SAUER DANFOSS

Steering Columns
Type OTP

Sensor
Type SASA

Valve Blocks
Type OVPL, OVR

Technical Information

OTP Steering Columns / OVPL, OVR Valve Blocks
Technical Information
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A Wide Range of Steering Components

A Wide Range of Steering Components

F300599

Sauer-Danfoss is the largest producer in the world of steering components for hydrostatic steering systems on off-road vehicles. Sauer-Danfoss offers steering solutions on both component and system level. Our product range makes it possible to cover applications of all types - ranging from ordinary 2-wheel steering (also known as Ackermann steering) to articulated steering, complicated 4-wheel steering, automatic steering (e.g. by sensor) and remote controlled steering via satellite.
We can offer more than 1000 different steering units, 150 different priority valves and 300 different steering columns categorized in types, variants and sizes.

For hydrostatic steering systems Sauer-Danfoss offers:

- Mini steering units with displacements from 32 to 100 cm^3 [1.95 to 6.10 in^3/rev] per revolution, flow up to 20 l/min [5.28 US gal/min], steering pressure up to 125 bar [1813 psi].
- Steering units with displacements from 40 to 1200 cm^3 [2.44 to 73.23 in^3] per revolution, flow up to 100 l/min [26.42 US gal/min], steering pressure up to 210 bar [3045 psi].
- Priority valves for rated flows of 40, 80, 120 and 160 l/min [10.57, 21.13, 31.70 and 42.27 US gal/min] pressure up to 350 bar [5076 psi].
- Flow amplifiers with amplification factors of 4, 5, 8, 10 or 20 for rated oil flows of 240 and 400 l/min [63.4 and 106 US gal/min], steering pressure up to 210 bar [3045 psi].
- Pilot operated steering valves with steering flows up to 100 l/min [26.4 US gal/min], steering pressure up to 250 bar [3625 psi].

For electro-hydraulic steering systems Sauer-Danfoss offers:

- Pilot operated steering valves (pilot operated by hydrostatic steering unit or by electrical signal) with steering flows up to 100 l/min [26.4 US gal/min], steering pressure up to 250 bar [3625 psi].

A Wide Range of Steering Components

A Wide Range of Steering Components (continued)

For the steering units Sauer-Danfoss offers:

- Steering columns: fixed, tiltable and/or telescopic with or without horn switch and sensor for start/stop of pump, in lengths from 45 to 1200 mm [1.77 to 47.24 in]

Characteristic features of steering units:

- Low steering torque: From 0.5 N•m to 3 N•m [4.42 to 26.6 lbf•in] in normal steering situations
- Low noise level
- Low pressure drop
- Many types available: Open center None reaction, Open center Reaction, Closed center None reaction, Load Sensing, Load Sensing Reaction
- One or more built-in valve functions: relief valve, shock valves, suction valves, none return valve in P-line and in LS-line
- Optional port connections (according to ISO, SAE or DIN standards)

Characteristic features of electro-hydraulic steering system:

- High steering pressure requiring smaller cylinders and flow
- Low pilot pressure and flow ensuring extremely low noise in the cabin
- The possibility of manual steering even of very heavy vehicles
- Minimization of side acceleration with articulated steering
- Electro-hydraulic steering valve EHPS can be combined with Sauer-Danfoss PVG 32 proportional valve

Concersion Factors

1 N•m	=	[8.851 lbf•in]	1 cm^3	=	[0.061 in^3]
1 N	=	[0.2248 lbf]	1 l	=	[0.264 US gal]
1 bar	=	[14.50 psi]	°F	=	[1.8 °C + 32]
1 mm	=	[0.0394 in]			

Contens and Technical Literature Survey

Survey of Literature with Technical Data on Sauer-Danfoss Steering Components

Detailed data on all Sauer-Danfoss steering components and accessories can be found in our steering component catalogues, which are divided into 6 individual sub-catalogues:

• General information	Steering components
• Technical data on mini steering units and steering columns for mini steering units	OSPM and OTPM
• Technical data on open center, and closed center steering units	OSPB, OSPC, OSPR, and OSPD
• Technical data on load sensing steering units, priority valves and flow amplifiers	OSPB, OSPC, OSPF, OSPD, OSPQ, OSPL, OSPBX, OSPLX, OLS and OSQ
• Technical data on hydraulic and electro-hydraulic pilot operated steering valves, electrical actuation modules and appropriate steering units	EHPS, PVES for EHPS and OSPCX
• Technical data on steering columns and valve blocks	OTP, SASA, OVPL and OVR

The most important data on all Sauer-Danfoss steering components are highlighted in a general survey brochure.
For technical information on individual variants, please contact the Sauer-Danfoss Sales Organization.

Fixed Steering Columns, OTP

Fixed Steering Columns, OTPB

The OTPB steering columns fit OSPB, OSPC, OSPD, OSPF, OSPL, OSPQ steering units and TAD torque amplifiers.

Fixed Steering Columns, OTPM

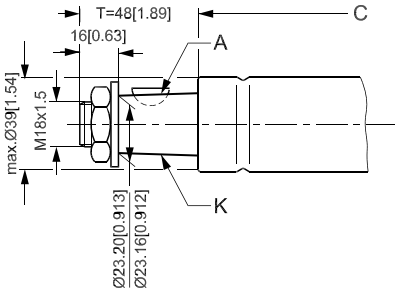
The OTPM steering columns fit OSPM steering units

Versions

Steering wheel connections: SWC

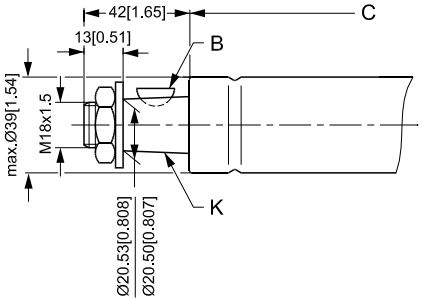
The OTPB steering columns are available with six different standard steering wheel connections:

1. A: 5 x 6,5 DIN 6888
   d_{min} = 23,16 mm [0.912 in]
   K: Taper 1:20



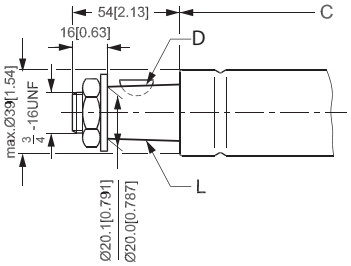
150-606.12

2. B: 5 x 7,5 DIN 6888
   d_{min} = 20,50 mm [0.807 in]
   K: Taper 1:20



150-198.10

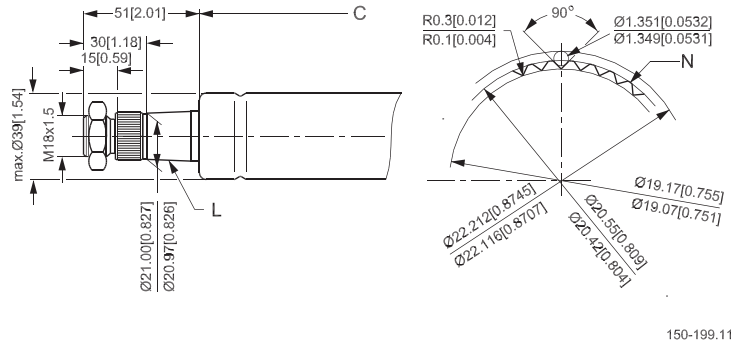
3. D: 3/16 x 3/8 SAE J502
   d_{min} = 20,0 mm [0.787 in]
   L: Taper 1:16



150-605.11

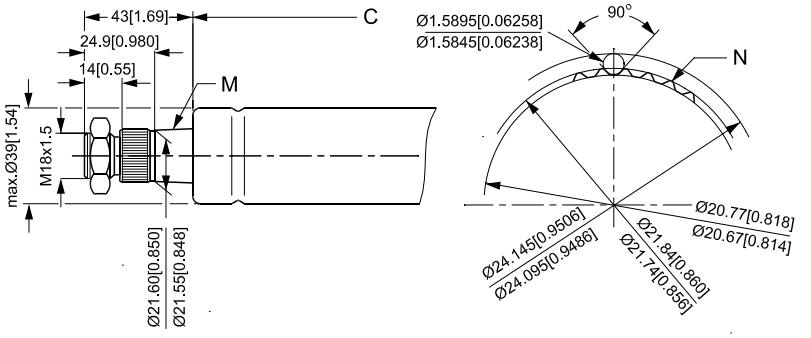
Versions (continued)

4. With 13/16 in-36 serration
   d_{min} = 20,97 mm [0.826 in]
   L: Taper 1:16
   N: 36 teeth



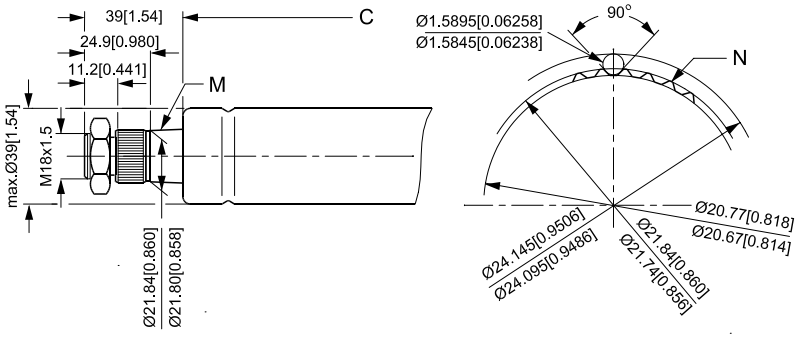
150-199.11

5. With 7/8 in-36 serration
   d_{min} = 21,55 mm [0.848 in]
   M: Taper 1:19,26
   N: 36 teeth



150-200.10

6. With 7/8 in-36 serration
   d_{min} = 21,80 mm [0.858 in]
   M: Taper 1:19,26
   N: 36 teeth



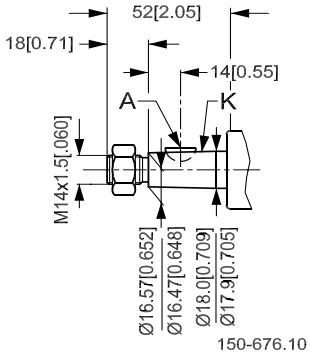
150-201.10

Versions (continued)

The OTPM steering columns are available with three different standard steering wheel connections.

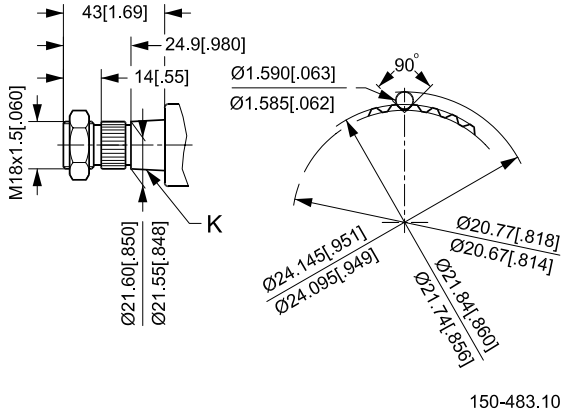
M1

A: 5 • 6.5 DIN 6888
d_{min} = 16.47 mm [0.648 in]
K: Taper 1:20



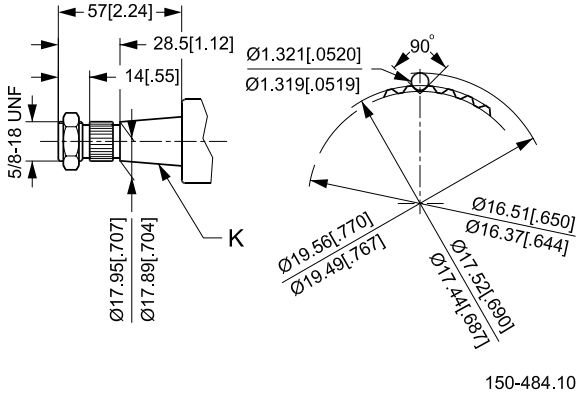
M2

(same as "5" page 8)
With 7/8 in-36 serration
d_{min} = 21,55 mm [0.848 in]
K: Taper 1:19,26



M3

With 11/16 in-40 serration
d_{min} = 17.89 mm [0.704 in]
K: Taper 1:12

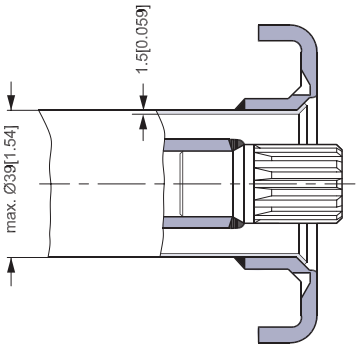


Versions (continued)

Body tubes

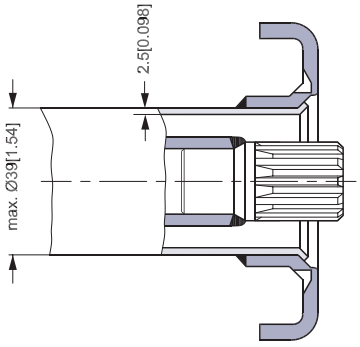
The OTPB steering columns are available with three different body tube dimensions:

1. Standard: Ø 38 • 1.5 mm [1.50 • 0.06 in]



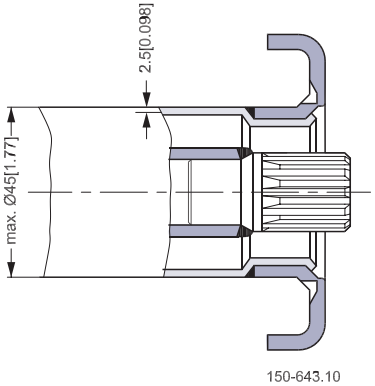
150-647.10.10

2. Ø38 • 2.5 mm [1.50 • 0.1in]



150-675.10

3. Ø45 • 2.5 mm [1.77 • 0.1 in]



150-643.10

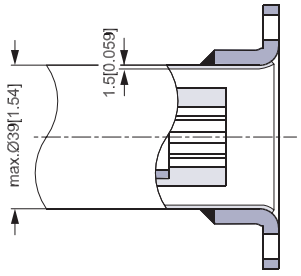
If the steering column is longer than 150 mm [5.91 in] and support is not possible, the recommended body tube is Ø38 x 2.5mm [1.50 • 0.1in] or Ø45 x 2.5mm [1.77 • 0.1 in].

