



Foreword

This is an Operator's Manual in accordance with Directive 2006/42/EC on Machinery of the European Parliament and Council dated 17 May 2006 and as an amendment to Directive 95/16/EC (revised version). The requirements for unfinished machines and/or machine parts shall apply. Technical safety instructions are not collated in a separate chapter and are covered with the relevant, individual topics.

Warning: Read this Operator's Manual before installation and start-up. The cardan shafts are supplied by us ready for use. Under normal circumstances, it is therefore not necessary to top up lubricant prior to start-up. Flange surfaces must be bare and clean prior to assembly. Installation, removal and maintenance may be carried out only by suitably qualified technical staff.

Contact

• Technical agency: Tel. 0049 (0)40-2263301-30, E-mail: tb@w-sass.de • Internet: www.w-sass.de • 24-hour service: Tel. 0049 (0)40-2263301-0

Contents

01 Flange screw connection 02 Installation 03 Removal 04 Transport and storage 05 Maintenance and lubrication 06 EU Declaration of Conformity

01 Flange screw connection

High-strength cardan bolts of rigidity class 10.9 or hexagonal bolts similar to DIN 960-10.9 should be used for the screw connection of the cardan flange with the companion flange. If bolts compliant with DIN 931-10.9 and/or DIN 933-10.9 are used for companion flanges with threaded bores, the adjusted torque values must be observed. Only self-locking nuts compliant with DIN 980-10 may be used. If other nuts are used, the nut must be secured without fail. The bolt must be secured when using threaded bores in the companion flange. Please note that the bolt can not always be inserted from the cardan-shaft side. The bolt should therefore be pushed through from the companion-flange side and the nut should be screwed in place from the flange side. Unless otherwise specified, all of our cardan shafts are supplied in this form. Unless otherwise requested, the cardan shafts are supplied without a set of bolts. Naturally, we can also supply you with any set of bolts if required. The flanges should be bolted in a slightly oiled condition. However, an excess of oil or even grease should never be applied to the bolts and nuts. When tightening or loosening locking bolts or nuts, the existing thread lock is always destroyed. The nut or bolt must therefore always be re-locked after tightening or loosening.

Screw connection, DIN flange

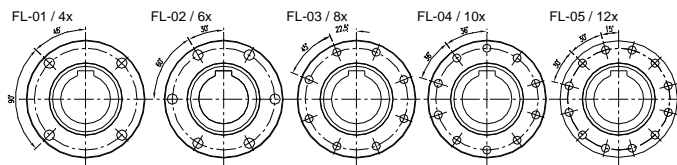
In accordance with ISO 7646

Cardan bolts, rigidity class 10.9

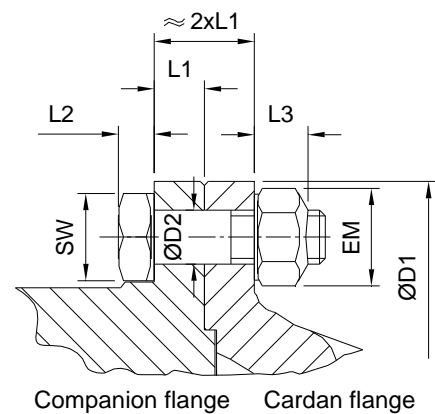
Hexagonal bolts, similar to DIN 960-10.9

