oil reservoir DO Engineering is supplied with the following parts :

- Separate oil reservoir
- Owners manual separate oil reservoir
- Connecting hose (oil filling unit to separate oil reservoir)
- Y-connector (for use of separate oil reservoir together with compensation hose)



Filling splitter (optional for XP)

The filling splitter allows you to fill 2 dampers at the same time. This saves time when you have to fill dampers for 4-wheel vehicles (cars and quads for instance). Also, this gives the advantage that left /right side differences are eliminated. This is especially important for sports cars, rally cars and formula cars. Using a filling splitter is not advised by DO Engineering for the filling of very large shock absorbers.

The filling splitter is supplied with the following parts :

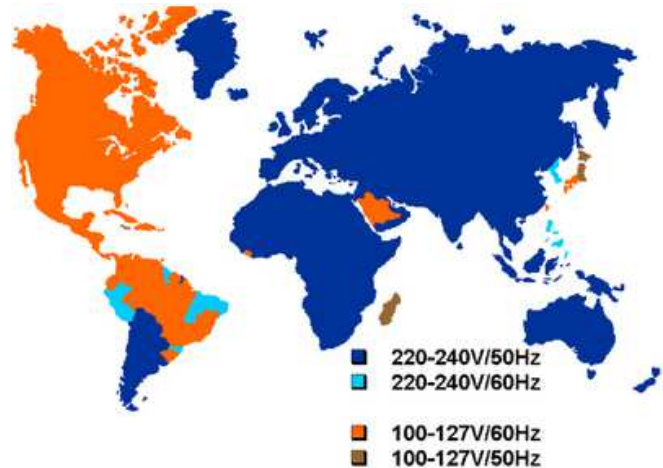
- Filling splitter

For shock absorber producing companies it is also possible to fill more dampers simultaneous. Please contact DO Engineering for the possibilities.



Voltage convertor 110V to 220V (optional for XP and LT)

For the use of the DO Engineering oil filling machine in country's that use a 110 V or 120 V electric power network.



Maintenance kit oil filling unit (optional XP and LT)

The maintenance kit oil filling machine contains all parts needed for 1 year of service of your oil filling machine (service intervals under normal circumstances).

The maintenance kit oil filling machine contains the following parts :

- 4x O-ring oil reservoir
- Exhaust filter vacuum pump




1 liter vacuum pump oil (extra)



1 liter bottle of oil for the vacuum pump of the DO Engineering oil filling machines. High quality oil with a large temperature range. (A 1 liter bottle is included with the DO Engineering oil filling units).

Set oil type cards (optional XP and LT)

The oil type card can be placed in the special compartment located on the front of the oil reservoir. This allows the user to clearly see what oil is filled into the oil reservoir, in order to avoid filling a shock absorber with the wrong oil. The DO Engineering oil filling machine and optional separate oil reservoir come with 1 card into the slot on the oil reservoir. The set oil type cards contains 10 extra oil type cards.

www.do-engineering.nl	
Description :	_____
Viscosity :	_____
Article nr :	_____
Remarks :	_____

Specials (options that can be custom developed)

DO Engineering is also able to offer custom developments, please contact us if you are interested in the possibility of custom developments, for instance :

- Filling adaptors (other than mentioned)
- Filling noses (other than listed)
- Tank (in other sizes than std.)
- Separate oil reservoir (in other configurations, for instance with 2, 3 or more oil reservoirs)
- Complete solutions for filling high tech hydraulic systems (advanced suspension systems, shift systems, main hydraulic unit etc.)



Pricing

Please contact DO Engineering for a price list or quotation.

Contact information

DO Engineering

Heideblauwtje 9

7826 GE Emmen

The Netherlands

t: +31 (0)24 848 72 71

e: info@do-engineering.nl

i: www.do-engineering.nl

Copyright © DO Engineering: All rights reserved, each form of multiplying or publication, also of parts of this brochure, is only permitted with prior explicit written authorization by DO Engineering.

This brochure replaces all previous editions and makes these invalid. DO Engineering can modify, or withdraw from the market, without preceding warning, products from this brochure or properties of these products, such as representations, images, properties, sizes and weights, without carrying out these modifications to products sold earlier. The in this brochure incorporated usage and safety instructions do not come in the place of normally applying rules of good use and of the applying laws and safety regulations. The product properties and performances specified for the products cannot form a basis of a contractual obligation.