The open industry standard for fully automatic quick couplers

Standardization by the Open-S Alliance

Revision B, May 20, 2021

For more information please see

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1. Introduction to Open-S – the industry standard for fully automatic quick couplers

The Symmetrical Quick Coupler standard for excavators (the S-Standard) is an industry standard that was originally defined in 2006 by the Swedish Trade Association for Suppliers of Mobile Machines. The Symmetrical standard, which is an open standard not controlled by one specific manufacturer, has since its inception grown to become a well-known coupler standard on the international market.

The main goal of the Symmetrical standard has always been to safeguard interchangeability and nomenclature between various manufacturers of quick couplers, tiltrotators, buckets and work tools. The result is that the end user can always rely on the fact that a coupler from one manufacturer will fit, from a mechanical perspective, with a bucket or work tool from another manufacturer, as long as both manufacturers comply with the standard.

The demand for quick couplers with integrated hydraulic couplings and electrical connectors, so called Fully Automatic Quick Couplers continue to grow. In order to achieve interchangeability the request for a standardized and well-defined interface is therefore apparent.

The purpose of this document is to describe the standard for Symmetrical Fully Automatic Quick Couplers based on the Symmetrical Quick Couplers (S-standard).

2. Denomination and interchangeability between Open-S and the S-standard

The denomination for Open-S couplers follows the same general principle as for S-couplers, where for instance an S70 coupler would correspond to an OS70 coupler. A simplified view would be that an OS70 coupler is an S70 coupler with the addition of a number of hydraulic and electrical connectors in defined positions.

This means it is always possible to use an OS70 coupler to pick up a work tool with an S70 bracket (without hydraulic couplings). However, since a work tool with an OS70 bracket includes hydraulic couplings, it is normally not possible to pick up a work tool with an OS70 bracket using an S70 coupler. Note: it is recommended that non fully hydraulic work tools complies with the “Dimensions and data for mechanical work tool manufacturers” also published by the Open-S Alliance.

Although the S-standard and Open-S standard are very closely related it should be noted that the Open-S standard has tighter tolerances and predefined material specification. The reason for this is to ensure that the hydraulic connectors meet each other in a precise manner to safeguard a stable and reliable function of the hydraulic connectors.

3. Purpose of Open-S industry standard

The purpose with Open-S-standard is closely related to the purpose of the S-standard namely to:

1. Increased safety and efficiency for excavator owners, excavator operators and ground personnel thanks to interchangeability is achieved between different manufacturers' products.
2. Create a competitive and open industry standard that is not controlled by a single producer.
3. Create a standard that is user-friendly and follows the highest safety standards required in all markets.
4. Create a uniform manufacturing standard for dimensions and tolerances adapted for an efficient production process.
5. Create a design that makes it cost efficient to retrofit adaptor brackets to used and new buckets and work tools.

4. The Open-S Alliance

The Open-S Alliance is a non-profit organization that consists of a number of companies that have taken the explicit decision to follow the main principles below:

1. Manufacture products that are within the tolerances stipulated by the Open-S Alliance.
2. Manufacture products that follow the material specification as specified below.
3. Tag products with the Open-S compliant seal for easy identification by customers.
4. Work towards mutual interchangeability of work tools and accept that products are CE-marked also when couplers and work tools come from different manufacturers.
5. Take responsibility for warranty for your own products if connected with products from another manufacturer complying with the Open-S requirements.

5. Work site safety and Open-S

Work site safety is of utmost importance and all manufacturers that are part of the Open-S Alliance are all committed to conform with relevant industry standards such as ISO-13031 and EN-474.

Further Open-S Alliance founding partners actively participate in the ISO/CEN standard work groups such as ISO/TC 127 – Earth moving machinery, to ensure we are staying in the forefront of safety for quick coupler and work tools.

6. The “Open-S” seal

To make it easy for operators to identify which products follow the Open-S standard the following seals are used to mark products.

The Open-S seal on a quick coupler, tiltrotator, adaptor or work tool indicates that the product complies with the Open-S standard. For specific design of the Open-S seals for product marketing see Open-S Design Guidelines.