Versions (continued)

Body tubes

The OTPM steering columns are available with one body tube dimensions:

1. Standard: Ø 38 • 1.5 mm [1.50 • 0.06 in]



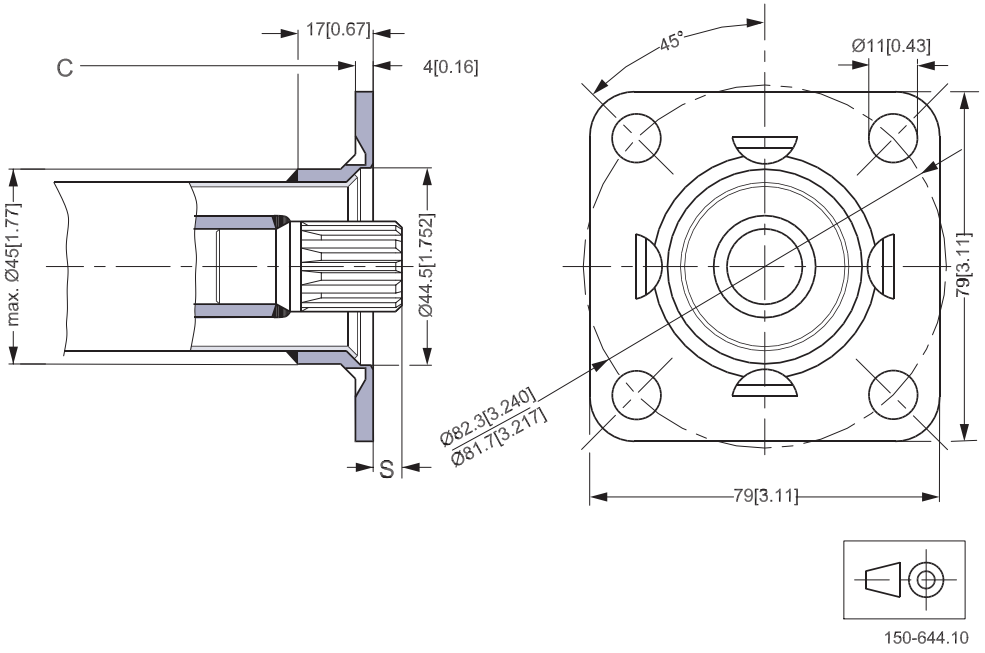
150-677.10

Versions (continued)

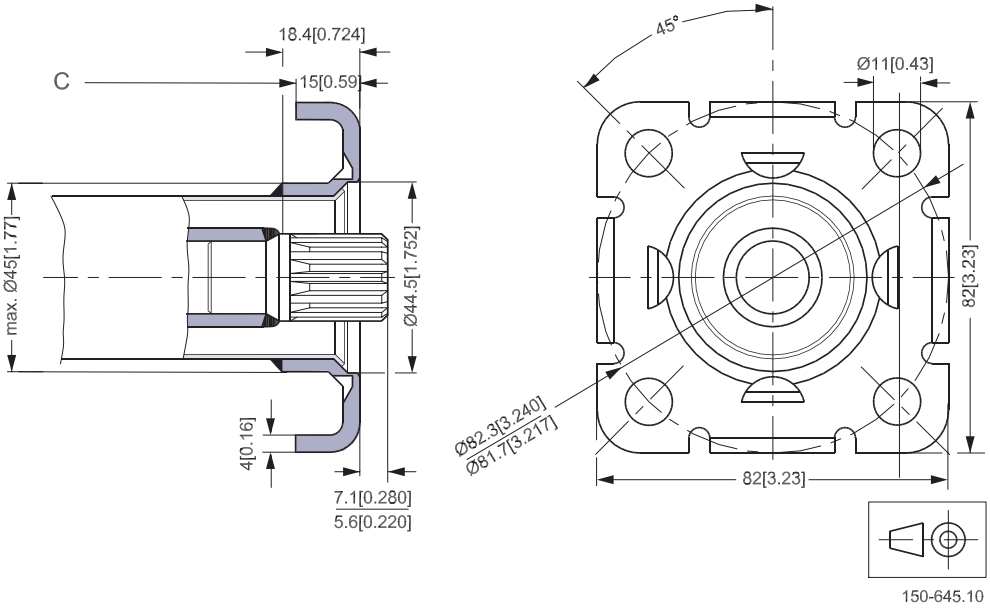
Flanges

Our OTPB steering columns are available with three different flanges:

Flange A



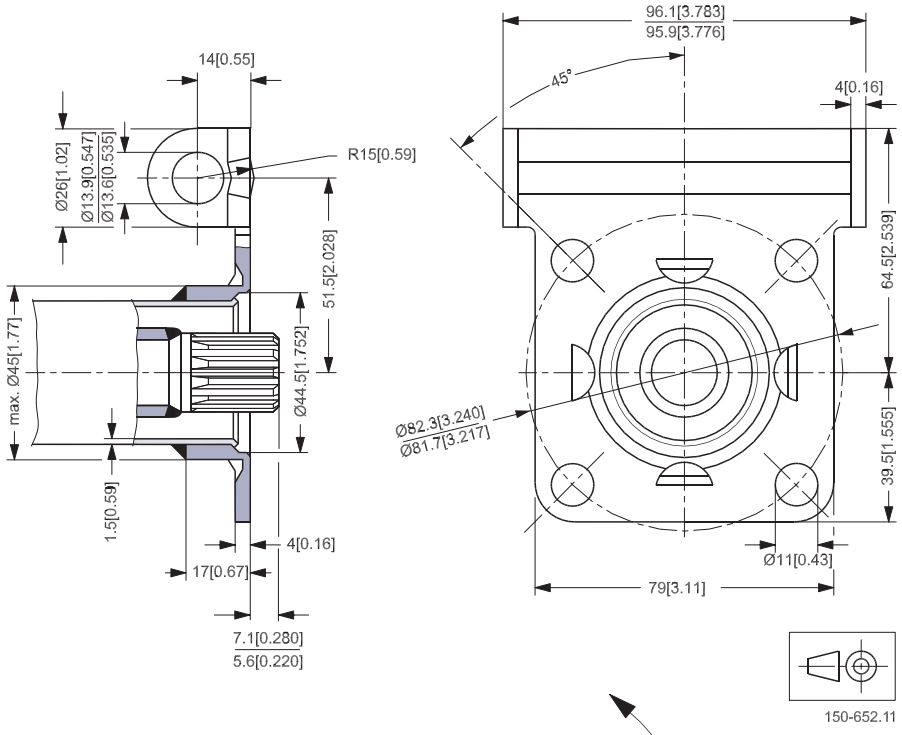
Flange B



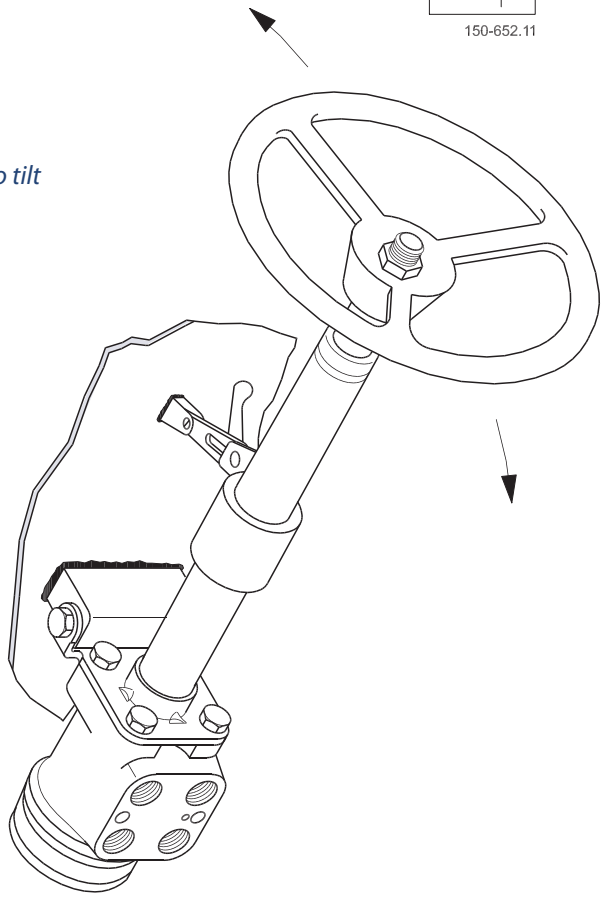
Versions (continued)

Flanges

Flange for bottom tilting



The tilting flange makes it possible to tilt steering column and steering unit.



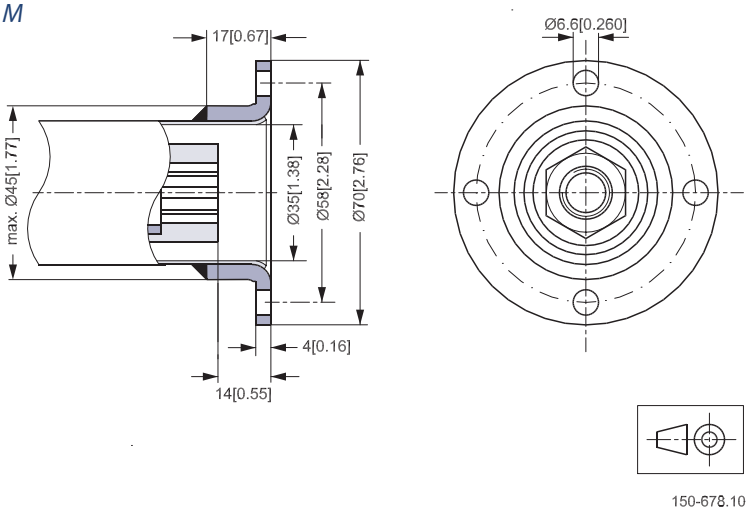
For other versions, please contact the Sauer-Danfoss Sales Organization

Versions (continued)

Flanges

The OTPM steering columns are available with one flange:

Flange M

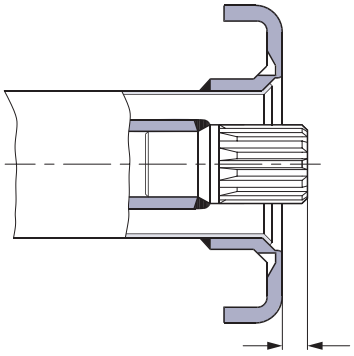


Versions (continued)

Axle journals

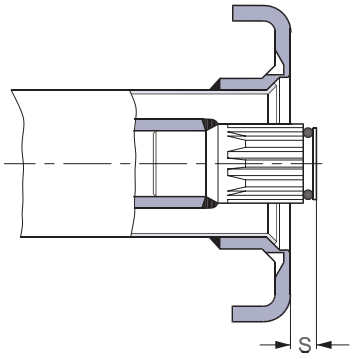
OTPB are available with three different axle journals for connection to the steering unit:

1. Standard axle journal with straight splines.
   In case of inadequate parallelism between the steering column's mounting plane (flange) and the steering unit's steering column plane, use a spherical axle journal.
   For standard splines, the required parallelism is better than 0.5 mm in relation to the steering unit's steering column plane.



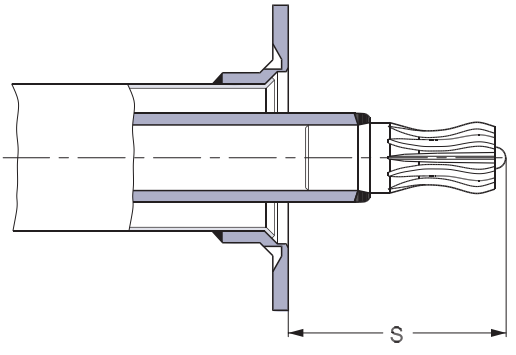
150-649.10

2. Axle journal with straight splines and O-ring for noise reduction



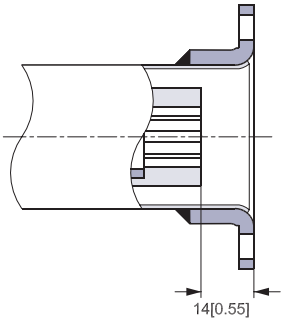
150-646.10

3. Spherical axle journal. This axle journal enables angular movements up to 10° between steering unit and steering column



150-650.10

4. OTPM are available with one type of axle journal type "M"



150-679.10

Versions (continued)

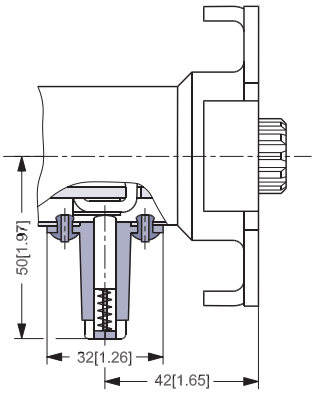
Surface protection

OTP steering columns are available with two different kinds of surface protection:
- Standard: yellow chromate
- Black chromate

Horn buttons

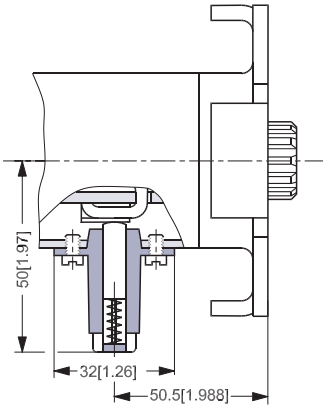
Our steering columns can be delivered with single ore double horn button (ref. below). description of horn buttons)

1. *Standard single horn button*
   For Ø38 mm [1.5 in] body tube, spare parts bag code number 150-5215



150-655.11

2. *Standard single horn button*
   For Ø45 mm [1.77 in]body tube, spare parts bag code number 150-4032



150-656.12

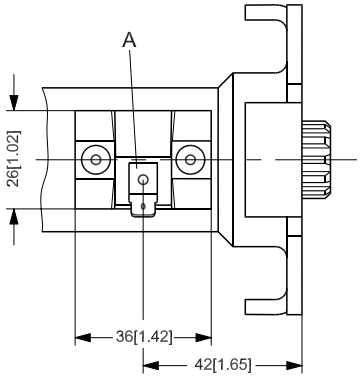
Fixed Steering Columns, OTP

Versions (continued)

3. Flat horn button

For Ø38 mm [1.5 in] and Ø45 mm [1.77 in] body tubes, spare parts bag code number 150-6762.
Height: 10 mm [0.39 in] from surface of body tube.
Due to the shape of the connecting hole in the steering column, the flat horn button cannot be directly interchanged with a standard horn button.

A: Spade connector DIN 46244-A6,3-0,8 BZ

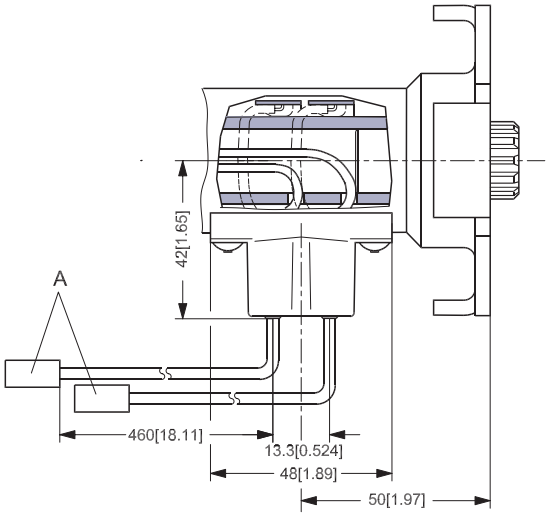


150-658.10

4. Double horn button.

Only for Ø38 mm [1.5 in] body tube, spare parts bag code number 150-6288

A: Covered male blade terminals AMP 3-520107-2



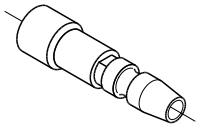
150-657.10

Versions (continued)

Wire ends for steering wheel horn button

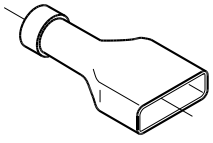
Steering columns with horn buttons are available with various wire ends in the steering wheel end of the column:

1. Standard: 100 mm wire with tin-plated end
2. 100 mm wire without tin-plated end
3. 100 mm wire with round AMP male connection, AMP no.160214



150-683.10

4. 100 mm wire with flat AMP female connection, fully insulated, AMP no. 735160-0

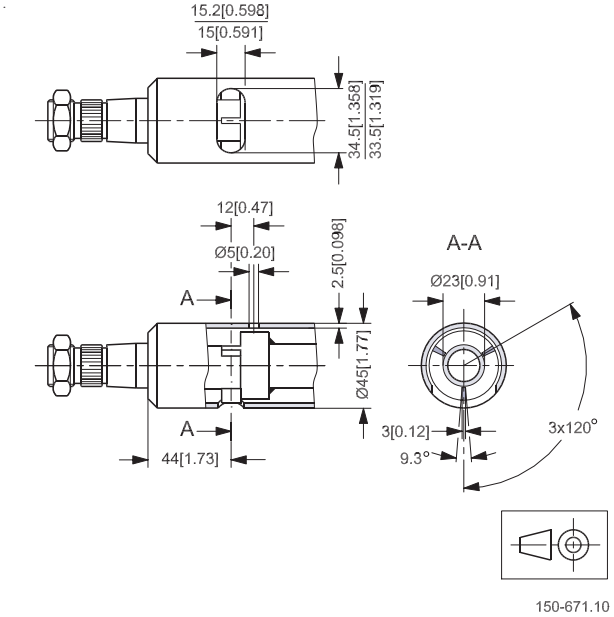


150-682.10

5. Customer defined

Flasher activator

OTP steering columns with body tube Ø45 mm are available with flasher activator. The activator returns the flasher switch into neutral after completion of steering rotation.