Hexagonal nut DIN 980-10

*** = Size 114: M10x1x35 mm



ØD1 mm	L1 mm	ØD2 mm	Flange	Bolts					
				Size	SW* mm	EM** mm	L2 mm	L3 mm	Torq. Nm
58	4	Ø5	FL-01 (4)	M5x15	8	8.8	3.5	5	9
65	5	Ø6	FL-01 (4)	M6x20	10	11.1	4	6	14
75	6	Ø6	FL-02 (6)	M6x20	10	11.1	4	6	14
90	8	Ø8	FL-01 (4)	M8x1x25	13	14.4	5.3	8	36
100	8	Ø8	FL-02 (6)	M8x1x25	13	14.4	5.3	8	36
120	10	Ø8 Ø10	FL-03 (8)	M8x1x30	13	14.4	5.3	8	36
				M10x1x30***	17	18.9	6.4	10	70
150	12	Ø10 Ø12 Ø14	FL-03 (8)	M10x1x35	17	18.9	6.4	10	70
			FL-04 (10)	M12x1.5x40	19	21.1	7.5	12	120
			FL-05 (12)	M14x1.5x45	22	24.5	8.8	14	190
180	14	Ø12 Ø14 Ø16	FL-03 (8)	M12x1.5x45	19	21.1	7.5	12	120
			FL-04 (10)	M14x1.5x45	22	24.5	8.8	14	190
			FL-05 (12)	M16x1.5x50	24	26.8	10	16	300
225	15	Ø16	FL-03 (8)	M12x1.5x50	19	21.1	7.5	12	120
			FL-05 (12)	M16x1.5x50	24	26.8	10	16	300
250	18	Ø18	FL-03 (8)	M18x1.5x60	27	30.2	11.5	18	450
285	20	Ø20	FL-03 (8)	M20x1.5x65	30	33.6	12.5	20	620
315	22	Ø22	FL-03 (8)	M22x1.5x75	32	35.8	14	22	830
350	25	Ø22	FL-04 (10)	M22x1.5x75	32	35.8	14	22	830
390	28	Ø24	FL-04 (10)	M24x1.5x85	36	40	15	24	1100
435	32	Ø27	FL-04 (10)	M27x1.5x95	41	45.2	17	27	1600



Companion flange Cardan flange

*SW = across flats, **EM = corner dimension

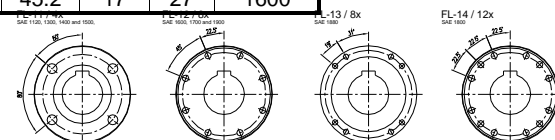
Screw connection, SAE flange

In accordance with ISO 7647

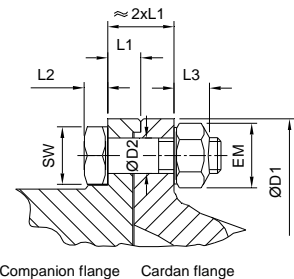
Cardan bolts, rigidity class 10.9

Hexagonal bolts DIN 960-10.9

Hexagonal nut DIN 980-10



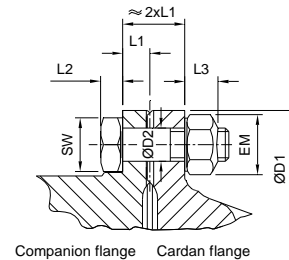
ØD1 mm	SAE Type	L1 mm	ØD3 mm	Flange	Bolts					
					Size	SW	EM	L2	L3	Torq. Nm
90	1100	6	Ø8	FL-11 (4)	M8x1x25 5/16"x1"	13	14.4	5.3	8	36
96	1300	7	Ø10 Ø9.5	FL-11 (4)	M10x1x30 3/8"x1 3/16"	17	18.9	6.4	10	70
116	1400	8	Ø12 Ø11.2	FL-11 (4)	M12x1.5x40 7/16"x1 5/8"	19	21.1	7.5	12	120
150	1500	8	Ø14 Ø12.7	FL-01 (4)	M14x1.5x45 1/2"x1 3/4"	22	24.5	8.8	14	190 120
175	1600	10	Ø10 Ø9.5	FL-12 (8)	M10x1x30 3/8"x1 3/16"	17	18.9	6.4	10	70
203	1700 1800	11	Ø12 Ø11	FL-12 (8) FL-14 (12)	M12x1.5x40 7/16"x1 5/8"	19	21.1	7.5	12	120
245	1880	15	Ø16	FL-13 (8)	M16x1.5x50	24	26.8	10	16	300
250	1900 GS	18	Ø12	FL-14 (12)	M12x1.5x50 7/16"x1 5/8"	19	21.1	7.5	12	120
276	1900	18	Ø16	FL-12 (8)	M16x1.5x60	24	26.8	10	16	300



