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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

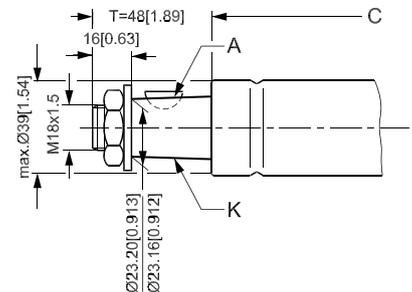


Versions

Steering wheel connections: SWC

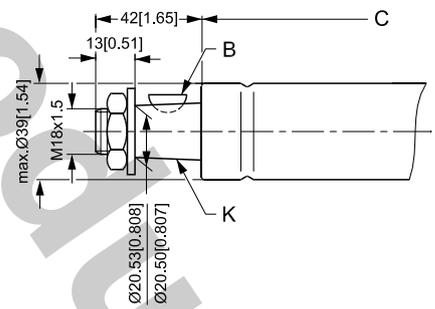
The OTPB steering columns are available with six different standard steering wheel connections:

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



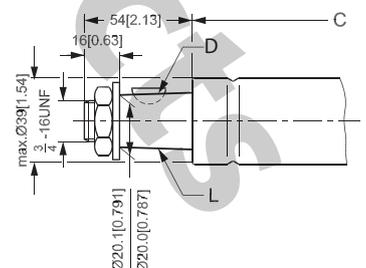
150-606.12

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



150-198.10

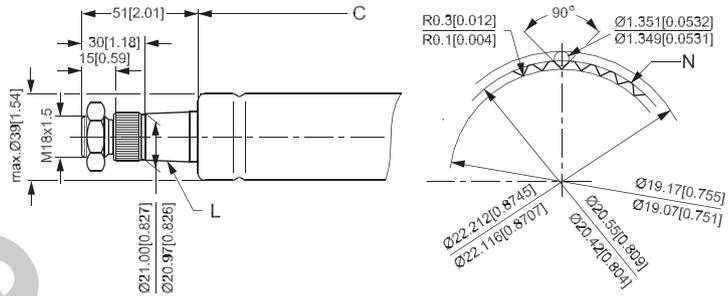
3. D: 3/16 x 3/8 SAE J502
 $d_{\min} = 20,0 \text{ mm [0.787 in]}$
 L: Taper 1:16



150-605.11

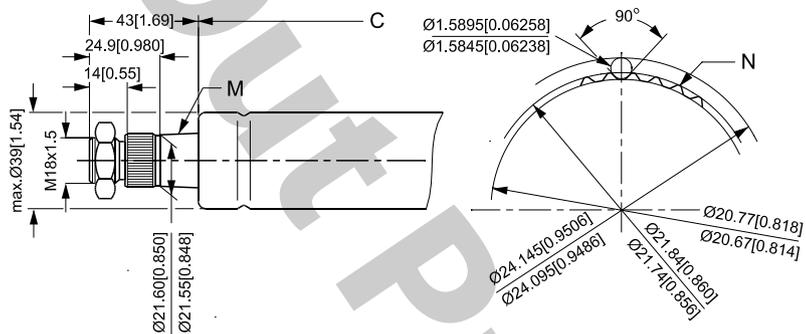
Versions (continued)

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



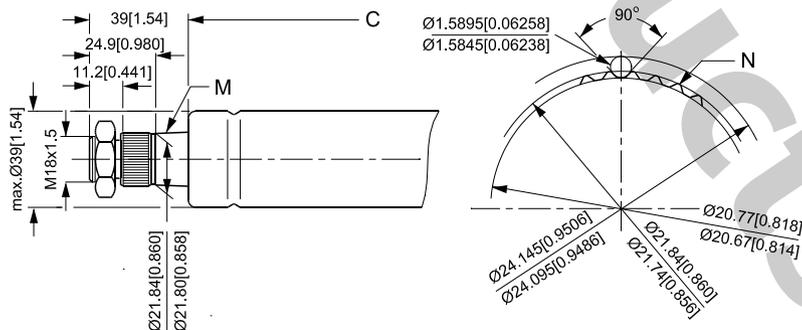
150-199.11

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



150-200.10

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



150-201.10

Versions (continued)

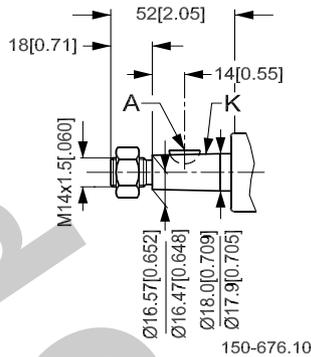
The OTPM steering columns are available with three different standard steering wheel connections.