150-671.10

It is not possible to equip one and the same OTP steering column with both flasher activator and steering wheel sensor.

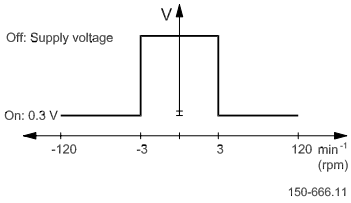
Versions (continued)

Steering wheel sensors

Our OTP steering columns are available in versions prepared for the installation of a steering wheel sensor for pump control. We can offer two different sensors:

1. ON/OFF sensor

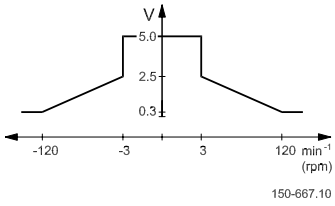
ON/OFF signal



Data:
Principle: Hall-effect, contactless, free of service.
Power supply: 24 or 48 V DC ± 25%.
Failure polarity protected.
Output: ON/OFF, open collector, NPN outputs.
Short circuit-protected.
Max load on signal: 50 mA
Response time: < 100 ms
Enclosure: IP 54
Wires: White = 24 or 48 V, Green = ON/OFF signal, Brown= 0 V
LED: For service, light is on when signal is active.

2. Proportional sensor

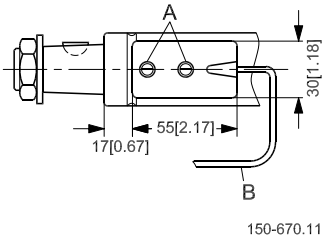
Proportional signal



Data:
Principle: Hall-effect, contactless, free of service.
Power supply: 18-80 V DC ± 10%. Failure polarity protected.
Output: Analogue output (short circuit protected),
Min load on proportional signal: 1 mA
Max load on proportional signal: 10 mA
Response time: < 100 ms
Enclosure: IP 54
Wires: White = 18-80 V, Green= proportional signal, Brown= 0 V
LED: For service, light is on when signal is active.

Steering wheel sensors are only available for body tube dimension Ø38 mm.
Sensors can only be mounted near to the top of the column, see dimensions.
ON/OFF and proportional sensors have same dimensions, see below.

Steering column sensor, dimensions



Height: Max. 12 mm [0.47 in] from surface of body tube.

A: Max tightening torque: 0,5 N•m
B: Wire length: As required
Connector on wire end:

- Standard:
  - contact pins: AMP no.: 926887-1
  - housing for contact pins: AMP no.: 350779-1
- Other connectors: contact Sauer-Danfoss Sales Organisation.

Code Numbers and Weights, OTPB

The following steering columns have Ø38 • 1.5 mm [1.5 • 1.06 in] body tube, B-flange, and yellow chromate coating.

Fixed steering columns without horn button

	Code number					
Type	**OTPB 75**	**OTPB 100**	**OTPB 150**	**OTPB 200**	**OTPB 250**	**OTPB 300**
Length of external tube (C) mm [in]	62.7 [2.47]	100 [3.94]	154 [6.06]	200 [7.87]	250 [9.84]	300 [11.81]
Weight kg [lb]	0.9 [1.98]	1.1 [2.43]	1.3 [2.87]	1.4 [3.09]	1.5 [3.31]	1.6 [3.53]
1* With woodruff key 5 • 6.5 mm [.197 • .256 in] D_{min}= 23.16 mm [0.912 in], taper 1 : 20	150-5031		150-5032			
2* With woodruff key 5 • 7.5 mm [.197 • .295 in] D_{min}= 20.50 mm [0.807 in], taper 1 : 20	150-5034		150-5035			
3* With woodruff key $^{3}/_{16}$ • $^{3}/_{8}$ D_{min}= 20.00 mm [0.787 in], taper 1 : 16	**150-5065		**150-5066			
4* With serration $^{13}/_{16}$ - 36 D_{min}= 20.97 mm [0.826 in], taper 1 : 16	150-5037		150-5038			
5* With serration $^{7}/_{8}$ - 36 D_{min}= 21.55 mm [0.848 in], taper 1 : 19.26	150-5040	150-5077	150-5041			
6* With serration $^{7}/_{8}$- 36 D_{min}= 21.80 mm [0.858 in], taper 1 : 19.26	150-5043	150Z1001	150-5044	150Z1002	150Z1003	150Z1004

* *The numbers refer to the dimensional sketch*, page 7 - 8
** These code numbers have black chromate as surface protection.

Fixed steering columns without horn button, continued

	Code number					
Type	**OTPB 350**	**OTPB 400**	**OTPB 450**	**OTPB 550**	**OTPB 650**	**OTPB 750**
Length of external tube (C) mm [in]	350 [13.78]	400 [15.75]	450 [17.72]	550 [21.65]	650 [25.59]	763 [30.02]
Weight kg [lb]	1.8 [3.97]	1.9 [4.19]	2.0 [4.41]	2.2 [4.85]	2.5 [5.51]	2.7 [5.95]
1* With woodruff key 5 • 6.5 mm [.197 • .256 in] D_{min}= 23.16 mm [0.912 in], taper 1 : 20						150-5033
2* With woodruff key 5 • 7.5 mm [.197 • .295 in] D_{min}= 20.50 mm [0.807 in], taper 1 : 20						150-5036
3* With woodruff key $^{3}/_{16}$ • $^{3}/_{8}$ D_{min}= 20.00 mm [0.787 in], taper 1 : 16						**150-5089
4* With serration $^{13}/_{16}$ - 36 D_{min}= 20.97 mm [0.826 in], taper 1 : 16						150-5039
5* With serration $^{7}/_{8}$ - 36 D_{min}= 21.55 mm [0.848 in], taper 1 : 19.26						150-5042
6* With serration $^{7}/_{8}$- 36 D_{min}= 21.80 mm [0.858 in], taper 1 : 19.26	150Z1005	150Z1006	150Z1007	150Z1008	150Z1009	150-5045

* *The numbers refer to the dimensional sketch*, page 7 - 8
** These code numbers have black chromate as surface protection.

If you need other lengths, body tube dimensions, surface protection, flasher activator, flanges, noise damping or steering wheel sensor, please fill in the form on page 23 and contact the Sauer-Danfoss Sales Organization.

Code Numbers and Weights, OTPB (continued)

Following steering columns are with Ø38 x 1,5 mm body tube, B-Flange, yellow chromate, with single standard horn button, and with standard tin-plated wire end.

Fixed steering columns with single horn button

	Code number					
Type	**OTPB 75**	**OTPB 100**	**OTPB 150**	**OTPB 200**	**OTPB 250**	**OTPB 300**
Length of external tube (C) mm [in]	62.7 [2.47]	100 [3.94]	154 [6.06]	200 [7.87]	250 [9.84]	300 [11.81]
Weight kg [lb]	1.0 [2.20]	1.2 [2.65]	1.4 [3.09]	1.5 [3.31]	1.6 [3.53]	1.7 [3.75]
1* With woodruff key 5 • 6.5 mm [.197 • .256 in] D_{min}= 23.16 mm [0.912 in], taper 1 : 20	150-5046		150-5047			
2* With woodruff key 5 • 7.5 mm [.197 • .295 in] D_{min}= 20.50 mm [0.807 in], taper 1 : 20	150-5049		150-5050			
4* With serration $^{13}/_{16}$ - 36 D_{min}= 20.97 mm [0.826 in], taper 1 : 16	150-5052		150-5053			
5* With serration $^{7}/_{8}$ - 36 D_{min}= 21.55 mm [0.848 in], taper 1 : 19.26	150-5055		150-5056			
6* With serration $^{7}/_{8}$ - 36 D_{min}= 21.80 mm [0.858 in], taper 1 : 19.26	150-5058	150Z1010	150-5059	150Z1011	150Z1012	150Z1013

* *The numbers refer to the dimensional sketch*, page 7 - 8

Fixed steering columns with single horn button, continued

	Code number					
Type	**OTPB 350**	**OTPB 400**	**OTPB 450**	**OTPB 550**	**OTPB 650**	**OTPB 750**
Length of external tube (C) mm [in]	350 [13.78]	400 [15.75]	450 [17.72]	550 [21.65]	650 [25.59]	763 [30.02]
Weight kg [lb]	1.9 [4.19]	2.0 [4.41]	2.1 [4.63]	2.3 [5.07]	2.6 [5.73]	2.8 [6.17]
1* With woodruff key 5 • 6.5 mm [.197 • .256 in] D_{min}= 23.16 mm [0.912 in], taper 1 : 20						150-5048
2* With woodruff key 5 • 7.5 mm [.197 • .295 in] D_{min}= 20.50 mm [0.807 in], taper 1 : 20						150-5051
4* With serration $^{13}/_{16}$ - 36 D_{min}= 20.97 mm [0.826 in], taper 1 : 16						150-5054
5* With serration $^{7}/_{8}$ - 36 D_{min}= 21.55 mm [0.848 in], taper 1 : 19.26						150-5057
6* With serration $^{7}/_{8}$ - 36 D_{min}= 21.80 mm [0.858 in], taper 1 : 19.26	150Z1014	150Z1015	150Z1016	150Z1017	150Z1018	150-5060

* *The numbers refer to the dimensional sketch*, page 7 - 8

If you need other lengths, body tube dimensions, surface protection, flasher activator, flanges, noise damping, types of horn button, or steering wheel sensor, please fill in the form on page 23 and contact the Sauer-Danfoss Sales Organization.

Fixed Steering Columns, OTP

Code Numbers and Weights, OTPM

Following steering columns are with Ø38 x 1,5 mm [1.496 • 0.059] body tube, M-Flange, and black chromate coating.

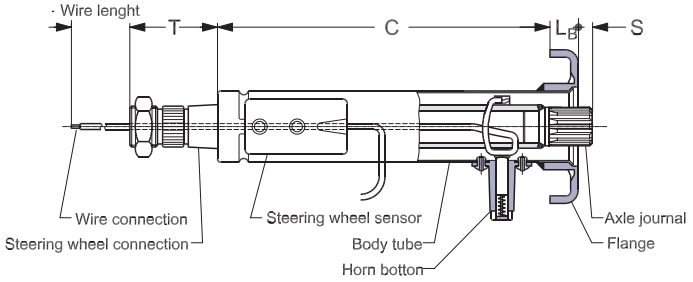
	Code number	
Type	**OTPM 163**	**OTPM 350**
Length of external tube (C) mm [in]	163 [6.42]	350 [13.78]
Weight kg [lb]	1.3 [2.90]	1.8 [4.00]
M 1*) With woodruff key 5 • 6.5 mm [.197 • .256 in] D_{min}= 16.47 mm [0.648 in], taper 1 : 20	150L1024	150L1025
M2*) With serration 7/8 - 36 D_{min}= 21.55 mm [0.848 in], taper 1 : 19.26	150L1026	150L1027
M6*) With serration 11/16 - 40 D_{min}= 17.89 mm [0.704 in], taper 1 : 19.26	150L1028	150L1029

* *The numbers refer to the dimensional sketch*, page 9

Fixed Steering Columns, OTPB

Specification Table for Non-Catalogue Numbers of Suaer-Danfoss OTPB Fixed Steering Columns

Fill in your company data. Tick off and give in values in the table where appropriate, and send to your local Sauer-Danfoss Sales Organization



150-663.10

T is linked to steering wheel connection type

Your company	**Name**		**Vehicle**		**Potential, pcs/year**		**Completed by**		**Date**	
For steering unit type	OTPB for: OSPB , OSPC, OSPD, OSPF, OSPL OSPQ and TAD								OTPM for: OSPM	
Steering wheel connection see page 7 - 9	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type M1	Type M2	Type M3	Customer defined
Body tube	Ø38 • 1.5 mm, standard			Ø38 • 2.5 mm			Ø45 • 2.5 mm			
Flange type	Type A		Type B		Tilting		Type M		Customer defined	
C-dimension	Min. 45 mm, state length									
	mm									
S-dimension	Type A standard 10.5 mm			Type B standard 6.5 mm			Type M: standard -14 mm		Other: State length	
									mm	
Axle journal	Standard, straigth splines			With O-ring			Spherical		Standard M	
Surface protection	Yellow chromate (not for OTPM)						Black chromate			
Horn button	None		Standard for Ø38mm body tube		Standard for Ø45 mm body tube		Flat version		Double for Ø38 mm body tube only	
Horn button: Wire length at steering wheel	Standard 100 mm						Customer defined, state length			
							mm			
Horn button: Wire connection steering wheel	Standard, tin-plated wire end		Wire end without tin-plating		Round male AMP		Flat female AMP insulated		Customer defined	
Flasher activator	No		Yes (for Ø45 mm body tube only)							
Prepared for steering wheel sensor	No		Yes (for Ø38 mm body tube only)							
Steering wheel sensor	None			ON/OFF			Proportional		Power supply, state voltage	
									V	

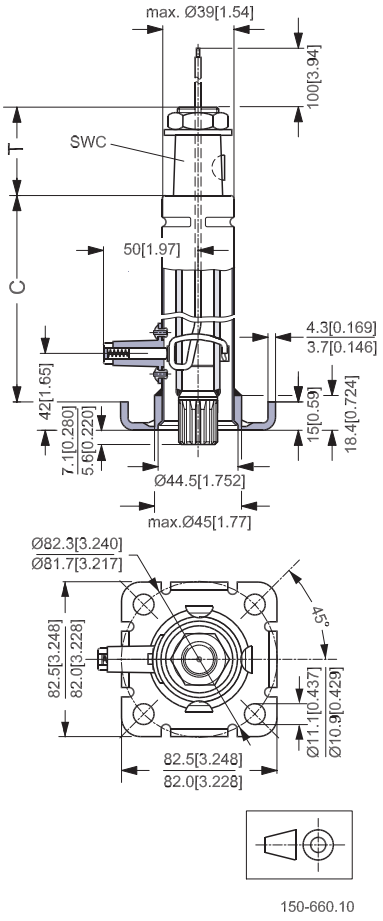
Alternativ specify by stating code number of basic steering column: _____

Requested modifications: _____

Dimensions

OTPB standard steering column referring to code numbers page 20 - 21.

T-dimension is linked to SWC, Steering Wheel Connection, see page 7 - 8

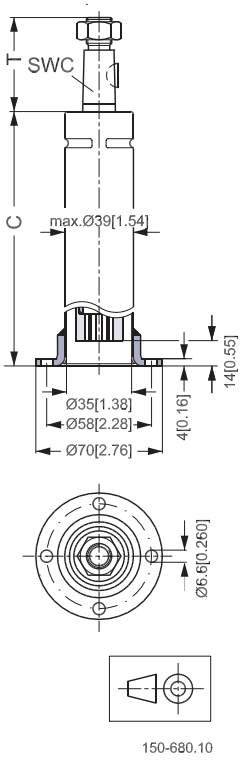


Type	C	
	mm	[in]
OTPB 75	62.7	[2.47]
OTPB 100	100	[3.94]
OTPB 150	153.9	[6.06]
OTPB 200	200	[7.87]
OTPB 250	250	[9.84]
OTPB 300	300	[11.81]
OTPB 350	350	[13.78]
OTPB 400	400	[15.75]
OTPB 450	450	[17.72]
OTPB 550	550	[21.65]
OTPB 650	650	[25.59]
OTPB 750	762.5	[30.02]

Dimensions

OTPM standard steering column referring to code numbers page 22.