7. Open-S and CE-marking

Each supplier on his own assumes the responsibility to CE-marking its products where necessary.

Quick couplers, tiltrotators, and hydraulic work tools are defined as interchangeable equipment by the 89/392/EEC Committee.

Buckets, rippers, etc. are simple work tools without moving parts and are not to be CE-marked.

Open-S ensures that work tool adaptors are compatible and no new risks are foreseen to arise when combining products from different manufacturers. The user needs to verify that the products are of the same size and type and are intended for combined use. Always consult the product operator manual if unsure.

Example of products or combinations of products: An Open-S quick coupler together with an Open-S adapter assembled on to a hydraulic breaker.

No new CE-marking for combined use is necessary as long as the operator instruction is followed and guidelines from each manufacturer.

For detailed information please consult your supplier.

8. Interchangeability with manufacturers <u>not</u> stating compliance to the Open-S standard

Some manufacturers produce products which in principle follow the Open-S standard approach to fully automatic quick couplers but are not a part of the Open-S. If you have non-Open-S products they may very well work with Open-S products but you must perform a thorough test to ensure compatibility.

When connecting Open-S products with a non-Open-S adaptor plate or quick coupler it is important to verify interchangeability in a structured way. This can be simplified by using a checklist. An example of such a checklist can be found in Annex 1.

As quick coupler and work tools are defined as interchangeable equipment according to the EEC Committee it is still perfectly ok to use a non-Open-S product combined with an Open-S product without a new CE-marking. The compatibility needs to be verified and the products used in accordance with the operator manuals and the combination is verified to have full functionality.

9. Reference documentation

- Symmetrical Quick Couplers for Excavators, Swedish Trade Association for Suppliers of Mobile Machines, June 2011.
- CECE Guidance on the classification of attachments to construction equipment for the machinery directive 2006/EC/42, Committee for European Construction Equipment, February 2012.
- ISO-13031:2015
- EN474-5

10. Technical specification

10.1. Break out torque

The coupler should at least withstand the following requirements regarding positive and negative breakout torque.

Positive torque is defined as the torque around the front axis when used in the digging direction. Negative torque is defined as the torque in the bucket opening direction.

See Figure 1.

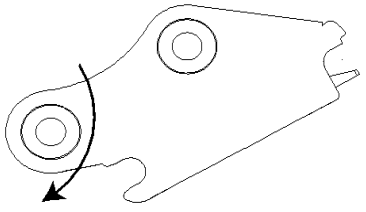
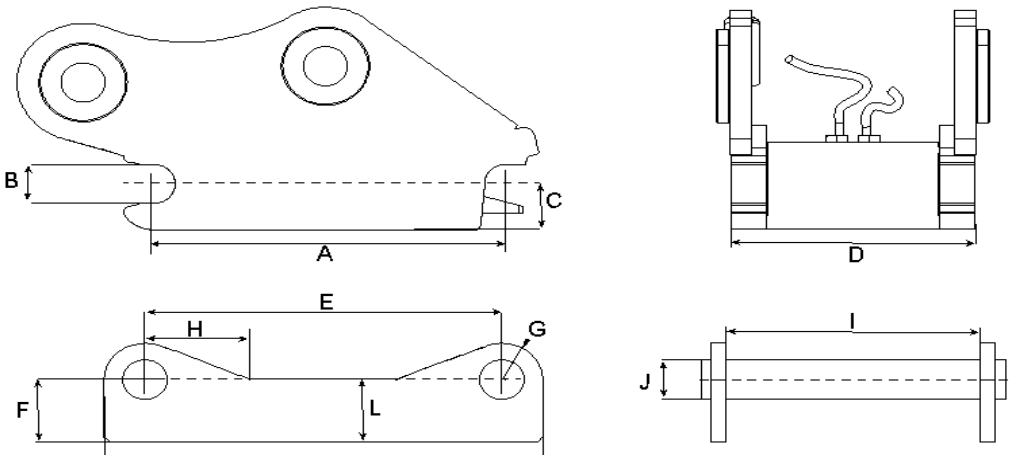