M1

A: 5 • 6.5 DIN 6888

$d_{\min} = 16.47 \text{ mm [0.648 in]}$

K: Taper 1:20



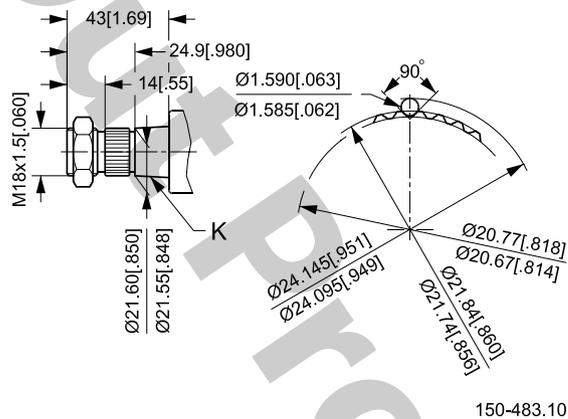
M2

(same as "5" page 8)

With $\frac{7}{8}$ in-36 serration

$d_{\min} = 21.55 \text{ mm [0.848 in]}$

K: Taper 1:19,26

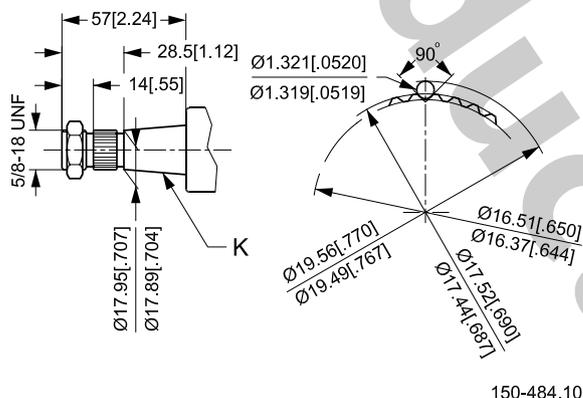


M3

With $\frac{11}{16}$ in-40 serration

$d_{\min} = 17.89 \text{ mm [0.704 in]}$

K: Taper 1:12

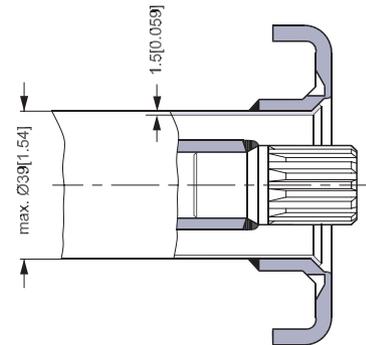


Versions (continued)

Body tubes

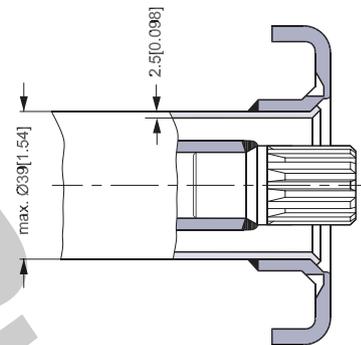
The OTPB steering columns are available with three different body tube dimensions:

1. Standard: $\varnothing 38 \cdot 1.5 \text{ mm}$ [1.50 • 0.06 in]



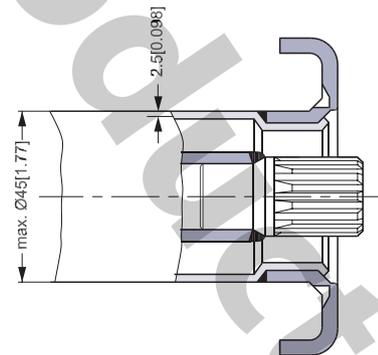
150-647.10.10

2. $\varnothing 38 \cdot 2.5 \text{ mm}$ [1.50 • 0.1 in]