T-dimension is linked to SWC, Steering Wheel Connection, see page 9.



Type	C	
	mm	[in]
OTPM 163	163	[6.42]
OTPM 350	350	[13.78]

Installation

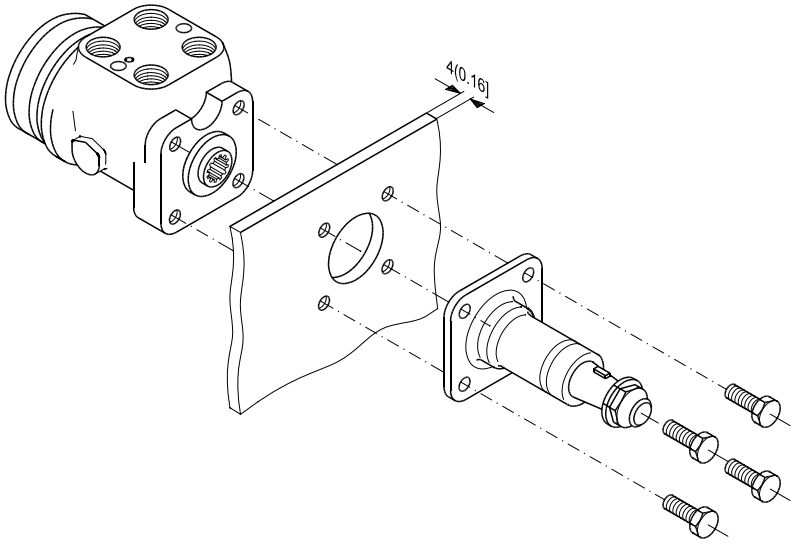
Installation of steering column with A-flange

Sauer-Danfoss steering column with A-flange can be mounted on the cabin floor, and the Sauer-Danfoss steering unit can be mounted under the cabin floor. The S-dimension has to be equal to the thickness of the cabin floor + 6.5 mm [0.26 in]. Example: If the cabin floor is 4 mm [0.16in], then S = 4 + 6.5 = 10.5 mm [0.16 + 0.26 = .0.41 in]

⚠ Caution

The steering column must be coaxial with the splined connection of the steering unit: It must be guaranteed that the shaft of the steering column generates no radial and/or axial forces in the splined connection of the steering unit.

Max tightening torque for fixing screws is 30 N•m [265.5 lbf•in]. Recommended tightening torque for the steering wheel connection is 40 ±5 N•m [354 ±44 lbf•in].

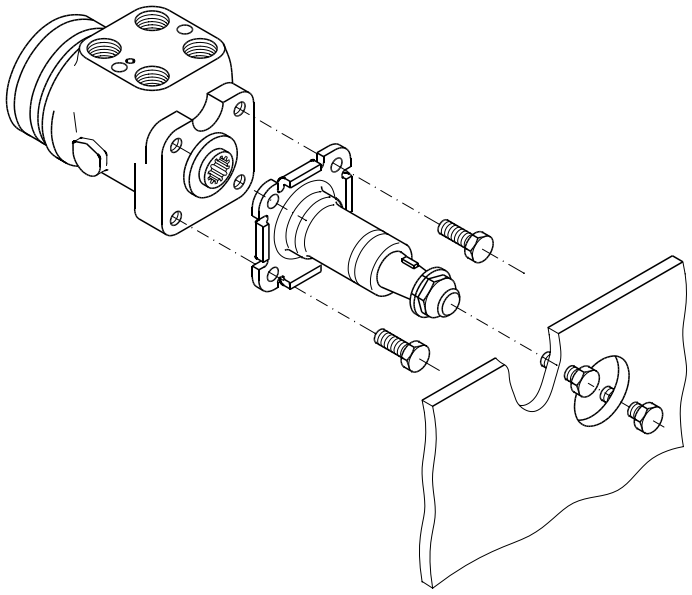


150-607.10

Installation (continued)

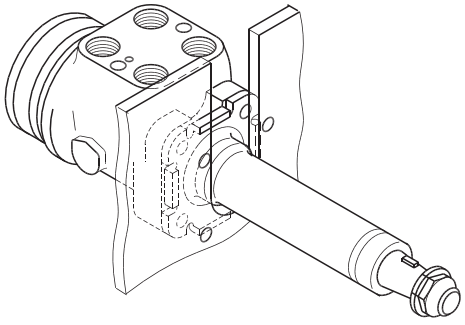
Installation of steering column with B-flange

Sauer-Danfoss steering column with B-flange and Sauer-Danfoss steering unit must be assembled directly with one another. Max tightening torque for fixing screws is 30 N•m [265.5 lbf•in]. Recommended tightening torque for the steering wheel connection is 40 ±5 N•m [354 ±44 lbf•in].



150-311.10

A good alternative installation method is using a bracket, which is slotted so that steering column and steering unit can be mounted radically.
Max. tightening torque for fixing screws is 30 N•m [265.5 lbf•in].

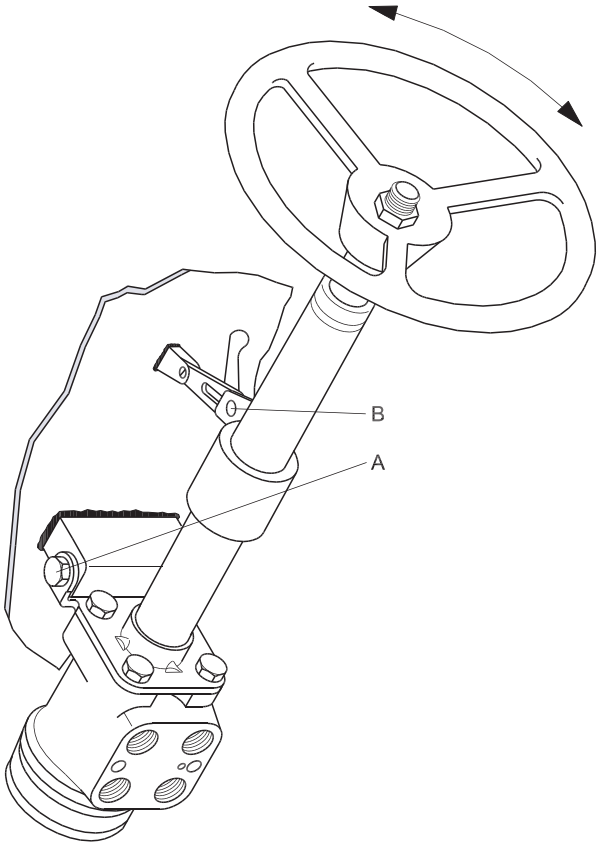


150-261.10

Installation (continued)

Installation of steering column with tilting flange

Sauer-Danfoss steering column with tilting flange and Sauer-Danfoss steering unit must be assembled directly with one another. Max tightening torque for fixing screws is 30 N•m [354 ±44 lbf•in].
The holes in the tilt-point (A) are Ø 13.6 +0.3/-0 mm [0.54 +0.11/-0 in]
Sauer-Danfoss recommends bushings to be mounted in the tilt point. Brackets (B) to fix the steering column in position are not included in the steering column delivery but must be customer made. To mount a fix point for the bracket on the steering column, please see the below installation drawing as an example.

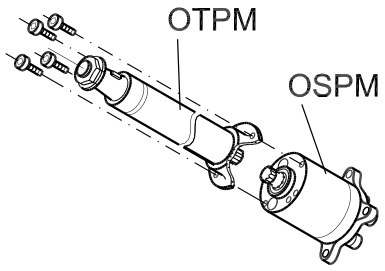


150-608.11

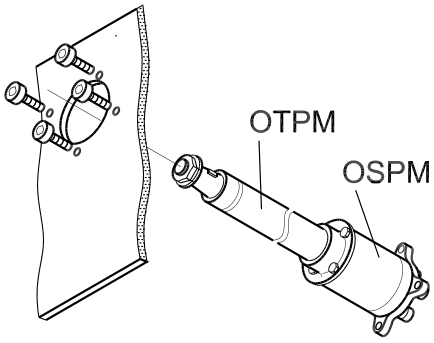
Installation (continued)

Installation of steering column OTPM

The OTM column has to be mounted directly on the OSPM steering unit. Max. tightening torque for M6 fixing screws is 11 N•m [97 lbf•in].
The OSPM steering unit with OTPM steering column, has to be mounted on the cabin floor / instrument board. Max tightening torque for M8 fixing screws is 20 N•m [177 lbf•in].



150-638.10



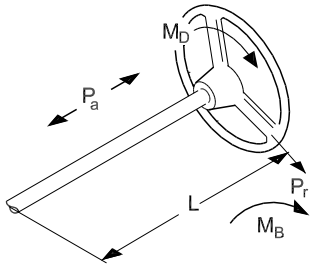
150-640.10

Installation (continued)

Load on fixed steering columns

Symbols:

L	(m) [in]:	Axial length between mounting surface and steering wheel
P_r	(N) [lbf]:	Radial force on steering wheel
P_a	(N) [lbf]:	Axial force on steering wheel
M_D	(N•m) lbf•in]:	Turning torque
M_B	(N•m) lbf•in]:	Bending moment on the steering column, $M_B = P_r * L$



150-271.12

When L exceeds 150 mm [5.91 in], the standard steering column with body tube Ø38 • 1.5 mm [1.50 • 0.06 in] must be supported, and when using standard body tube Ø38 • 1.5 mm [1.50 • 0.06 in], the following max permissible values must not be exceeded

M_D : max 240 N•m [2124 lbf•in]
M_B : max 200 N•m [1770 lbf•in]
P_a : max 1000 N•m [8850 lbf•in]

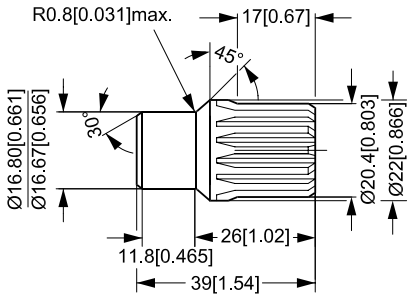
If L >150 mm [5.91 in] and no support is possible, Sauer-Danfoss recommends columns with body tube Ø38 • 2.5 mm [1.50 • 0.10 in] or Ø45 • 2.5 mm [1.77 • 0.10 in].

Installation (continued)

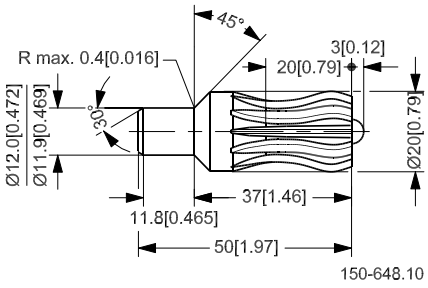
Axle journals for customer made columns

Customers, who wish to construct their own steering columns, can purchase axle journals from Sauer-Danfoss.

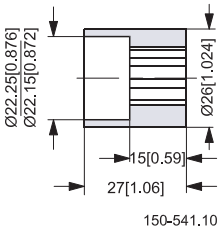
Standard axle journal, code number 150-0674 .



Spherical axle journal, code number 150-4036



Standard splined tube section type "M" (for OSPM only), code number 150L0387



When constructing your own steering column, please observe the following points:

1. Make sure that length and other dimensions of the axle journal part protruding from the mounting surface are correct to ensure the right engagement with the Sauer-Danfoss steering unit (See page 24 - 25).
2. The steering column must only be provided with one bearing (in the top).
3. The welded journal must be coaxial with the steering column.

4a. The steering column must be coaxial with the spigot hole Ø44.6 mm [ø1.76 in] (see page 24 for OSP except OSPM).

4b. The steering column must be coaxial with the spigot hole Ø35 mm [ø1.38 in] (see page 25 for OSPM).

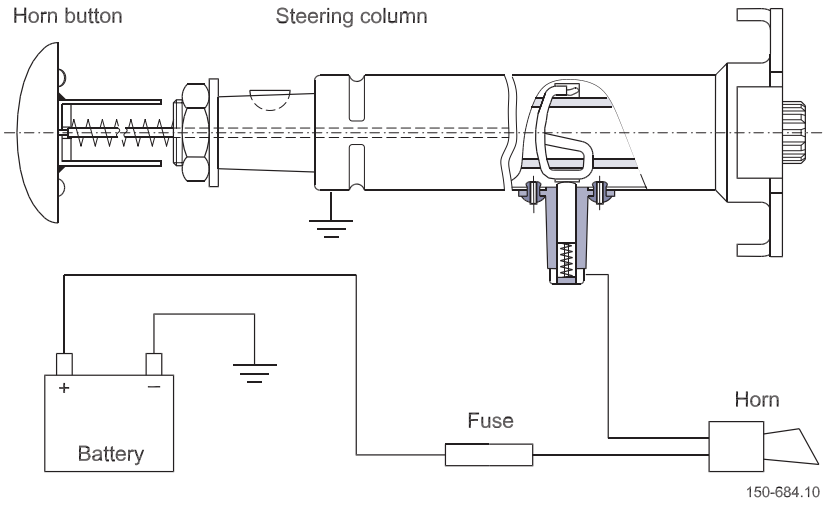
5. As the axle journal material is chrome alloy steel, we recommend CO_2 welding.

Installation (continued)

Horn button

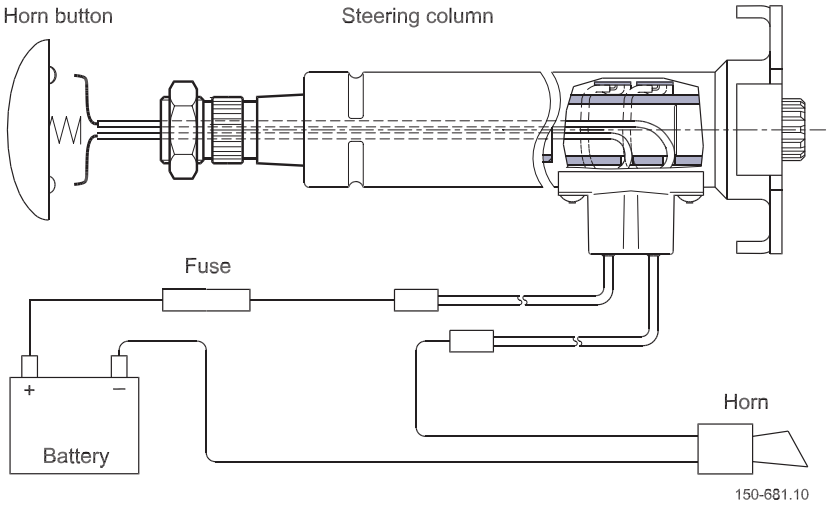
The figure below illustrates a proposal of an electrical circuit with single horn button on steering column.

Single horn contact system



The figure below illustrates a proposal of an electrical circuit with double horn button on steering column.

Double horn contact, system



Max. electrical load on horn buttons: 60 W

Adjustable Steering Columns, OTP

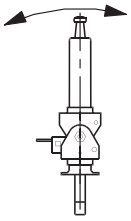
Adjustable Steering Columns

Sauer-Danfoss adjustable steering columns fit OSPB, OSPC, OSPD, OSPF, OSPL, OSPM, OSPQ steering units and TAD torque amplifiers.