Figure 1. Positive torque direction

10.2. Main dimensions and load table

Quick Coupler Size	Width (mm)	Shaft c-c (mm)	Shaft diameter (mm)	Positive Torque (kNm)	Negative Torque (kNm)	Max recommended machine weight (metric ton)
OS45	290	430	45	65	42	11
OS50	270	430	50	65	42	11
OS60	340	480	60	150	75	18
OS65	440	530	65	240	150	22
OS70	450	600	70	300	195	30
OS70/55	550	600	70	350	230	32
OS80	590	670	80	600	390	40
OS90	750	750	90	1000	650	70

10.3. Dimensions and tolerance table



Measurements (mm)	OS45	OS50	OS60	OS65	OS70	OS70/55	OS80	OS90
A.	429,7 ±0,1	429,7 ±0,1	479,7 ±0,1	529,8 ±0,1	599,7 ±0,1	599,7 ±0,1	669,6 ±0,1	749,6 ±0,1
B.	45 H9	50 H9	60 H9	65 H9	70 H9	70 H9	80 H9	90 H9
C.	65	65	80	85	100	100	115	125
D.	290 ± 0,25	270 ± 0,25	340 ± 0,25	440 ± 0,25	450 ± 0,25	550 ± 0,25	590 ± 0,25	620 ± 0,25
E.	430,25 ± 0,25	430,25 ± 0,25	480,25 ± 0,25	530,25 ± 0,25	600,25 ± 0,25	600,25 ± 0,25	670,25 ± 0,25	750,25 ± 0,25
F. (min)	70	70	85	90	115	115	135	155
G. (max)	45	45	60	65	75	75	90	110
I.	291.5 ± 0,5	271.5 ± 0,5	341.5 ± 0,5	441.5 ± 0,5	451.5 ± 0,5	551.5 ± 0,5	591.5 ± 0,5	751.5 ± 0,5
J.	45 f8	50 f8	60 f8	65 f8	70 f8	70 f8	80 f8	90 f8

10.4. Material specification in shafts

In order to safeguard durability and longevity of product it is important that work tool shafts are of hardened high-grade material. The hardness of the shafts is specified in the detailed drawings.

10.5. Coupling radial movements

Male couplings should be able to move minimum 2 mm radially relative to their nominal position in the work tool.

The locking system must ensure that both the quick coupler and the hydraulic couplings are fully connected under all work conditions.

10.6. Coupling flow capacity

In order to allow for efficient work tool usage, it is important that the hydraulic couplings are designed in such a way that high flow is achieved. The following flows are the minimum acceptable level for hydraulic couplings manufactured by members of the Open-S Alliance.

Coupling	**Nose diameter**	**Continuous flow l/min** (delta pressure max 3 bar)
1”	40 mm	250
3/4"	32 mm	140
1/2"	24,5 mm	70
3/8”	15 mm	40
1/4"	14 mm	20

All couplings are designed for 350 bar operating pressure.

10.7. Coupling dimensions and positions – male couplings

The purpose of the tables is to make it possible to distinguish between the different sizes of couplings during installation and to verify correct position as well as define the recommended usage for each coupling position.

The measurements do not include tolerances for manufacturing purposes.