150-675.10

3. $\varnothing 45 \cdot 2.5 \text{ mm}$ [1.77 • 0.1 in]



150-643.10

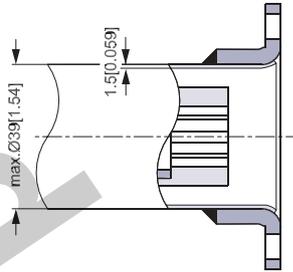
If the steering column is longer than 150 mm [5.91 in] and support is not possible, the recommended body tube is $\varnothing 38 \times 2.5 \text{ mm}$ [1.50 • 0.1 in] or $\varnothing 45 \times 2.5 \text{ mm}$ [1.77 • 0.1 in].

Versions (continued)

Body tubes

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

1. Standard: $\varnothing 38 \cdot 1.5$ mm [1.50 \cdot 0.06 in]



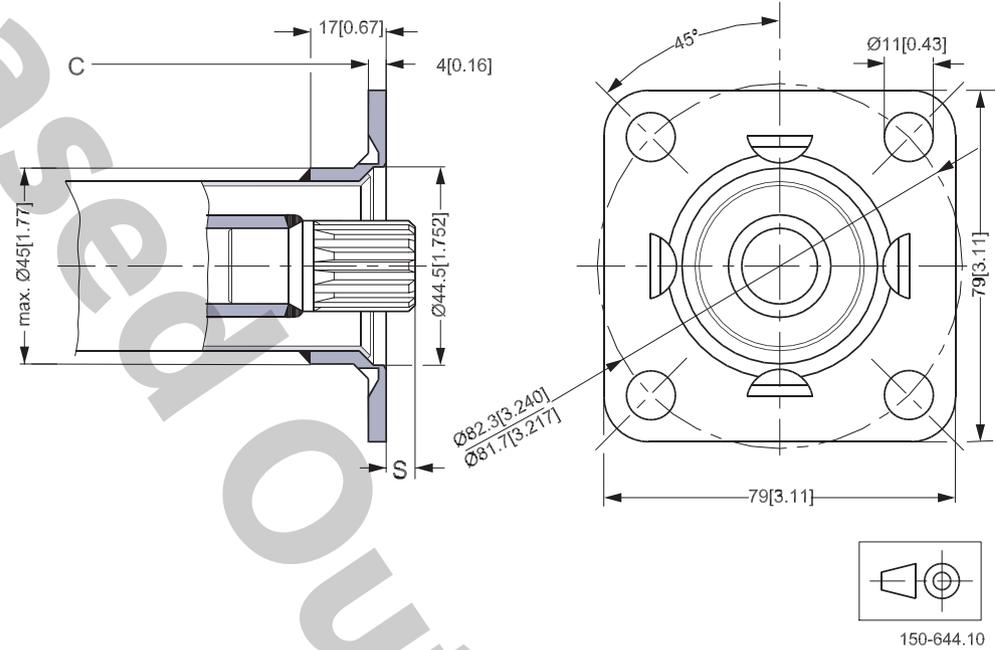
150-677.10

Versions (continued)