Versions

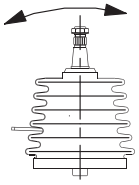
Four different kinds of adjustable steering columns are available:

1. *OTP-ST, standard OTP tilting steering columns*



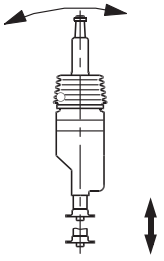
150-668.10

2. *OTP-MT, mini tilting steering columns*



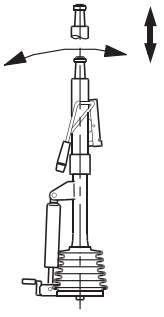
150-665.10

3. *OTP-STT, standard tilting and telescopic steering columns, tilt point above telescope section.*



150-669.10

4. *OTP-BTT, bottom tilt and telescope steering columns, tilt point below telescope section.*



150-664.10

Versions (continued)

The matrix below shows the features available for the different types of adjustable columns:

Feature \ Type	OTP-ST Standard tilt	OTP-MT Mini tilt	OTP-STT Standard tilt and telescope	OTP-BTT Bottom tilt and telescope
9 different steering wheel connections	x	x	x	x
Horn button	x		x	
Flasher activator	x		x	
Flange: Type A	x		x	
Type M	x		x	
Customer defined	x		x	
Specific		x		x
Axle journal: Straight splines, S= customer defined	x	x	x	x
Straight splines with O-ring S= customer defined	x		x	
Spherical splines, S= customer defined	x		x	
Straight spline "M" for OSPM only	x	x	x	x
Steering wheel sensor	x		x	

Adjustable steering columns always have a black chromate coating.
Specifications for wheel connections, horn buttons, flanges and axle journals are identical for fixed and for adjustable columns.
Horn buttons are placed on the upper part of OTP-ST and OTP-STT.
All features of wheel connections, horn buttons, flasher activator, flange type A, axle journals and steering wheel sensors are described in the section for fixed steering columns.

Tilting: Maximum tilt angle from lock to lock is 40°. Adjusting principle and area: see the specific types.

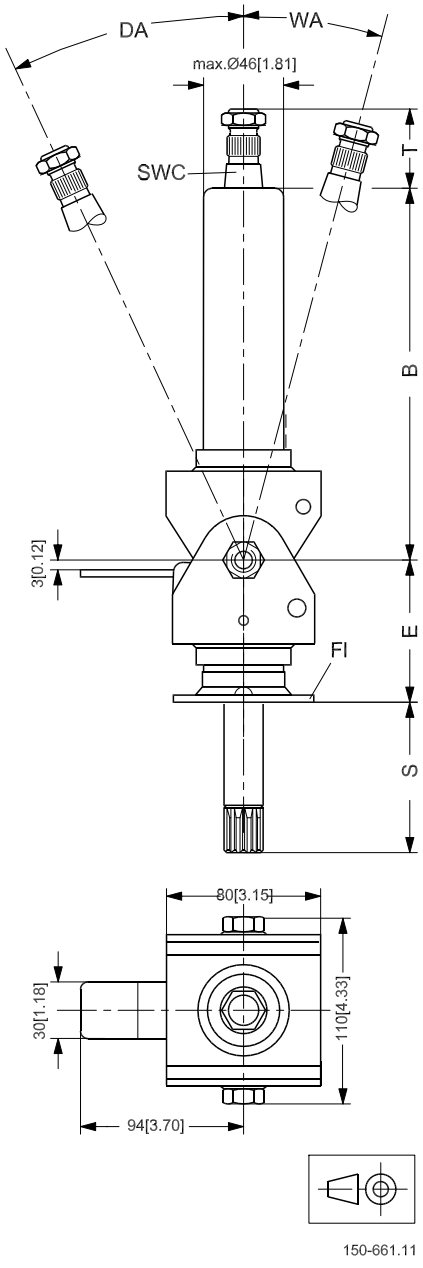
Telescope: For OTP-STT and OTP-BTT the adjustable length is 80 mm [3.15 in].

Adjustable Steering Columns, OTP

OTP-ST, Standard Tilting Steering Columns

OTP-ST standard tilting columns are provided with a mechanical incremental locking system for the tilt function. The tilting angles are adjusted in steps of 5°.
The maximum tilt angles can be selected between DAmax = 25°/WAmax = 15° or DAmax = 15°/WAmax = 25°.
DA = degrees towards the driver, WA = degrees towards the windscreen/away from the driver.

Dimensions
OTP-ST standard tilting



T dimension is linked to SWC, Steering Wheel Connection type, see page 7 - 9

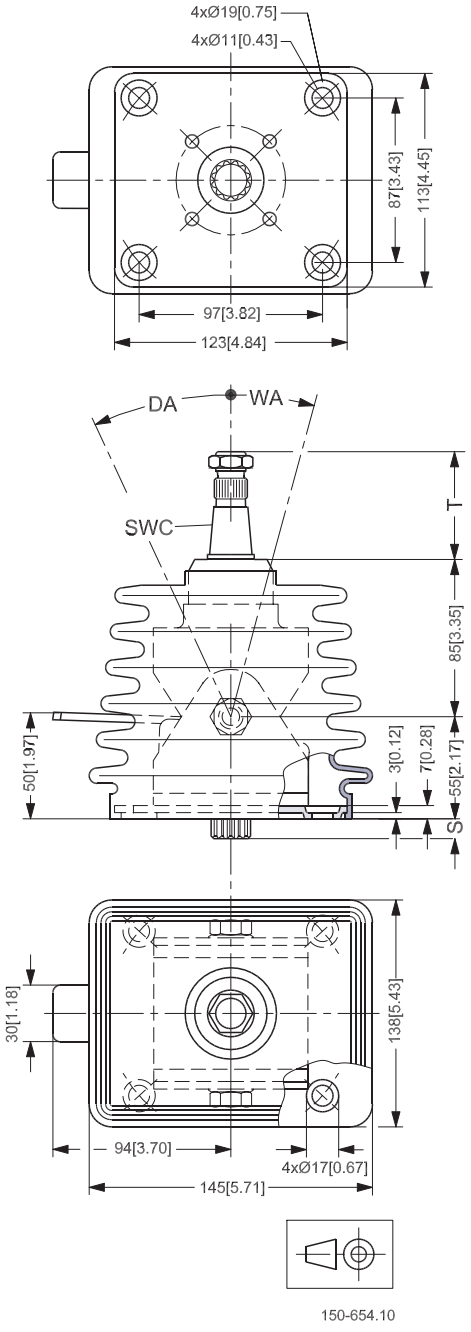
Fl: Flange, see page 12
A-flange is standard.

OTP-MT, Mini Tilting Steering Columns

When using mini tilt columns, the steering unit except OSPM must be flanged onto a flange in the cabin by means of special Allen screws with flat heads, M10x16 mm, see page 42. These screws are included in the steering column delivery.

OTP-MT mini tilt columns are provided with a mechanical incremental locking system for the tilting function. The tilt angles are adjusted in steps of 5°.
The maximum tilt angles can be selected between DAmax = 25°/WAmax = 15° or DAmax = 15°/WAmax = 25°.
DA = degrees towards the driver, WA = degrees towards the windscreen/away from the driver.

Dimensions
OTP-MT mini tilt



T dimension is linked to SWC, Steering Wheel Connection type, see page 7 - 9

Adjustable Steering Columns, OTP

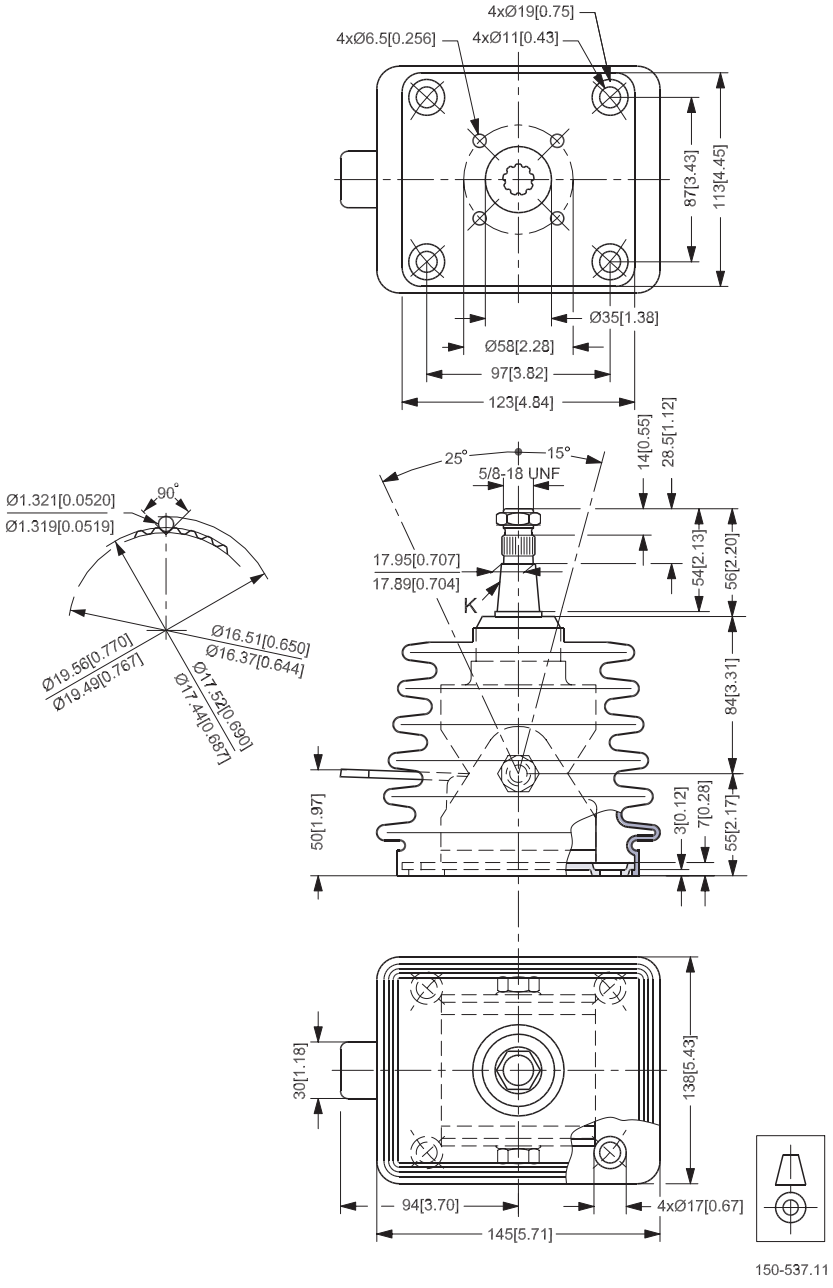
OTP-MT, Mini Tilting Steering Columns

When using OTP-MT together wih OSPM, the OSPM is mounted directly on the botton plate of the steering columnby means 4 pieces of standard M6 • 12 mm Allen screws (not includet in the steering column delivery), using the 4 • ø6.5 holes in the bottom of the column.

Type	Code number	Weight
OTP-MT 140	150L1100	2.7 kg [5.95 lb]

Dimensions

Below drawing is OTP-MT code no 150L1100 for OSPM



With $^{11}/_{16}$ in-40 serration
d_{min} = 17.89 mm [0.704 in]
K: Taper 1:12

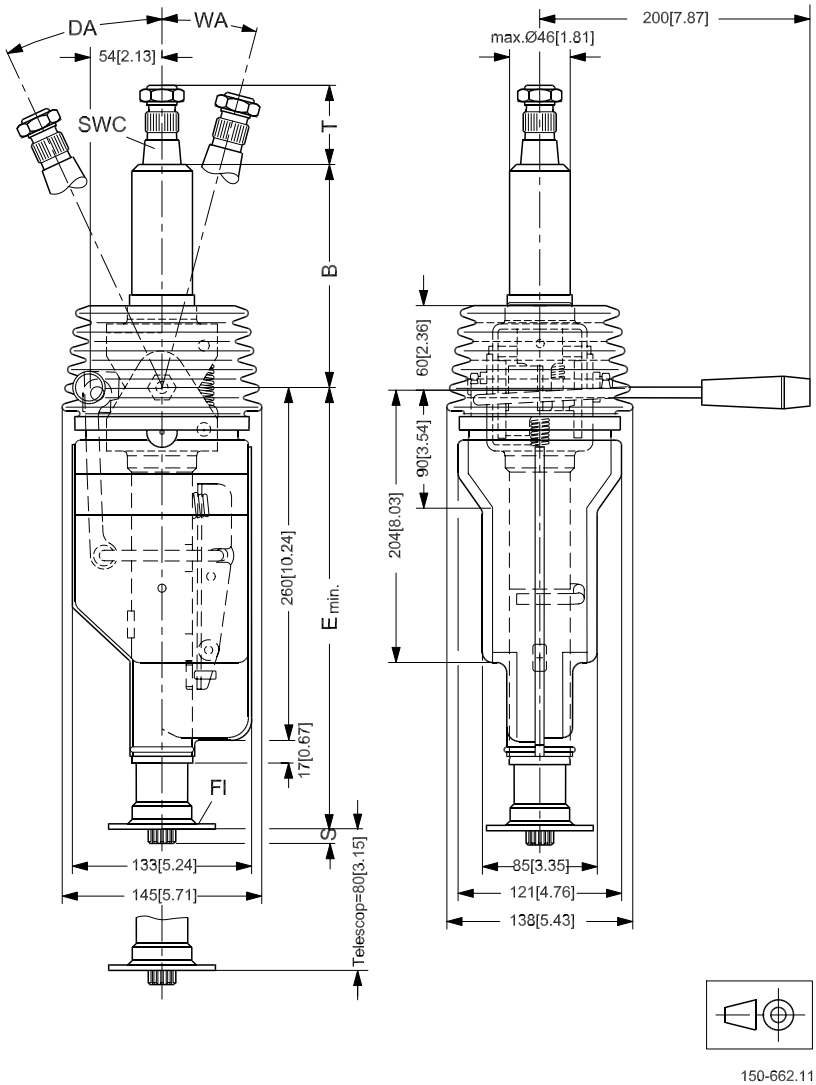
Adjustable Steering Columns (continued)

OTP-STT, standard tilt and telescopic steering columns

The standard version of the tilt and telescope steering columns has the telescope function placed below the tilt point. A plastic cover and a rubber bellows for covering the tilt and telescope functions are optional. The lever of the column activates both functions: Lever upwards activates the telescope function and lever downwards activates the tilt function.

OTP-STT standard columns are provided with a mechanical incremental locking system for the tilting function. The tilt angles are adjusted in steps of 5°.
The maximum tilt angles can be selected between DAmax = 25°/WAmax = 15° or DAmax = 15°/WAmax = 25°.
DA = degrees towards the driver, WA = degrees towards the windscreen/away from the driver.