Screw connection, KV flange

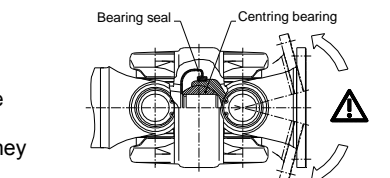
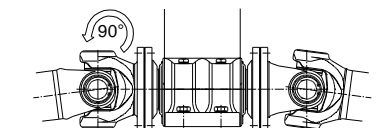
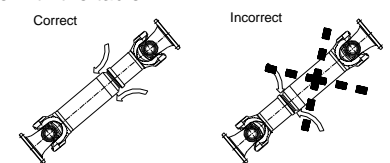
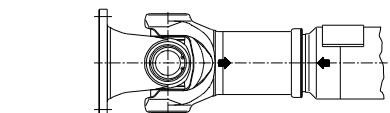
In accordance with ISO 12667 and ISO 8667. All cross-toothed flanges have four bolts per flange. Cardan bolts, rigidity class 10.9, hexagonal bolts similar to DIN 960-10.9, hexagonal nuts DIN 980-10.

ØD1 mm	L3 mm	ØD2 mm	Bolts					
			Size	SW mm	EM mm	L2 mm	L3 mm	Torq. Nm
100	10	Ø8	M8x1x30	13	14.4	5.3	8	36
120	14	Ø11	M10x1x40	17	18.9	6.4	10	70
150	16	Ø13	M12x1.5x45	19	21.1	7.5	12	120
180	18	Ø15	M14x1.5x55	22	24.5	8.8	14	190
200	20	Ø15	M14x1.5x55	22	24.5	8.8	14	190



02 Installation

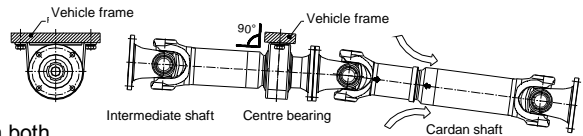
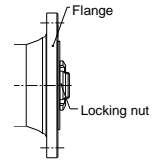
- Before installation, remove any transport locks, if applicable.
- Before installation, check whether the cardan shaft is connected precisely in line with the marking on the offset.
- If the cardan shaft is painted, make sure that the area for the length adjuster remains free.
- Use only bolts and nuts of the correct quality and size in accordance with the table.
- Always install the cardan shaft so that dirt is deflected from the offset and water can drain away.
- Always tighten flange screw connections in cross-wise sequence with a torque wrench in accordance with the table.
- Before screwing them together, always ensure that the front faces of the cardan flange and the opposite flange are free of any dirt, grease, oil, anti-corrosion agents and paint.
- Never exchange the offset or other cardan-shaft parts of different cardan shafts. Otherwise, the cardan shafts would no longer be balanced properly.
- If it is necessary to pull the cardan shaft fully out of the offset, pay close attention to the marking when putting the offset back together.
- Never remove weight panels or other parts from the cardan shaft or carry out any other conversion work. Otherwise, the function of the cardan shaft would no longer be guaranteed and our guarantee would be rendered null and void immediately.
- Following installation, the length adjuster must have freedom of movement on both sides, so that both the minimum and maximum operating lengths can be set with the length adjuster.
- Always install cardan shafts without a length adjuster free from any tension.
- On gearboxes, intermediate bearings and similar machine elements with cardan connections on both sides, the cardan shafts should each be attached with a 90° offset.
- Never rotate the cardan shaft with assembly tools such as pipe extensions or levers in the joint. Grease nipples and seals could be damaged.
- Check the companion flange. Its shape and size must correspond precisely to the cardan flange.
- Protect cardan shafts with a centred double joint against tilting too far during installation. Otherwise, the centring bearing could be damaged.
- All other machine parts must be positioned outside the working area and the rotation diameter of the cardan shaft.
- To ensure the safety of the vehicle, important machine elements must be protected to ensure that they cannot be damaged if a fault occurs in the cardan shaft.
- Before starting up the cardan shaft, play close attention to the instructions for topping up lubricant.