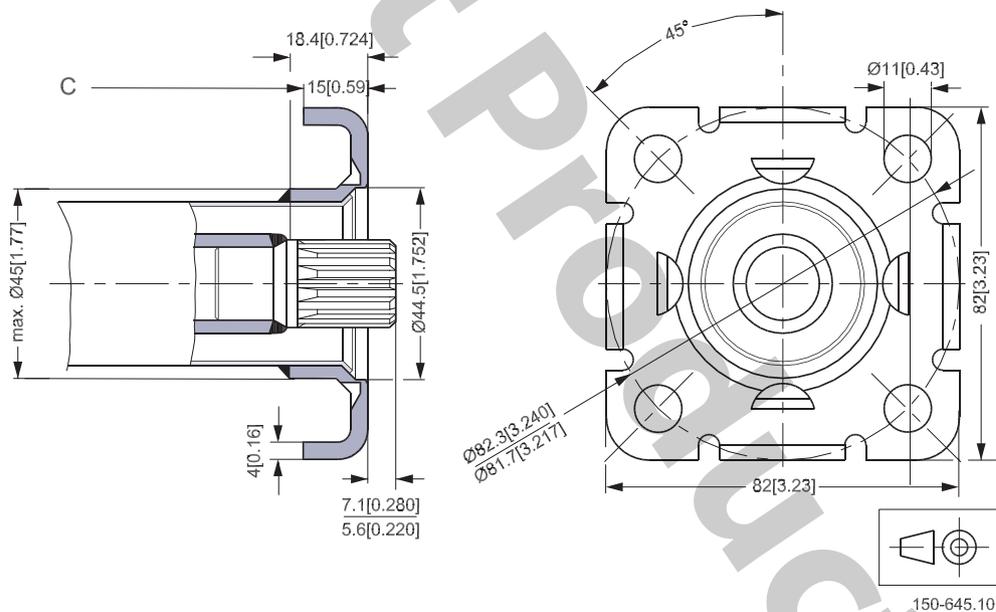
Flanges

Our OTPB steering columns are available with three different flanges:

Flange A



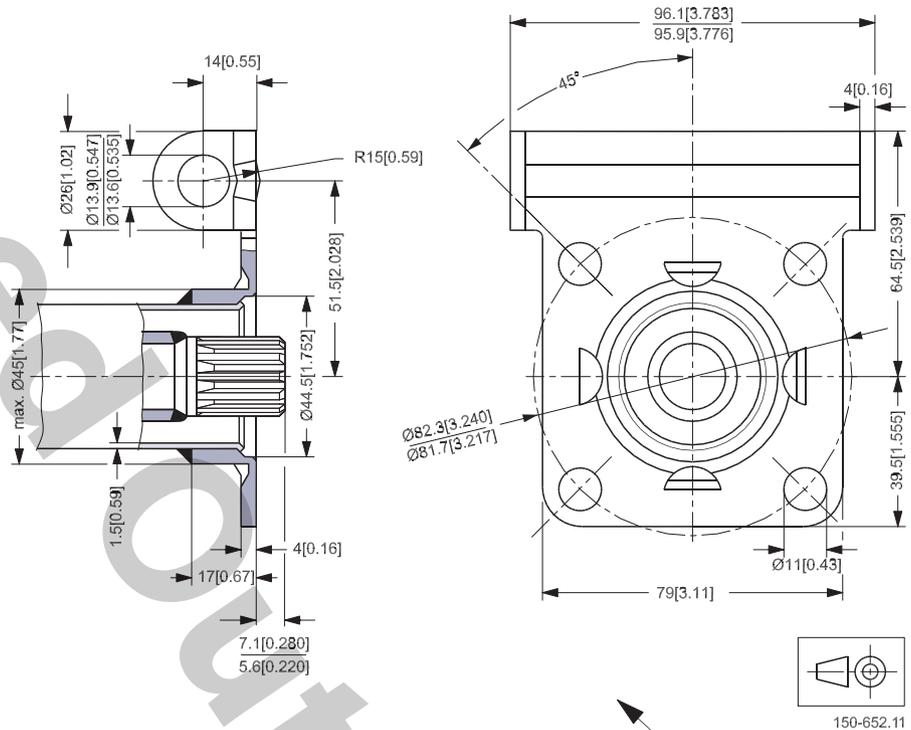
Flange B



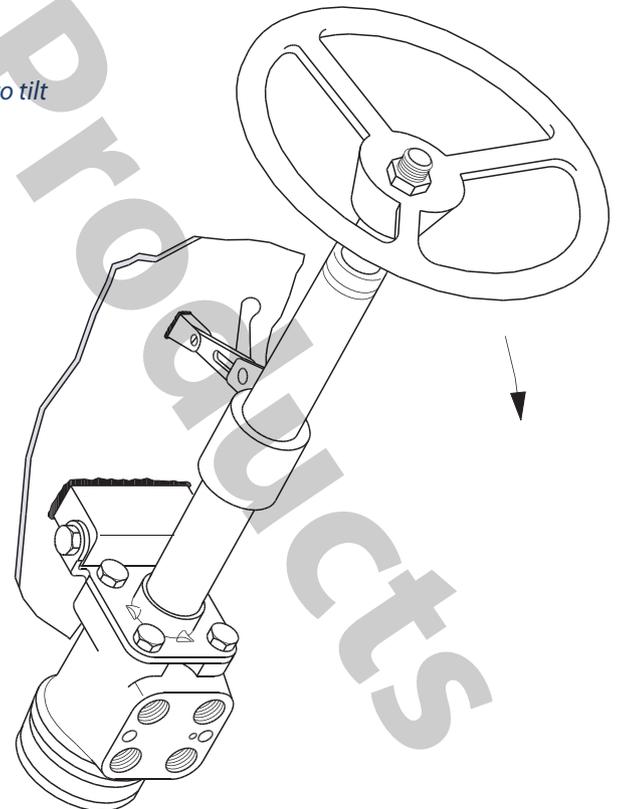
Versions (continued)

Flanges

Flange for bottom tilting



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



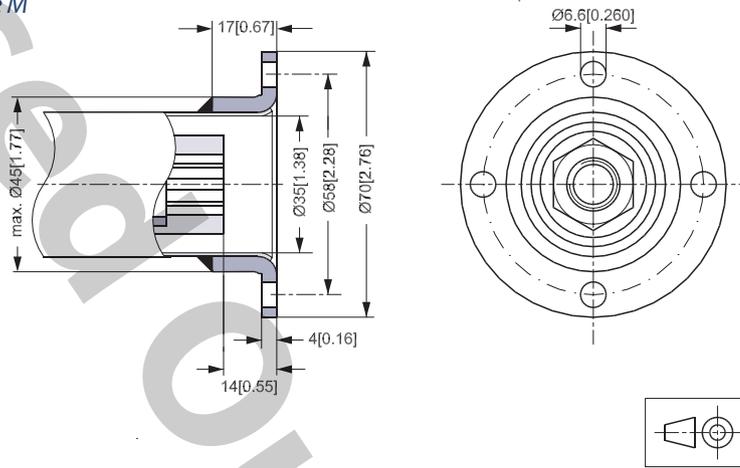
For other versions, please contact the Sauer-Danfoss Sales Organization

Versions (continued)

Flanges

The OTPM steering columns are available with one flange:

Flange M



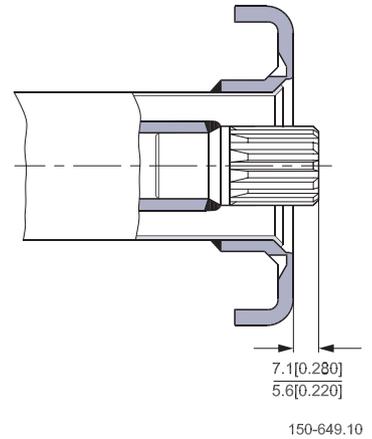
150-678.10

Versions (continued)

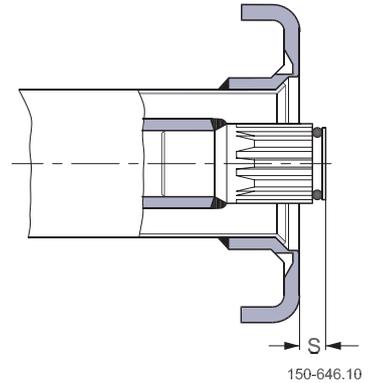
Axle journals

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

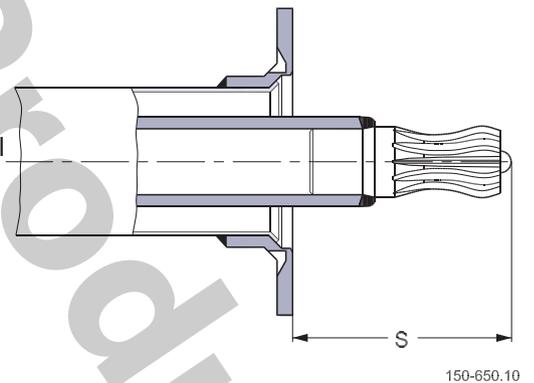
1. Standard axle journal with straight splines.
In case of inadequate parallelism between the steering column's mounting plane (flange) and the steering unit's steering column plane, use a spherical axle journal. For standard splines, the required parallelism is better than 0.5 mm in relation to the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