Dimensions
OTP-STT, standard tilt and telescope



150-662.11

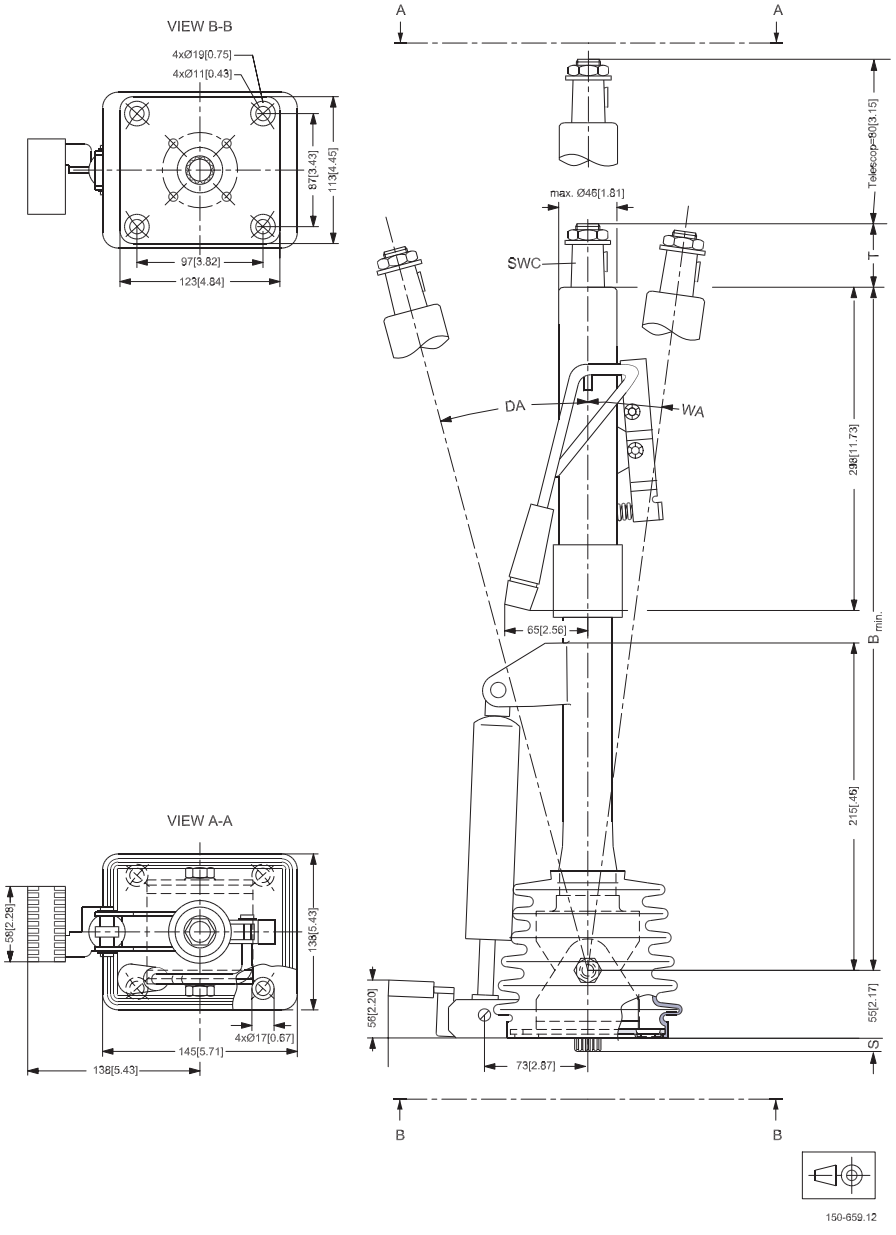
T dimension is linked to SWC, Steering Wheel Connection type, see page 7 - 9
Fl: Flange, see page 12
A-flange is standard.

Adjustable Steering Columns (continued)

OTP-BTT, bottom tilt and telescope steering columns

This version of the tilt and telescopic steering columns has its tilt point near the bottom plate and the telescope function is therefore placed above tilt point. The tilt point is covered with a rubber bellow. The column has two levers: one for telescope activation by hand and one for tilt activation by foot.
This column is provided with a step-less locking system for the tilt and telescope function. The maximum tilt angles can be selected between DAmax = 25°/WAmax = 15°.
Maximum B measurement is 700 mm.
When using bottom tilt columns, the steering unit must be flanged onto a flange in the cabin by means of special Allen screws with flat heads, M10 x 16 mm, see page 50. These screws are included in the steering column delivery.

Dimensions OTP-BTT, bottom tilt and telescope steering columns



T dimension is linked to SWC, Steering Wheel Connection type, see page 7 - 9

Specification Table for Sauer-Danfoss Adjustable Steering Columns

Fill in your company data. Tick off and give in values in the table where appropriate and send to your local Sauer-Danfoss Sales Organization

Your company	**Name**	**Vehicle**	**Potential, pcs/year**	**Completed by**	**Date**
Type of adjustable column	OTP-ST Standard tilt	OTP-MT Mini tilt	OTP-STT Strandard tilt with telescope	OTP-BTT Bottom tilt and telescope	
For steering unit type	OSPB, OSPC, OSPD, OSPF, OSPL, OSPQ and TAD			OSPM	

Steering wheel connection	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type M1	Type M2	Type M3	Customer defined

Tilt angle*	DA: Towards driver, step of 5°, max. 25°	WA: Towards windscreen, step of 5°, max. 25°. For OTP-BTT.max. 15°
	°	°
Flange type	Fixed for OTP-MT and OTP-BTT, see drawings	Type A (OSP-ST and OTP-STT only)	Type M (OTP-ST and OTP-STT only)	Customer defined (OTP-ST and OTP-STT only)
B-dimension**	Min. 85 mm, state length			mm
E-dimension	Fixed for OTP-MT and OTP-BTT, see drawings		OTP-ST: min. 90 mm, OTP-STT: min 300 mm, state length	
				mm
S-dimension	State length (S= distance from bottom of flange to steering column surface of steering unit + 6.5 mm)			OSPM: -14 mm
			mm	mm
Axle journal	Standard straigth splines	With O-ring	Sherical	Standard M
Horn button	None	Standard (for OTP-ST and OTP-STT only)		Flat version (for OTP-ST and OTP-STT only)
Horn button: Wire length at steering wheel	Standard 100 mm		Customer defined	
				mm

Horn button: Wire connection at steering wheel	Standard, tin-plated wire end	Wire end without tin-plating	Round male AMP	Flat female AMP insulated	Customer defined
Flasher activator	No	Yes (for OTP-ST and OTP-STT only and for Ø45 mm body tube only)			
Prepared for steering wheel sensor	No	Yes (for OTP-ST and OTP-STT only and for Ø38 mm body tube only)			

Steering wheel sensor	None	ON/OFF	Proportional	Power supply, state voltage
				V
Rubber bellows	No		Yes	
Plastic cover	No		Yes (F or OTP-STT only)	

* Tilt angle: Sum of DA and WA must not exceed 40°

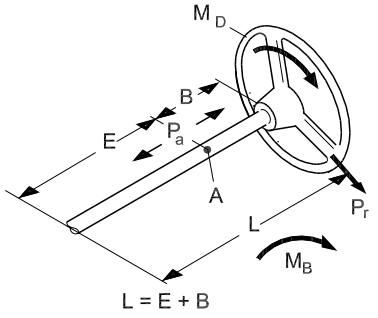
** B-dimension: If horn button or steering wheel sensor is mounted, B-measurement must be 150 mm minimum.

Adjustable Steering Columns, OTP

Load on Adjustable Steering Columns

Symbols:

A		:	Tilt point
L	m [in]	:	Axial length between mounting point and steering wheel.
E	m [in]	:	Axial length between mounting point and tilt point.
B	m [in]	:	Axial length between tilt point and end of body tube.
P_r	N [lbf•in]	:	Radial force on steering wheel
P_a	N [lbf•in]	:	Axial force on steering wheel.
MD	Nm [lbf•in]	:	Turning torque
MB	Nm [lbf•in]	:	Bending moment on the steering column, MB = P_r * L



150-673.10

The following max permissible values must not be exceeded:

M_D : max 240 Nm [2124 lbf•in]
M_B : max 200 Nm [1770 lbf•in]
P_a : max 1000 N. [224.8 lbf]

Installation

Installation of adjustable steering columns.

⚠ Caution

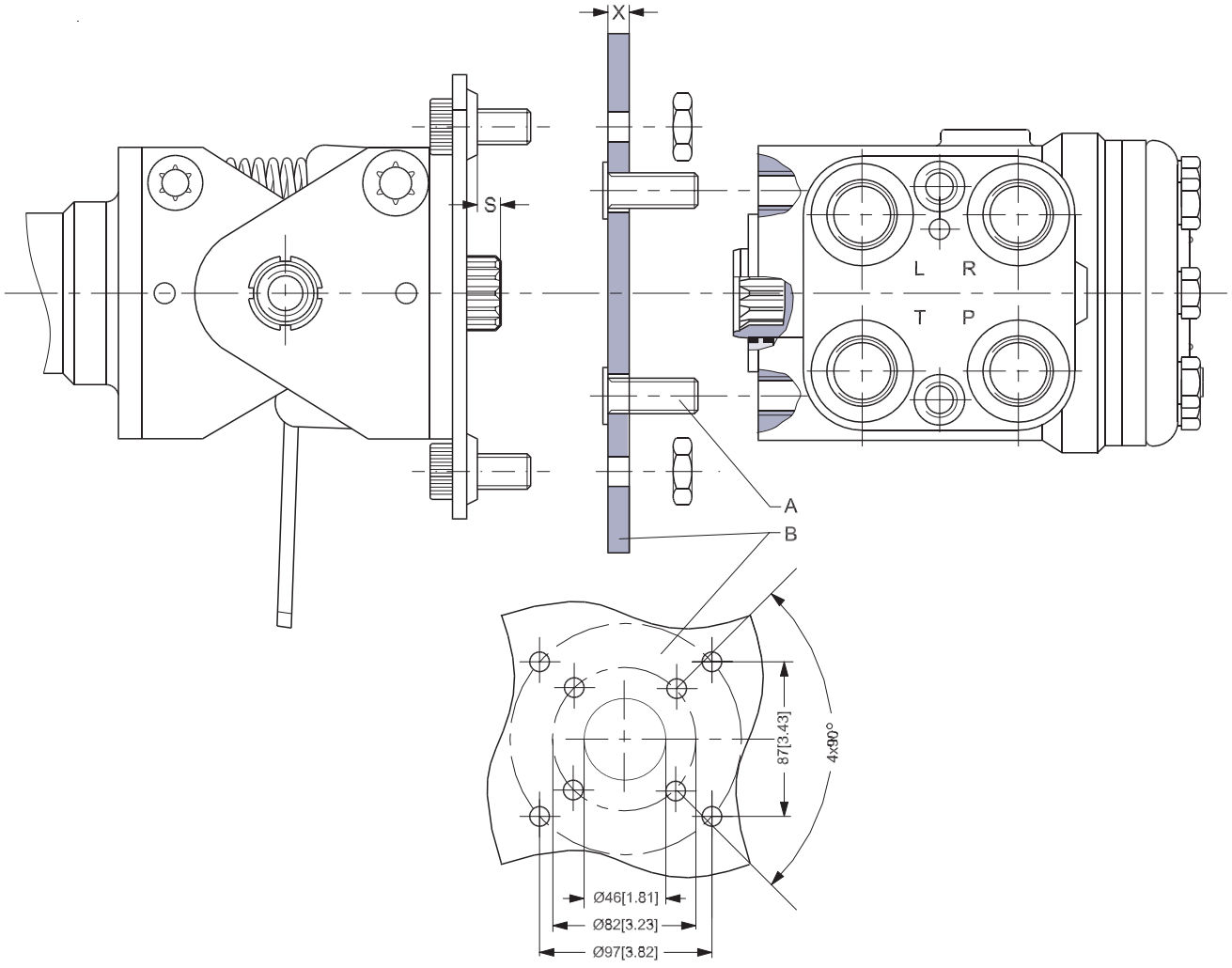
Alignment of steering column and steering unit is very important.
The steering column must be coaxial with the splined connection of the steering unit: It must be guaranteed that the shaft of the steering column generates no radial and/or axial forces in the splined connection of the steering unit.

Installation

Installation of OTP-MT and OTP-BTT

A. Allen screws with flat heads, M10 • 16 mm.
These screws are included in the steering column delivery.
B. Customer console plate.
Holes not defined on drawing: Ø11 mm [0.43 in].

The S-dimension must be equal to the thickness of the console plate (x) + 6.5 mm [(x) + 0.26 in]
Example: If the console plate thickness is 4 mm, then S = 4 + 6.5 = 10.5 mm [0.16 + 0.26 = 0.42 in].
The screws (A) can be used for console plate thickness 4 – 6 mm [0.16 - 0.24 in].



150-672.10

Sensor Type SASA

Sensor Type SASA General

The SASA sensor detects the absolute position and speed of the steering wheel. The sensor can be used in electro-hydraulic steering systems using Sauer-Danfoss EH or EHPS steering valves with programmable controller.
The use of SASA sensor is relevant e.g. for variable steering ratio and closed loop set-ups where steering wheel position and steering angle have to match.
SASA is based on a non-contact inductive principle giving a very high resolution.
The sensor features a robust design and resists e.g. electro-magnetic radiation.
The output is a CAN signal, which makes it easy to interface to advanced vehicle controllers.
The steering wheel shaft turns the rotor of the SASA sensor, and the sensor is simply mounted between steering unit and steering column. The shaft of the steering column must be 15 mm longer when using SASA sensor.
In cases where customers want to use the same steering column in applications with and without SASA sensors, Sauer-Danfoss offers an adapter kit type SAK to built in between column and sensor.
The SASA sensor offers the following features:

- High resolution < 0.1°
- Output CAN signal
- High safety, "fail silent" concept
- Plus+1 compliant
- Flanged in between steering unit and column
- Compact design

E1 COMPLIANT

versions, code numbers and weights sasa sensor

Code number	Type	Supply voltage	Termination Resistor	Cable length	Connector	Weigth kg [lb]
150Z6010	CAN	9 - 32 V_{DC}	Non	500 mm	AMP code no. 2-967059-1	0.25 [0.55]
150Z6012	CAN	9 - 32 V_{DC}	120 Ω	500 mm	AMP code no. 2-967059-1	0.25 [0.55]

Code number and weight, sak adapter kit

Code number	Weight kg	[lb]
150Z6000	0.8	[1.76]

CAN Message Protocol

Interface: CAN 2.0 B
Baud rate: 125 kBaud, 250 kBaud (default), 500 kBaud
SASA returns cyclic the following CAN message every 5, 10 (default) or 20 ms.

301 h	Data							
	0 Low byte	1 High byte	2	3 Low byte	4 High byte	5	6 Low byte	7 High byte
ID	Steering angle		Count	Steering angle change		Status	CRC-16	

Identifier: 301h (11 bit)

Steering angle: 12 bit word (0 – 4095) relative to a 0-index point.
0 = 0 degrees
4095 = 359,912 degrees
Overflow at 4095 for CW activation shall increment 0
Underflow at 0 for CCW activation shall decrement 4095

Count: byte (0-255)
Increments 1 for each message

Steering angle change: Difference between 2 transmitted position values in succession.
16 bit integer with 2's complementary encoding for negative values (-32768 to 32767).
-4095 = -359,912 degrees
0 = 0 degrees
4095 = 359,912 degrees

Status byte

7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	Progamming mode

Programming mode: Normal state is 1
Response with a 0 when starting the programming sequence
(See the programming sequence described below under setup message)
CRC-16: The standard CRC16 polynomial is used (x^16+x^15+x^2+1)

Parameter Setup

Setup message: sensor can be programmed as shown in the CAN setup message below.

0C0h	Data							
	0	1	2	3	4	5	6 Low byte	7 High byte
ID	Baud rate	Data rate	Set 0-index		Programming sequence		CRC-16	

Identifier: 0C0h (11 bit)

Baud rate: Byte 0 is set to 02h for 125 kBaud
03h for 250 kBaud (default)
04h for 500 kBaud
during the programming sequence

Data rate: Byte 1 is set to 02h for 5 ms
03h for 10 ms (default)
04h for 20 ms
during the programming sequence

Set 0-index: If byte 2 is set to AAh during the programming sequence, the actual angle will be stored as a reference value (0 degree) in persistent memory.

