The open industry standard for fully automatic quick couplers



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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 <u>not</u> 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 "Open-S dimensions and data for manufacturers of mechanical work tools" 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 material requirements to ensure that the hydraulic connectors meet each other in a precise manner to safeguard a reliable function of the hydraulic couplings and electrical connectors.

3. Purpose of the Open-S industry standard

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

- Increased safety and efficiency for excavator owners, excavator operators and other worksite personnel thanks to the standardized interchangeability between different manufacturers' products.
- 2. Create a competitive and open industry standard that is not controlled by a single manufacturer.
- 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 adapter 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.
- Work towards mutual interchangeability of work tools and accept that products comply with governing regulations (CE/UKCA etc) when couplers and work tools from different manufacturers are combined.
- 5. Take responsibility for warranty for their own products if combined 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.

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 couplers and work tools.

6. The "Open-S" seal

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



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

7. Open-S and CE-marking

Each supplier on his own assumes the responsibility of 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 products 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 product combination: An Open-S quick coupler together with an Open-S adapter assembled with a hydraulic breaker.

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

For detailed information, please consult your supplier.

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

Some manufacturers make products that basically follow the Open-S standard for fully automatic quick couplers, but are not part of 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 adapter plate or quick coupler, it is important to verify interchangeability in a structured manner. This can be simplified by using a checklist, an example of such a checklist can be found in Appendix 1.

Since quick couplers 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 new CE-marking. The compatibility and full functionality of the combination must be verified and the products must be used in accordance with the respective operator manuals.

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
- 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 pin 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

To be able to verify that the basic dimensions of a quick coupler or work tool bracket are within Open-S specifications, the following table can be used as a reference. Detailed dimensions and tolerances regarding quick couplers and hydraulic work tool brackets are available to Open-S members. Detailed dimensions and tolerances regarding non-hydraulic work tool brackets are available in the document "Open-S dimensions and data for manufacturers of mechanical work tools".



Figure 2. Quick coupler main dimensions

Quick Coupler Size	D1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Positive Torque (kNm)	Max recommended machine weight (metric ton)
OS45	45 H9	429,7 +/-0,1	290 +/-0,25	65 Max	65	11
OS50	50 H9	429,7 +/-0,1	270 +/-0,25	65 Max	65	11
OS60	60 H9	479,7 +/-0,1	340 +/-0,25	80 Max	150	18
OS65	65 H9	529,8 +/-0,1	440 +/-0,25	85 Max	240	22
OS70	70 H9	599,7 +/-0,1	450 +/-0,25	100 Max	300	30
OS70/55	70 H9	599,7 +/-0,1	550 +/-0,25	100 Max	350	32
OS80	80 H9	669,6 +/-0,1	590 +/-0,25	115 Max	600	40
OS90	90 H9	749,6 +/-0,1	750 +/-0,25	125 Max	1000	70



Figure 3. Work tool bracket main dimensions.

Quick Coupler Size	A1 (mm)	A3 (mm)	A5 (mm)
OS45	291,5 +/-0,5	430,25 +/-0,25	45 f8
OS50	271,5 +/-0,5	430,25 +/-0,25	50 f8
OS60	341,5 +/-0,5	480,25 +/-0,25	60 f8
OS65	441,5 +/-0,5	530,25 +/-0,25	65 f8
OS70	451,5 +/-0,5	600,25 +/-0,25	70 f8
OS70/55	551,5 +/-0,5	600,25 +/-0,25	70 f8
OS80	591,5 +/-0,5	670,25 +/-0,25	80 f8
OS90	751,5 +/-0,5	750,25 +/-0,25	90 f8

10.3. Tiltrotator and work tool geometry

To ensure that tiltrotators and work tools can be designed with optimal building height and also interchanged and utilized efficiently, certain basic geometries must be considered. Open-S alliance recommends that the following geometries be applied.



Figure 4. Tiltrotator and work tool geometry

Dimension	Description	OS45 - OS90
A1	Angle between upper bracket shafts and tilting axis	0°
A2	Angle between tilting axis and rotation axis	90°
A3	Angle between rotation axis and lower quick coupler	84°
A4*	Angle between bracket shafts and working surface	6°
A5*	Angle between rotating axis and working surface	90°

(*) A4 and A5 only applies to relevant work tools such as pallet forks, grading beams, etc where the working surface benefits from being perpendicular to the rotation axis.