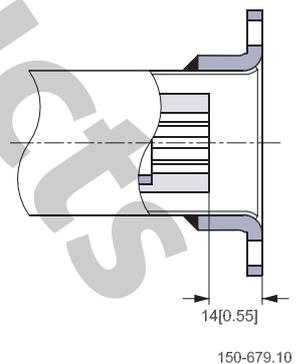
2. Axle journal with straight splines and O-ring for noise reduction



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



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



Versions (continued)

Surface protection

OTP steering columns are available with two different kinds of surface protection:

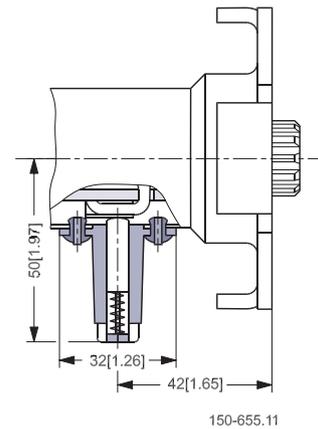
- Standard: yellow chromate
- Black chromate

Horn buttons

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

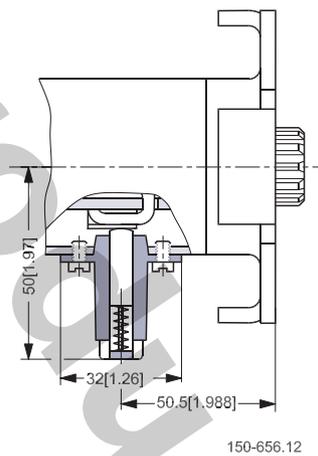
1. Standard single horn button

For $\varnothing 38$ mm [1.5 in] body tube, spare parts bag code number 150-5215



2. Standard single horn button

For $\varnothing 45$ mm [1.77 in] body tube, spare parts bag code number 150-4032



Versions (continued)

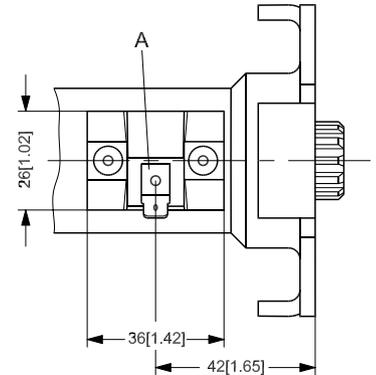
3. Flat horn button

For $\varnothing 38$ mm [1.5 in] and $\varnothing 45$ 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

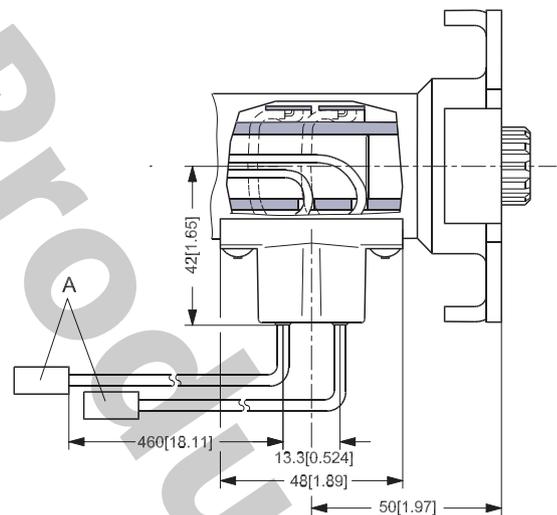


150-658.10

4. Double horn button.

Only for $\varnothing 38$ mm [1.5 in] body tube, spare parts bag code number 150-6288

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



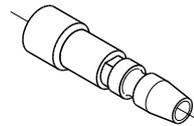
150-657.10

Versions (continued)