Installation of cardan-shaft strands

- Intermediate shafts and cardan-shaft strands are supplied completely assembled with the relevant centre bearings. Therefore never disassemble the bearings before installation, but secure them together with the cardan shaft.
- Never loosen or tighten the locking nuts or locking bolt(s) of the bearing, as otherwise the safety mechanism will be destroyed.
- When installing the cardan-shaft strand, observe the relevant installation specifications of the manufacturer.
- Secure the centre bearing on the vehicle only when the drive side and the output side of the cardan-shaft strand have been attached. The centre or intermediate-shaft bearing must always be installed without any force.
- The cardan-shaft strand is generally relatively long and so considerable leverage forces are applied to the joints during installation. To ensure that the joints are not damaged during installation, do not allow the cardan-shaft strand to sag or the joints to be bent excessively.
- The intermediate bearing must always be positioned at right angles to the intermediate shaft and to the cardan-shaft strand.
- The frame under the bearing mount must be sturdy and strong enough to withstand the applied forces.
- Position the cardan-shaft strand so that any dirt is deflected from the offset and water can drain away.
- To secure the centre bearing on the vehicle frame, follow the specifications of the vehicle manufacturer and use the bolts stipulated there to secure the bearing accordingly.
- Following installation, the length adjuster must have freedom of movement on both sides, so that both the minimum and maximum operating lengths can be set with the length adjuster.

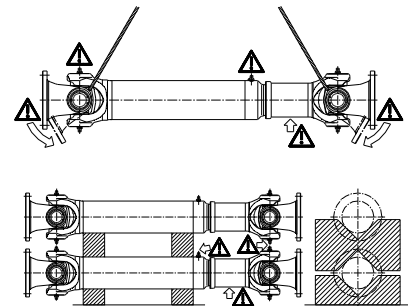


03 Removal

- When removing the cardan shaft, prevent the offset from slipping down.
- If the marking on the offset is no longer visible, apply a position marking on the spline and the spline bore hub before pulling them apart.
- Always work safely. Secure the joints against tipping over. When performing removal work under the vehicle, prevent the cardan shaft from falling down.
- Never exchange different parts of different cardan shafts.

04 Transport and storage

- Ensure that all shipments are always horizontal. If a vertical transport is inevitable, ensure that the offset cannot slide out.
- When transporting with a forklift truck, place wood under the machine and lift only under the pipe.
- Always pay close attention to the grease nipples. No squared timber or lifting cables may be allowed to touch the grease nipples.
- No load may be applied to the profile protection under any circumstances during storage or transportation.
- In the event of crane transportation, use only plastic cables or lifting straps. If only steel cables are available, apply edge protectors to the contact points.
- During transportation and storage, always protect the cardan shaft against rolling away with wedges.
- If you intend to stack several cardan shafts on top of each other, please use only suitable wooden or prisms, frames, which prevent the shafts from rolling out.
- Always store cardan shafts in dry places. Never apply loads to the offset or the profile protection.
- During storage, place supports only under the pipe. The joints, flanges, offsets, profile protection and grease nipples must be free and must not be loaded.
- Secure any cardan shafts with a centred double joint against bending too far during transportation and storage. Otherwise, the centring bearing will be damaged.