Programming sequence: The following sequence is used when programming the sensor.
The controller unit sends a setup message where byte 4 is set to AAh and byte 5 is set to 55h.
The sensor answers with a 0 on the status byte (bit 0).
The control unit then sends a setup message where byte 4 is set to 0Fh and byte 5 is set to F0h.
The first and second message shall match.
After receiving the last message the programming takes place in the sensor if the parameters are in the defined range, the timeout period has not been exceeded and the CRC-16 check is correct in both messages.
After programming the status bit in the output message changes back from 0 to 1

Timeout period: 1s between first message from controller and response from sensor, and 1s between response from controller and second message from controller.

CRC-16: The standard CRC16 polynomial is used (x^16+x^15+x^2+1)

Technical Data

Mechanical

Input range:	Continuous 360° rotation
Rotor torque:	≤ 0.2 Nm
Expected life:	> 10 million cycles

Electrical

Supply voltage:	9 - 32 VDC
Power consumption:	<1 W

Output

CAN V2.0B, (compatible to J1939)

Termination resistor:	120 ohm (optional)
Baud rate:	125, 250 or 500 kb/s
Angle:	12-bit word (0 - 4095) relative to a programmable 0-index point.
Resolution:	< 0.1°
Linearity:	±1.0%
Angle change:	16 bit integer with 2's complementary encoding for negative values (-32768 to 32767).

Safety function

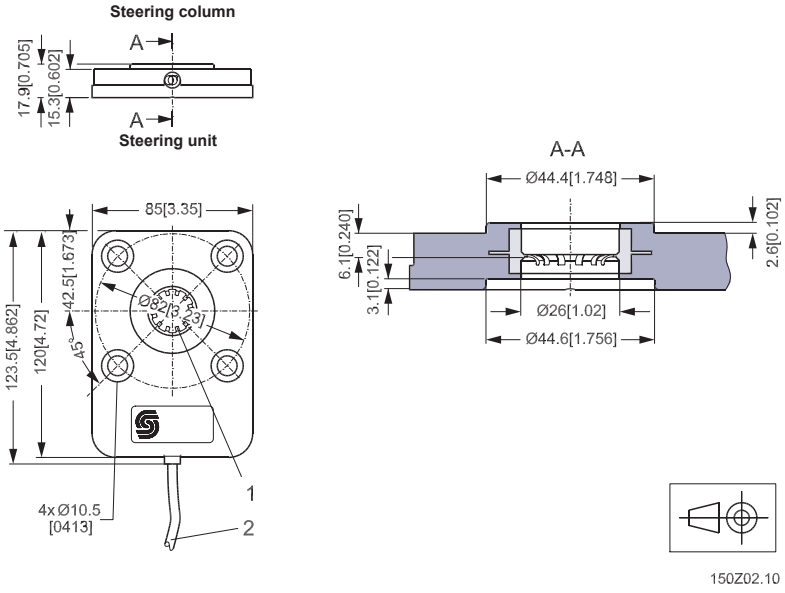
If a failure occurs the CAN-bus will "fail silent" (The CAN-bus driver will be disabled).

Environmental

Operating temperature:	-30° to 85°C [-22 to 185°F]
Storage temperature:	-40° to 105°C
Sealing:	IP65
EMI/RFI Rating:	100 V/m
Vibration:	Meets IEC 60068-2-64
Shock:	Meets IEC 60068-2-27 test Ea

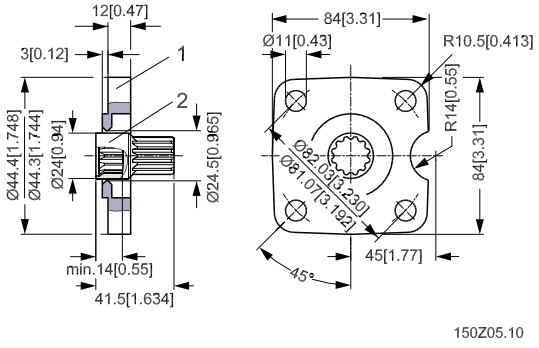
Sensor Type SASA

Dimensions SASA Sensor



1. Flexible teeth, 12 pieces to interact with splines on steering column
2. Cable, 500 mm with connector. See "Code numbers" for type of connector

SAK Adapter Kit

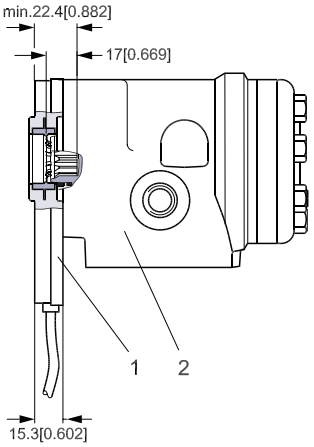


1. Distance plate
2. Shaft

Installation

SASA has to be mounted between steering column and steering unit (OSP) with 4 bolts max 30 N•m [265.5 lbf•in]. Shaft in column must be 15 mm [0.59 in] longer when using SASA.

Assembly: SASA sensor and OSP steering unit

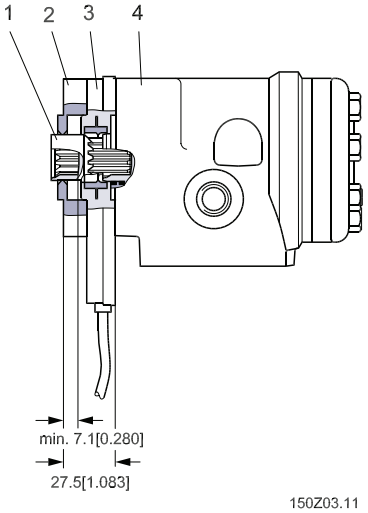


1. SASA sensor
2, OSP steering unit

Caution!

Make sure that the spline profile of the SASA sensor is aligned to the spline profile of the steering column shaft. A safe method of assembly is to place SASA sensor on the steering column spline shaft first – and not opposite! In case of using force, there is a risk of bending the spline profile of SASA sensor.

For use of original steering column, use adapter kit type SAK, see sketch below.
Assembly: SAK adapter kit, SASA sensor and OSP steering unit

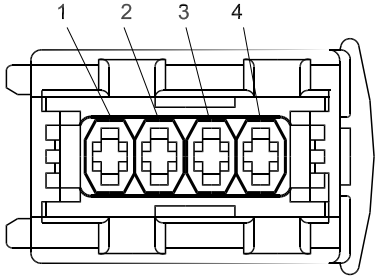


1. Shaft of SAK adapter kit
2. Distance plate of SAK adapter kit
3. SASA sensor
4. OSP steering unit

Installation (continued)

Electric connection through cable mounted with an AMP Connector.

AMP type 2-967059-1
Pin 1 CAN-Low
Pin 2 +supply voltage
Pin 3 Gnd
Pin 4 CAN-High



Mating connector assembly
AMP type 2-965261-1
JPT contacts 2-962915-1
Wire sealing 828904-1

Recommended wiring practice

- Protect all wires from mechanical abuse.
- Use a wire gauge that is appropriate for the sensor electrical mating connector.
- Use wire with abrasion resistant insulation.
- Separate high current wires such as feeds to solenoids, lights, alternators, or fuel pumps from control wires. Recommended minimum separation is 300 mm [11.8 in].
- Run wires along the inside of or close to metal machine frame surfaces where possible. This simulates a shield which minimizes the effects of EMI/RFI radiation.
- Do not run wires near sharp metal corners. Run wires through grommets when rounding a corner.
- Provide strain relief for all wires.
- Avoid running wires near moving or vibrating components.
- Avoid long, unsupported wire spans.
- All sensors have dedicated wired power sources and ground returns. They should be used.
- Twist sensor lines about one turn every 100 mm [3.94 in].
- Use wire harness anchors that will allow wires to float with respect to the machine frame rather than rigid anchors.

Valve Block OVPL

Valve Block OVPL

OVPL valve blocks can be flanged onto Sauer-Danfoss steering units type OSPL, which are prepared for OVPL mounting.

Versions

OVPL valve blocks contain shock valves, suction valves, check valve and back-pressure valve. OVPL valve blocks are available with 4, 5 or 7 connections. OVPL with 7 connections have 2 L and 2 R connections, which means that 2 steering cylinders can be connected directly to the valve block.

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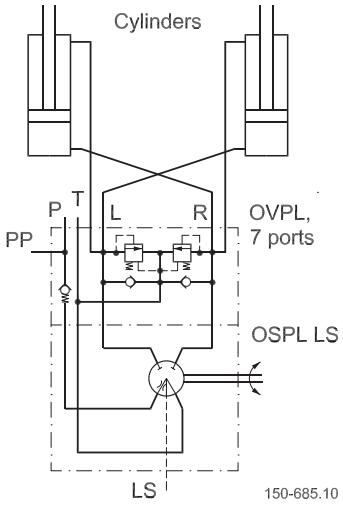
OVPL, 7 ports



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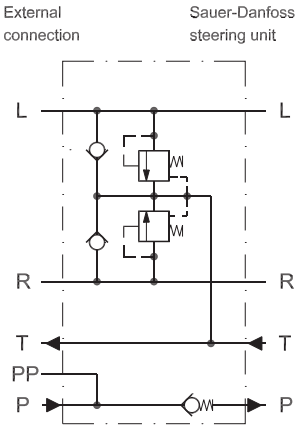
Code Numbers and Weights

OVPL Valve blocks

OVPL in the table below have all the following valve functions incorporated:

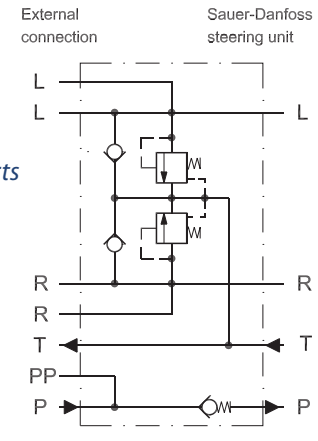
- Check valve in P-port
- Shock valves
- Suction valves

OVPL, 5 ports



150-628.10

OVPL, 7 ports



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Valve block	Code numbers Connections European version P, T, L, R: G 1/2-S** PP: G 1/4-S**	Number of ports	Valve settings Shock valve bar [psi]	Weight kg [lb]
OVPL 24	152-1117	5	240 [3480]	2.0 [4.41]
OVPL 28	152-1114	5	280 [4061]	2.0 [4.41]
OVPL 28	152-1116	7	280 [4061]	2.0 [4.41]

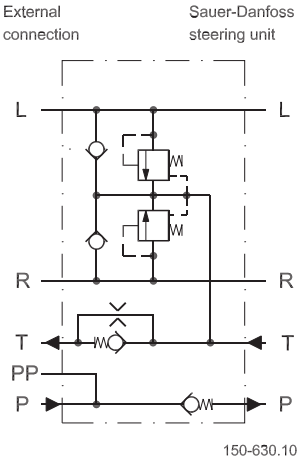
S** : Spot face around port connections

Code Numbers and Weights (continued)

OVPL in the table below has the following valve functions incorporated:

- Check valve in P-port
- Shock valves
- Suction valves
- Backpressure valve, with by-pass to reduce stand-by pressure in neutral position.

OVPL, 5 ports and backpressure valve with by-pass



Valve block	Code numbers		Valve settings		Weight	
	Connections European version P, T, L, R: G 1/2 - S** PP: G 1/4 - S**	Number of ports	Shock valve bar	[psi]	kg	[lb]
OVPL 24	152-1120	5	240	[3480]	2.0	[4.41]
OVPL 28	152-1130	5	280	[4061]	2.0	[4.41]

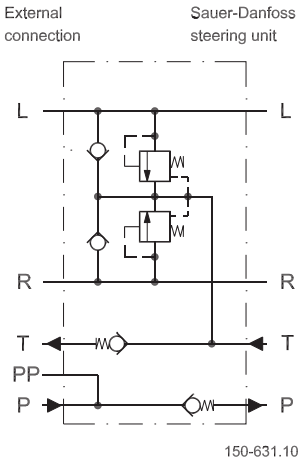
S** : Spot face around port connections

Code Numbers and Weights (continued)

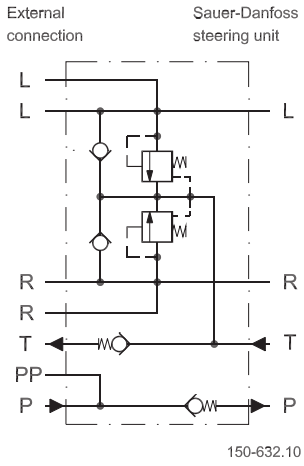
OVPL in the table below have all the following valve functions incorporated:

- Check valve in P-port
- Shock valves
- Suction valves
- Backpressure valve, without by-pass.

OVPL, 5 ports and backpressure valve



OVPL, 7 ports and backpressure valve



Valve block	Code numbers		Valve settings		Weight	
	Connections European version P, T, L, R: G 1/2- S** PP: G 1/4- S**	Number of ports	Shock valve bar	[psi]	kg	[lb]
OVPL 24	152-1132	5	240	[3480]	2.0	[4.41]
OVPL 28	152-1115	7	280	[4061]	2.0	[4.41]

S** : Spot face around port connections

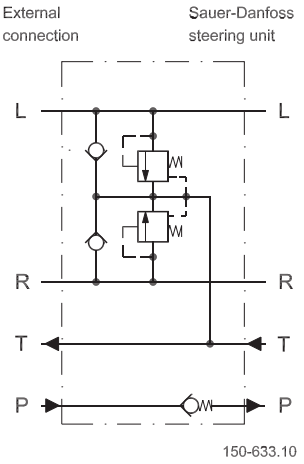
Valve Block OVPL

Code Numbers and Weights (continued)

OVPL in the table below has following valve functions incorporated:

- Check valve in P-port
- Shock valves
- Suction valves

OVPL, 4 ports



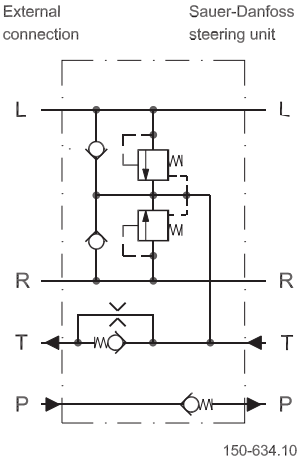
Valve block	Code numbers		Valve settings		Weight	
	Connections US version 3/4 - 16 UNF O* + S**	Number of ports	Shock valve bar	[psi]	kg	[lb]
OVPL 28	152-1133	4	280	[4061]	2.0	[4.41]

O* : O-ring chamfer on port connections
S** : Spot face around port connections

OVPL in the table below has the following valve functions incorporated:

- Check valve in P-port
- Shock valves
- Suction valves
- Backpressure valve with by-pass to reduce stand-by pressure in neutral position.

OVPL, 4 ports and backpressure valve with by-pass



Valve block	Code numbers		Valve settings		Weight	
	Connections US version 3/4 - 16 UNF O* + S**	Number of ports	Shock valve bar	[psi]	kg	[lb]
OVPL 28	152-1136	4	280	[4061]	2.0	[4.41]

O* : O-ring chamfer on port connections
S** : Spot face around port connections

Technical Data

Common data

Look in sub-catalogue: "General, steering components "

Valve functions

The data below come from measurements on a representative sample of valve blocks from production.
An oil with a viscosity of 21mm²/s [SUS] at 50°C [122°F] was used during measuring.