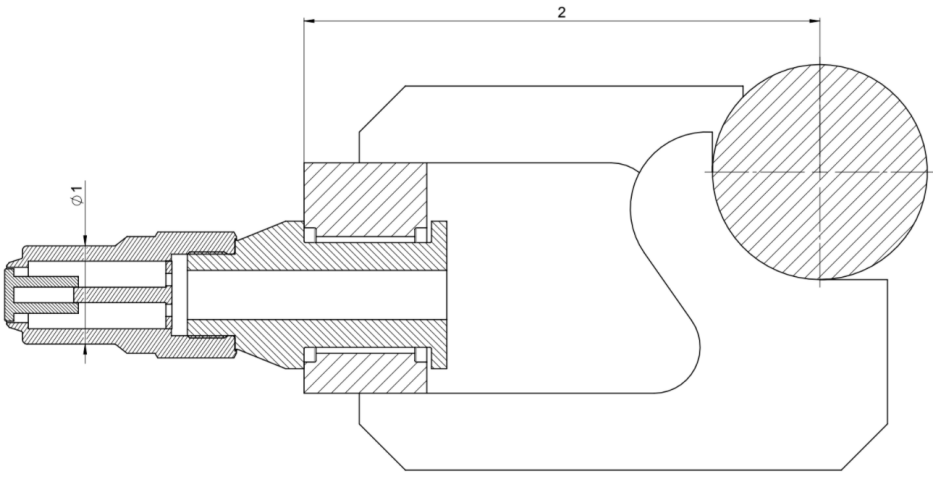
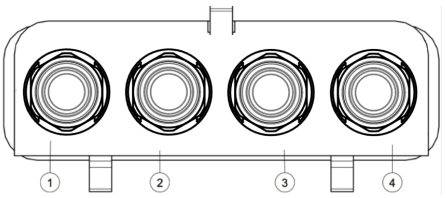


Figure 3. Coupling dimensions

10.7.1 OS45-4

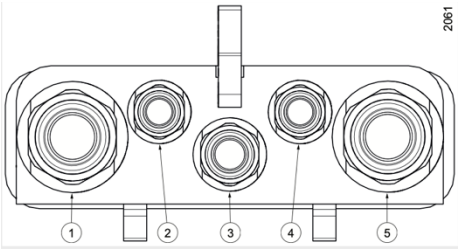
Dimensions (Fig. 3)	½”
1. Nose diameter	24.5
2. Ramp length	112,5



Positions	Size	Breaker type	Shear type
1.	½”	Pressure	Shear Close
2.	½”	N/A	Rotation A
3.	½”	Tank (optional)	Rotation B
4	½”	Tank	Shear Open

10.7.2 OS45-5

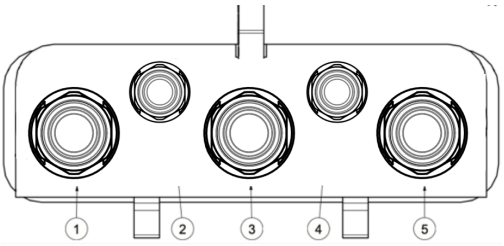
Dimensions (Fig. 3)	⅜”	½”
1. Nose diameter	15	24.5
2. Ramp length	112,5	112,5



Positions	Size	Breaker type	Shear type
1.	½	Pressure	Shear Close
2.	⅜”	N/A	Rotation A
3.	⅜”	Tank (optional)	Drain
4	⅜”	N/A	Rotation B
5.	½	Tank	Shear Open

10.7.3 OS50

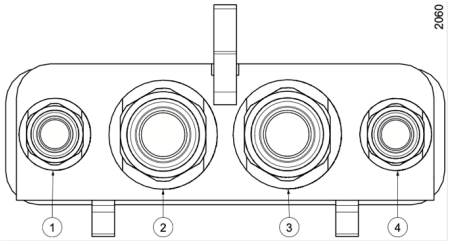
Dimensions (Fig. 3)	⅜”	½”
1. Nose diameter	15	24.5
2. Ramp length		



Positions	Size	Breaker type	Shear type
1.	½”	Pressure	Shear Close
2.	⅜”		Rotation A
3.	½”	Tank (optional)	Drain
4	⅜”		Rotation B
5.	½”	Tank	Shear Open

10.7.4 OS60-4

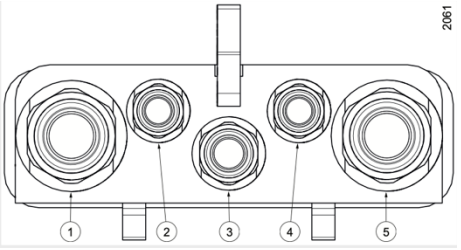
Dimensions (Fig. 3)	½”	¾”
1. Nose diameter	24,5	32,0
2. Ramp length	131,0	131,0



Positions	Size	Breaker type	Shear type
1.	½”	N/A	Rotation A
2.	¾”	Pressure	Shear Close
3.	¾”	Tank	Shear Open
4	½”	Tank (optional)	Rotation B