Storage conditions for cardan shafts and vertical bearings

All parts should be stored in their original packaging. The storage area must be clean, dry, dust-free and without any chemical vapours and the stored items must be at rest, i.e. without any vibrations. The applicable maximum room parameters are as follows: -5°C to +25°C for the temperatures, 8°C for the temperature difference between day and night and 65% for the relative humidity. Given compliance with all of these specifications, cardan shafts and vertical bearings can be stored for up to 5 years. Before start-up with parts that have been stored for longer than one year, it is necessary, however, to completely replace the old lubricant with a top-up procedure.

05 Maintenance and lubrication

Topping up lubricant and inspection of the cardan shaft can be carried out together with inspections of the vehicle or the machine. Of course, all of our specifications with regard to the lubricant intervals are only guidelines, because they are dependent on individual operating conditions. Every user must therefore determine his/her intervals for topping up lubricant and inspections at his/her own discretion.

Intervals for topping up lubricant and inspections (guidelines)

Vehicle or machine	Topping up lubricant every	or max. after	Inspection every	or max. after
Commercial vehicles in long-distance use and all comparable vehicles	50,000 km	12 months	100,000 km	12 months
Commercial vehicles in mixed on-road/off-road use Commercial vehicles in urban use All vehicles in comparable use	25,000 km	6 months	50,000 km	12 months
Buses/coaches in long-distance use	50,000 km	12 months	100,000 km	12 months
Buses/coaches in urban use	25,000 km	3 months	50,000 km	6 months
Commercial vehicles and construction machines in construction site use* Work vehicles, tractors, military vehicles* All vehicles in comparable use*	12,500 km or 250 h	3 months or after use in water	25,000 km	6 months
Ship engines	1,500 h	3 months	1,500 h	6 months
All types of industrial plant and lifting devices in intensive production	500 h	6 months	500 h	6 months

* Lubricant must be topped up in all cases after driving through rivers or other waters.



Cleaning the cardan shaft

Never clean the cardan shaft with a high-pressure cleaner or steam blaster. However, if such a cleaning procedure cannot be avoided, always top up the lubricant in the cardan shaft afterwards in the described manner until only fresh grease emerges from the seals.

Topping up lubricant

Before topping up the lubricant, clean the grease nipples and ensure that the grease can pass through properly. Do not top up the lubricant with excessive pressure or in a jerky fashion. We recommend 5 bar. Continue to top up the lubricant until the fresh grease emerges from the seals of the bearings. At the spline end, top up only with 2 to 3 strokes off the grease gun per interval. Always observe the seals carefully and top up the lubricant sensitively.

Lubricants

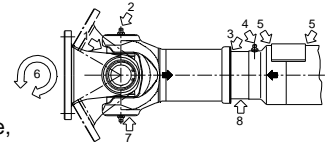
The cardan shafts are always supplied by us in lubricated condition. Cardan shafts that have been stored for longer than six months should always have their lubricant topped up without fail before start-up. Use only lithium-soap greases. We use and recommend *Fuchs Renolit LX-PEP 2* or *Microlube GL 262* as standard lubricant. The latter is a special grease on a mineral-oil basis with a special lithium soap. Other lubricant brands which can also be used as a standard grease are as follows: *BP Energrease LS 2*, *Esso Beacon EP 2*, *Shell Alvania EP 2*, *Mobil Mobilux 2*. Do not use any sodium-bicarbonate greases, Molykote lubricants or lubricants containing MoS₂ additives! If the cardan shaft is fitted with a low- or high-temperature cross and bearing kit, use only appropriate greases! Unless noted otherwise in the drawing, the grease nipples on our cardan shafts comply with DIN 71412. All grease nipples compliant with DIN 71412 are fitted with a removable plastic cap to protect against dirt and moisture.