Valve block	Max. Oil flow		Max. pressure on connections					
			P, PP		T		L, R	
	l/min	[US gal/min]	bar	[psi]	bar	[psi]	bar	[psi]
OVPL 24	100	[26.42]	190	2756	15	[218]	240	[3480]
OVPL 28	100	[26.42]	225	3263	15	[218]	280	[4061]

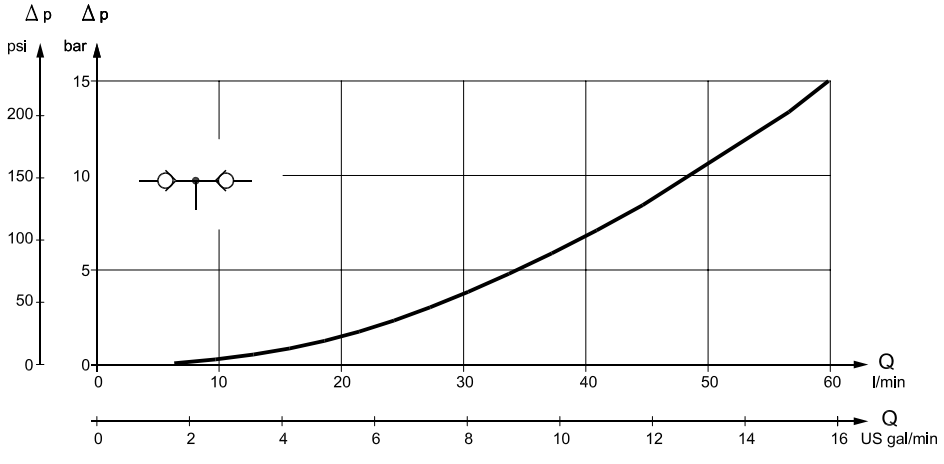
Shock valves

The shock valves protect the valve block and steering unit and limit maximum external forces on the steering cylinder. The shock valves in the valve block limit the maximum pressure drop from L to T and from R to T.
The shock valves are set at 10 l/min. [2.64 US gal/min].
The shock valves are of the direct acting type, so they react very quickly.
Setting tolerance: rated value +/- 10 bar [145 psi] , ex. 240 [3480 psi] +/- 10 bar [145 psi].

Suction valves

The suction valves ensure oil suction to avoid cavitations in the steering cylinder. To provide correct suction, a back pressure valve must be fitted in the tank line from the steering unit.
The capacity of the suction valves can be increased by building in a back pressure in the valve block.

The curve below shows pressure drop across a suction valve

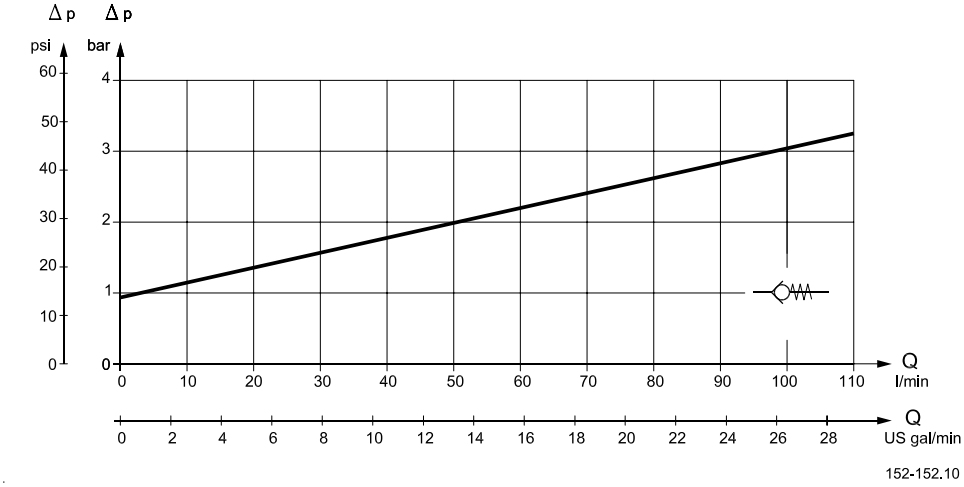


Technical Data (continued)

Check valve

The check valve protects the driver against steering wheel jerks. The check valve prevents oil from flowing backwards into the pump line when steering against a high pressure on the cylinder side.
The check valve is built into the P connection of the valve block.

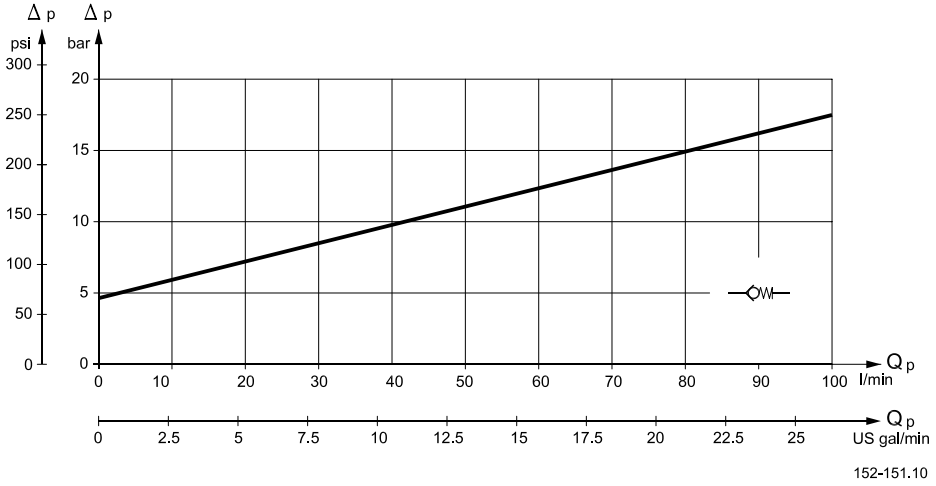
The curve below shows pressure drop across the check valve in p-connection



Backpressure valve

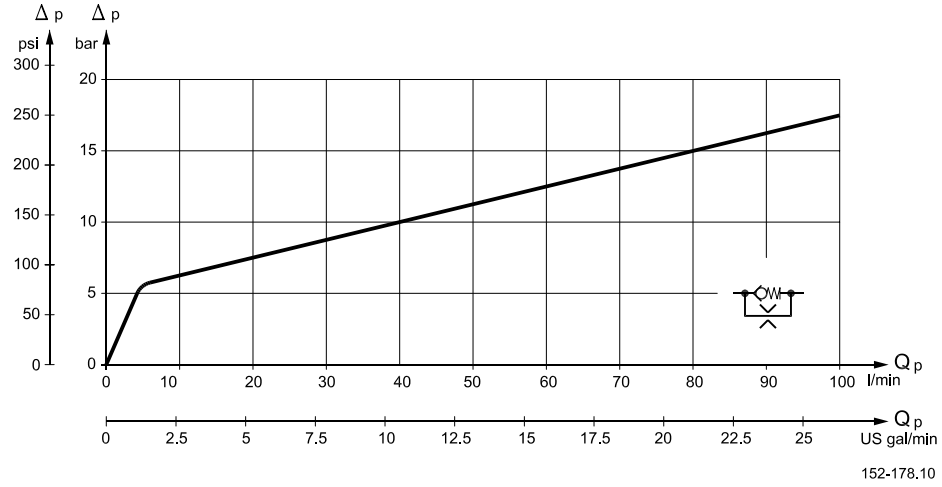
A backpressure valve increases the capacity of the suction valves.

The curve below shows pressure drop for backpressure valve without by-pass.



Technical Data (continued)

The curve below shows pressure drop for backpressure valve with by-pass.



Installation

Connection P in the valve block must be placed over the connection P in the steering unit, so OVPL is provided with a positioning pin to fit the positioning hole in the steering unit.
The valve block is supplied inclusive of 2 mounting screws and 4 O-rings for building onto the steering unit.
Tightening torque 65 ±5 N•m [575 ±44 lbf•in]. It is only allowed to mount OVPL blocks on steering units with a flat port flange, no spot face is allowed.

Valve Block OVPL

Dimensions

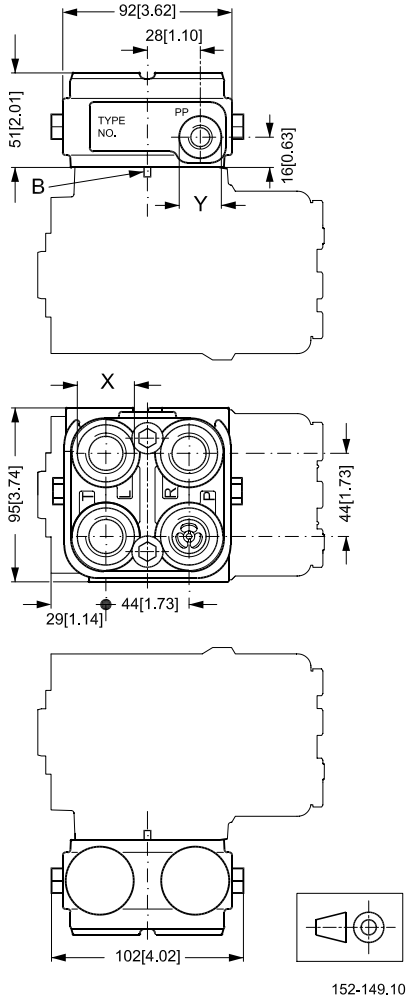
OVPL, 5 ports

European version:
P, T, L and R:
G ½ w. spot face,
15 mm (0.59 in) deep
PP: G ¼, w. spot face,
11,5 mm (0.45 in) deep
X: 30,2 +0,2
Y: 21,3 +/- 0,2

OVPL, 4 ports (no PP)

US version:
P, T, L and R:
¾ -16 UNF O-ring boss
15 mm (0.59 in) deep
X: 30,2 +0,2

B: Positioning pin
premounted in OVPL



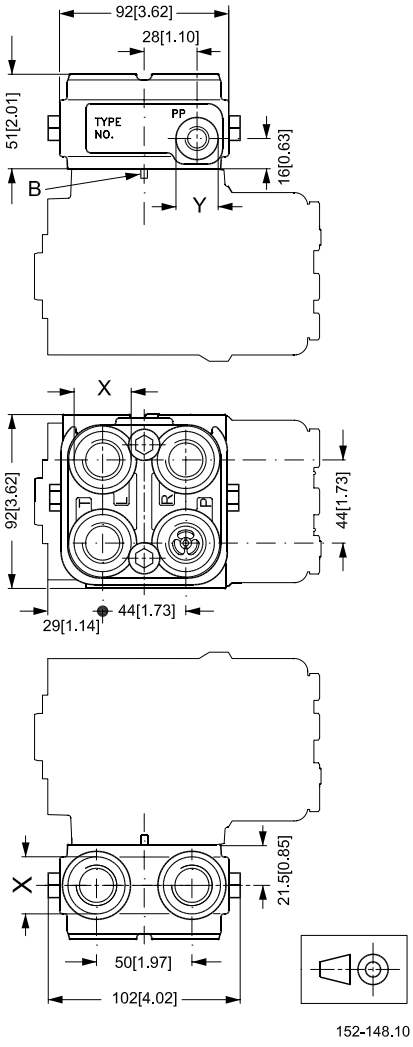
152-149.10

Dimensions (continued)

OVPL, 7 ports

European version:
P, T, 2xL and 2xR:
G ½ w. spot face,
15 mm (0.59 in) deep
PP: G ¼, w. spot face,
11,5 mm (0.45 in) deep
X: 30,2 +0,2
Y: 21,3 +/- 0,2

B: Positioning pin
premounted in OVPL



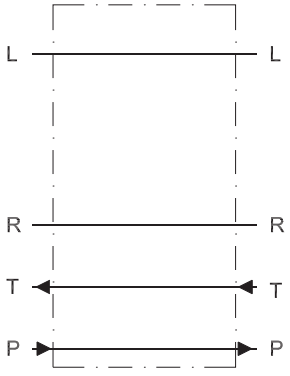
Angle Block OVR

Angle Block OVR

OVR angle blocks are especially designed for applications in which pipes and/or hoses must run parallel with the steering column axis, and where space is limited.
The valve block can be flanged onto Sauer-Danfoss steering unit OSPB, OSPC, OSPD, OSPF, OSPQ and OSPL, which have no spot face around the ports.
Use the angle block makes angle and swivel connections and pipe bends unneccessary.
The OVR connections are positioned away from the steering wheel. (see *dimensions* page 53)

Version

OVR



150-635.10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Code Numbers and Weight

OVR in the table below has no valve functions incorporated.

Angle block	Code numbers	Weight	
	Connections European version P, T, L, R: G ½ S**	kg	[lb]
OVR	152-0201	2.0	[4.41]

S** : Spot face around port connections

Installation

The valve block is supplied inclusive of 2 mounting screws and 4 O-rings for building onto the steering unit.
Tightening torque 65 ±5 N•m [575 ±44.3 lbf•in]. OVR blocks may only be mounted on steering units with a flat port flange, (no spot facing).

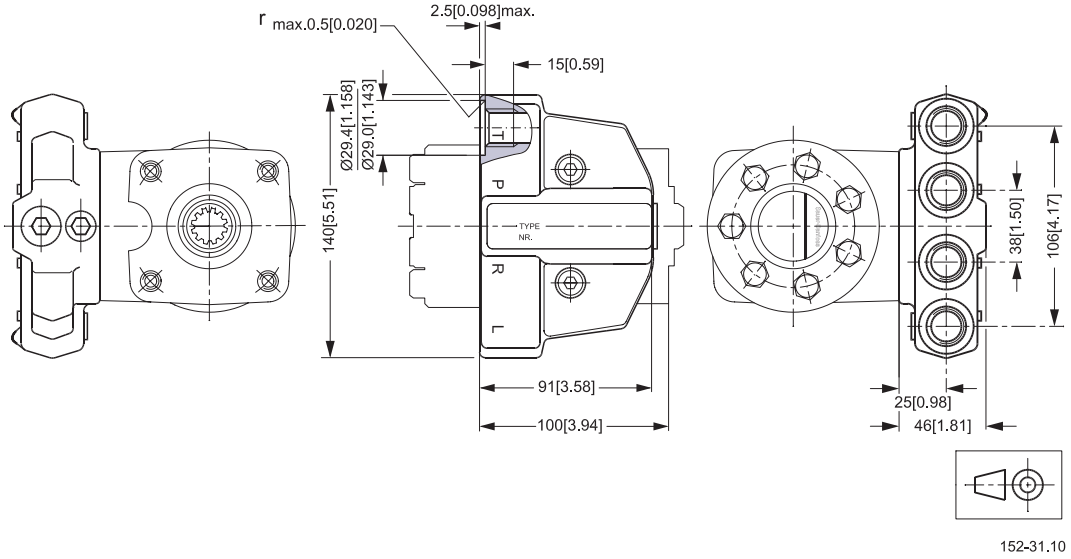
For OVR blocks with other thread ore kind of valves mounted, please contact the Sauer-Danfoss Sales organisation.

Angle Block OVR

Dimensions

OVR

European version:
P, T, L and R:
G ½, 15 mm (0.59 in) deep



Notes

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Local address:

Sauer-Danfoss (US) Company
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239-6000
Fax: +1 515 239 6618

Sauer-Danfoss ApS
DK-6430 Nordborg, Denmark
Phone: +45 7488 4444
Fax: +45 7488 4400

Sauer-Danfoss GmbH & Co. OHG
Postfach 2460, D-24531 Neumünster
Krokamp 35, D-24539 Neumünster, Germany
Phone: +49 4321 871-0
Fax: +49 4321 871 122

Sauer-Danfoss-Daikin LTD
Sannomiya Grand Bldg. 8F
2-2-21 Isogami-dori, Chuo-ku
Kobe, Hyogo 651-0086, Japan
Phone: +81 78 231 5001
Fax: +81 78 231 5004

11015554 • Rev AB • May 2008

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www.sauer-danfoss.com