10.7.5 OS60-5

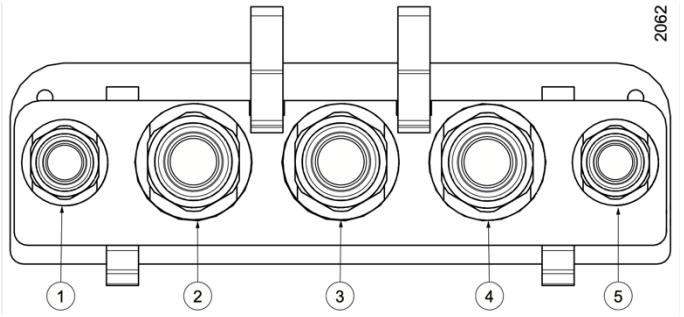
Dimensions (Fig. 3)	⅜”	½”	¾”
1. Nose diameter	15,0	24,5	32,0
2. Ramp length	131,0	131,0	131,0



Positions	Size	Breaker type	Shear type
1.	¾”	Pressure	Shear Close
2.	⅜”	N/A	Rotation A
3.	½”	Tank (optional)	Drain
4.	⅜”	N/A	Rotation B
5-	¾”	Tank	Shear Open

10.7.6 OS65

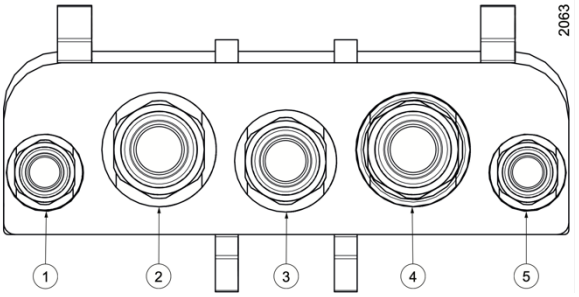
Dimensions (Fig. 3)	½”	¾”
1. Nose diameter	24,5	32,0
2. Ramp length	140,5	140,5



Positions	Size	Breaker type	Shear type
1.	½”	N/A	Rotation A
2.	¾”	Pressure	Shear Close
3.	¾”	Tank (optional)	Drain
4	¾”	Tank	Shear Open
5.	½”	N/A	Rotation B

10.7.7 OS70

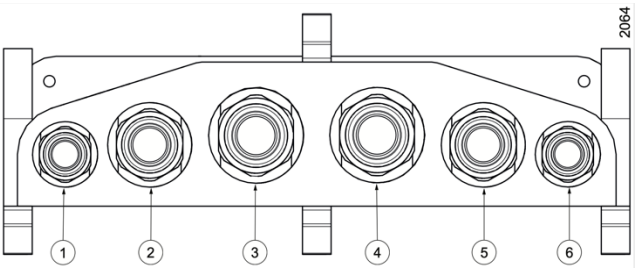
Dimensions (Fig. 3)	½”	¾”	1”
1. Nose diameter	24,5	32,0	40,0
2. Ramp length	168,0	168,0	168,0



Positions	Size	Breaker type	Shear type
1.	½”	N/A	Rotation A
2.	1“	Pressure	Shear Close
3.	¾”	Tank (optional)	Drain
4	1“	Tank	Shear Open
5.	½”	N/A	Rotation B

10.7.8 OS70/55

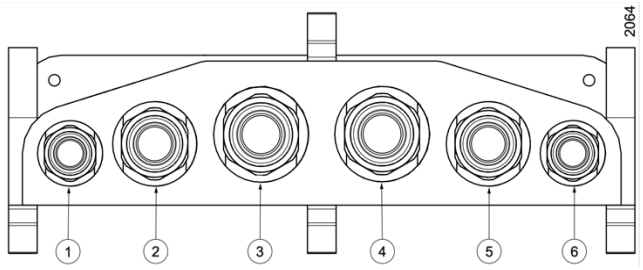
Dimensions (Fig. 3)	½”	¾”	1”
1. Nose diameter	24,5	32,0	40,0
2. Ramp length	168,0	168,0	168,0