All other lubricants may be used for standard operations which satisfy the following requirements:

Operating temperature: -30°C to +140°C consistency class: 2 (DIN 51818, NLGI), penetration: approx. 265 to 295 (DIN ISO 2137), drop point: >220 to 250°C (DIN ISO 2176), density: approx. 0.9 g/cm³ (DIN 51757 at 20°C), water resistance: approx. 1 to 90 (DIN 51807 – 3 h/90°C), flow pressure: approx. 1400 mbar (DIN 51805 – 25°C), anti-corrosion properties: 1 (DIN 51802 Emcor test), speed characteristics: approx. 300,000 to 400,000 (dm x n).

Inspection checklist (may be carried out with the cardan shaft installed in the vehicle or plant)

- Check the firm fit of the flange and the screw connections. If necessary, tighten with a torque wrench according to the table.
- Check whether all the bearing bushings of the cross and bearing kits are still firmly secured with safety rings (7).
- Check the bases of the bushings for discolouration or distortion, which indicates a positional fault or overheating (7). In the event of discolouration, the entire cross and bearing kit must be replaced.
- Check the bases of the bushings for traces of rotation under the locking ring, which indicate that the bushing has spun (7). In this case, the fork element and the cross and bearing kit must be replaced.
- Check whether any weight panels have come loose or have been lost (5). In the event of damaged or lost weight panels, the cardan shaft must be balanced again.
- Conduct a visual inspection of all the seals on the cross and bearing kits (1). If a seal is damaged, worn or lost, the cross and bearing kit must be replaced.
- Examine all seals in the offset and any possible plastic coatings for damage (1+3+8). In the event of damage, the seals must be replaced or the relevant parts must be exchanged by us.
- Check all grease nipples (2+4) and their protective caps. If necessary, replace the grease nipples and clean the lubrication ducts, if required, enabling the grease to pass through freely.
- Relieve the load on the shaft by raising it slightly and try to rotate the load and the joints (6). If it is possible to rotate them, the cardan shaft has too much play and must be overhauled.
- Carry out a visual inspection for dents in the pipe or in the profile protection and check all parts of the cardan shaft for visible cracks or breaks. If cracks are evident anywhere or a dent can be detected in the pipe, the shaft must be overhauled by us.
- Examine the centre bearing in intermediate shafts and cardan-shaft strands:



The bearing must not cause any noise during running. If noises occur, the bearing must be replaced. In the event of elastic intermediate bearings, the elastic rubber insert must not show any cracks or damage; it must fit precisely and be well anchored in its position. The roller bearing must also be anchored precisely in its position on the bearing frame. There must be no play in the position of the bearing in the rubber insert. Check the mounting bolts. If necessary, tighten according to the table above. The actual roller bearing must run smoothly, must not show any damage or have any play and must not cause any noise during running. The companion flange must be positioned firmly on the bearing shaft and it must not be possible to move it. There must be no play during rotation or on the horizontal plane. A loose washer or guard plate may be a sign of a loose flange. If necessary, tighten the locking bolts or nuts according to the table above.

06 EC Declaration of Conformity in accordance with EC Machinery Directive 2006/42/EC and EC Chemicals Regulation 1907/2006 (REACH)

Product: **Cardan shafts** Type: **GW-500 to GW-599**

We hereby declare that the cardan shafts described above satisfy the relevant fundamental health and safety requirements of the corresponding EC Directives with regard to their conception, design and the version brought into circulation by us. In the event of any modification to the cardan shafts that is not authorised by us, this Declaration shall become invalid. Internal measures ensure that the series devices always comply with the requirements of the currently applicable EC Directives and any related standards. It is forbidden to start up the part until the machine in which this part is incorporated has satisfied all requirements of the currently applicable EC Directives and any related standards.

The signatory is authorised to act on behalf of the company.

Stapelfeld, 01.01.2016

Gelenkwellenfabrik Wilhelm Sass KG, Brookstraße 14, D-22145 Stapelfeld. Court of Jurisdiction: Reinbek, Commercial Register A 2151

Page: 4 of 4 DOC-ID: VL TB001 Betriebsanleitung EN – version: 01.01.2016