10.4. Mechanical properties of bracket shafts

In order to safeguard durability and longevity of products it is important that work tool shafts are of hardened high-grade material. Detailed hardening specifications are available in the document "Open-S dimensions and data for manufacturers of mechanical work tools".

Exceptions from hardening requirements can be made for applications where shafts are not subject to excessive wear from normal use.

10.5. Coupling radial movements

Male couplings should be able to move a minimum of 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	Continuous flow I/min (delta pressure max 3 bar)
1"	250
3/4"	140
1/2"	70
3/8"	40
1/4"	20

All couplings are designed for an operating pressure of at least 350 bar.

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 5. Coupling dimensions

10.7.1 OS45-4

Dimensions (Fig. 5)	1/2"
1. Nose diameter	24.5
2. Ramp length	112,5



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

10.7.2 OS45-5

Dimensions (Fig. 5)	3/8"	1/2"
1. Nose diameter	15	24.5
2. Ramp length	112,5	112,5



Positions	Size	Breaker type	Shear type
1.	1/2"	Pressure	Shear Close
2.	3/8"	-	Rotation A
3.	3/8"	Drain	Drain
4.	3/8"	-	Rotation B
5.	1/2"	Tank	Shear Open

10.7.3 OS50

Dimensions (Fig. 5)	3/8"	1/2"
1. Nose diameter	15	24.5
2. Ramp length	101,5	101,5



Positions	Size	Breaker type	Shear type
1.	1/2"	Pressure	Shear Close
2.	3/8"	-	Rotation A
3.	1/2"	Drain	Drain
4.	3/8"	-	Rotation B
5.	1/2"	Tank	Shear Open

10.7.4 OS60-4

Dimensions (Fig. 5)	1/2"	3/4"
1. Nose diameter	24,5	32,0
2. Ramp length	131,0	131,0



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

10.7.5 OS60-5

Dimensions (Fig. 5)	3/8"	1/2"	3/4"
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.	3/4"	Pressure	Shear Close
2.	3/8"	-	Rotation A
3.	1/2"	Drain	Drain
			Rotation B (optional)
4.	3/8"	-	Rotation B
5.	3/4"	Tank	Shear Open

10.7.6 OS65

Dimensions (Fig. 5)	1/2"	3/4"
1. Nose diameter	24,5	32,0
2. Ramp length	140,5	140,5



Positions	Size	Breaker type	Shear type
1.	1/2"	-	Rotation A
2.	3/4"	Pressure	Shear Close
3.	3/4"	Drain	Drain
4.	3/4"	Tank	Shear Open
5.	1/2"	-	Rotation B

10.7.7 OS70

Dimensions (Fig. 5)	1/2"	3/4"	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.	1/2"	-	Rotation A
2.	1"	Pressure	Shear Close
3.	3/4"	Drain	Drain
4.	1"	Tank	Shear Open
5.	1/2"	-	Rotation B

10.7.8 OS70/55

Dimensions (Fig. 5)	1/2"	3/4"	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.	1/2"	-	Rotation A
2.	3/4"	Pressure (optional) Water (optional)	Pressure (optional) Electrical connector (optional) Water (optional)
3.	1"	Pressure	Shear Close
4.	1"	Tank	Shear Open
5.	3/4"	Drain	Drain
6.	1/2"	-	Rotation B

10.7.9 OS80

Dimensions (Fig. 5)	1/2"	3/4"	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.	1/2"	-	Rotation A
2.	3/4"	Pressure (optional) Water (optional)	Pressure (optional) Electrical connector (optional) Water (optional)
3.	1"	Pressure	Shear Close
4.	1"	Tank	Shear Open
5.	3/4"	Drain	Drain
6.	1/2"	-	Rotation B

10.7.10 OS90

Dimensions (Fig. 5)	3/8"	1/2"	3/4"	1"
1. Nose diameter	15,0	24,5	32,0	40,0
2. Ramp length	245	245	245	245



Positions	Size	Breaker type	Shear type
1.	1"	Pressure	Shear Close
2.	1"	Pressure	Shear Close
3.	1/2"	-	Rotation A
4.	1/2"	Water (optional)	Water (optional)
5.	1/2"	-	Rotation B
6.	3/8"	-	-
7.	3/4"	Drain	Drain
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
September 29, 2023	Misc updates in pictures and measurements. Added geometry recommendations regarding tiltrotator and work tool angles.	AW

Stockholm, September 29, 2023

Appendix 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.