Positions	Size	Breaker type	Shear type
1.	½”	N/A	Rotation A
2.	¾”	Pressure (optional) Central lubricating (optional) Water (optional)	Pressure (optional) Electrical connector (optional) Central lubricating (optional) Water (optional)
3.	1“	Pressure	Shear Close
4	1“	Tank	Shear Open
5.	¾”	Tank (optional)	Drain
6.	½”	N/A	Rotation B

10.7.9 OS80

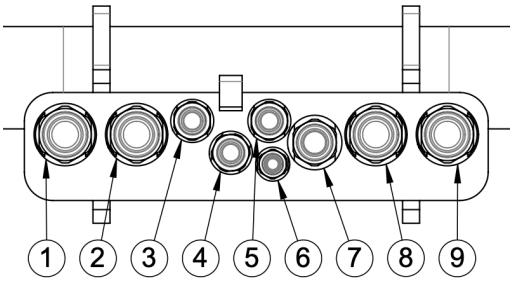
Dimensions (Fig. 3)	½”	¾”	1”
1. Nose diameter	24,5	32,0	40,0
2. Ramp length	216,5	216,5	216,5



Positions	Size	Breaker type	Shear type
1.	½”	N/A	Rotation A
2.	¾”	Pressure (optional) Central lubricating (optional) Water (optional)	Pressure (optional) Electrical connector (optional) Central lubricating (optional) Water (optional)
3.	1“	Pressure	Shear Close
4	1“	Tank	Shear Open
5.	¾”	Tank (optional)	Drain
6.	½”	N/A	Rotation B

10.7.10 OS90

Dimensions (Fig. 3)	⅜”	½”	¾”	1”
1. Nose diameter	15,0	24,5	32,0	40,0
2. Ramp length	244	244	244	244



Positions	Size	Breaker type	Shear type
1.	1“	Pressure	Shear Close
2.	1“	Pressure	Shear Close
3.	½”		Rotation A
4	½”	Drain (optional)	Drain (optional)
5.	½”		Rotation B
6.	⅜”	Central lubricating (optional)	Central lubricating (optional)
7.	¾”	Water (optional)	Water (optional)
8.	1“	Tank	Shear Open
9.	1“	Tank	Shear Open

Revision History

Date	Description	Done by (initials)
March 15, 2021	Original document.	MN
May 20, 2021	Minor updates in tables and text	MN

Stockholm, March 15, 2021

Annex 1. Procedure for verifying interchangeability

Open-S members provide high performing fully automatic oil couplers for excavators to connect hydraulic work tools.

Despite that all manufacturers follow the same standard it is still prudent to verify interchangeability when couplers and work tools are connected for the first time.

Once you have checked the interchangeability and verified functionality as described, then you can approve to combine our Quick Couplers and Work Tools with its counterparts from other manufacturers. As long as the products are used in accordance with their operator manuals, CE marking is not affected as no additional risks are foreseen to arise due to the combined use.

1) Check the interchangeability
   a) Ensure that the work tool adapter has the same configuration of hydraulic oil quick couplings as the quick coupler.
   b) Check that the size and position of all couplings are the same in both H-cylinder and coupling ramp.
   c) Ensure that the pins in the adapter of the work tool conforms to each other.
   d) Some work tools may have additional plates not covered by the Open-S or Symmetrical standard. When these plates obstruct the connection process please contact your supplier to verify if modification is possible.
   e) If the work tool has an electrical connector the quick coupler must have the same type of connector as the work tool.

2) Verify the functionality (on plain ground and with no people close by)
   a) Gently couple the work tool(s) with the quick coupler and verify that no mechanical interference occurs. Any interference must be fixed prior to next steps.
   b) Couple the work tool(s) and ensure they are securely held in the quick coupler and verify the locking functions. Follow the procedures in the operator manual.
   c) Couple the work tool(s) correctly in the quick coupler and verify the function of the hydraulic oil quick couplings. Check that no leakage exists and ensure full hydraulic function in the work tool.
   d) If the work tool has an electrical connector, verify that all electrical signals have full functionality.