Wire ends for steering wheel horn button

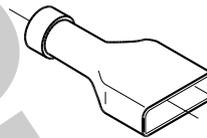
Steering columns with horn buttons are available with various wire ends in the steering wheel end of the column:

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

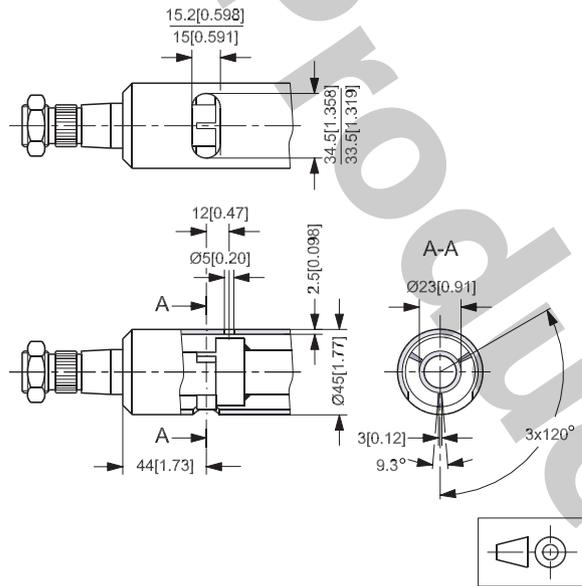


150-682.10

5. Customer defined

Flasher activator

OTP steering columns with body tube $\varnothing 45$ 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)

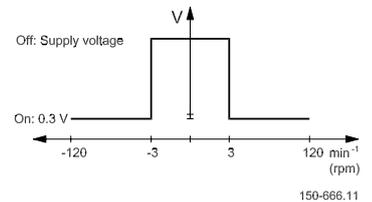
Steering wheel sensors

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

Data:
 Principle: Hall-effect, contactless, free of service.
 Power supply: 24 or 48 V DC \pm 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.

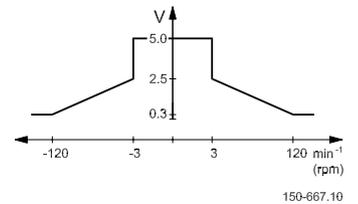
ON/OFF signal



2. Proportional sensor

Data:
 Principle: Hall-effect, contactless, free of service.
 Power supply: 18-80 V DC \pm 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.

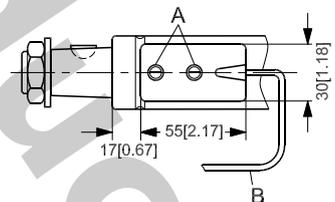
Proportional signal



Steering wheel sensors are only available for body tube dimension \varnothing 38 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.



150-670.11

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 $\varnothing 38 \cdot 1.5$ mm [1.5 · 1.06 in] body tube, B-flange, and yellow chromate coating.

Fixed steering columns without horn button

Type	Code number					
	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

Type	Code number					
	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 $\varnothing 38 \times 1.5$ 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

Type	Code number					
	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

Type	Code number					
	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.

Code Numbers and Weights, OTPM

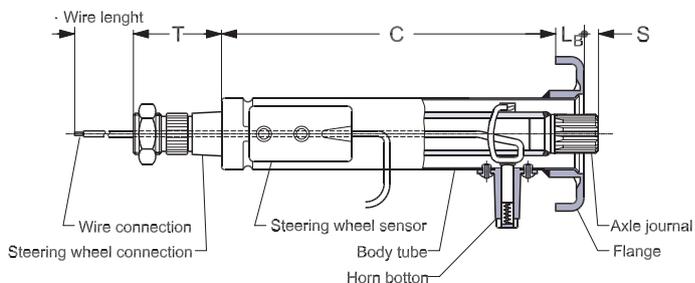
Following steering columns are with $\varnothing 38 \times 1.5$ mm [1.496 • 0.059] body tube, M-Flange, and black chromate coating.

Type	Code number	
	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

**Specification Table for
 Non-Catalogue Numbers
 of Sauer-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



T is linked to steering wheel connection type

150-663.10

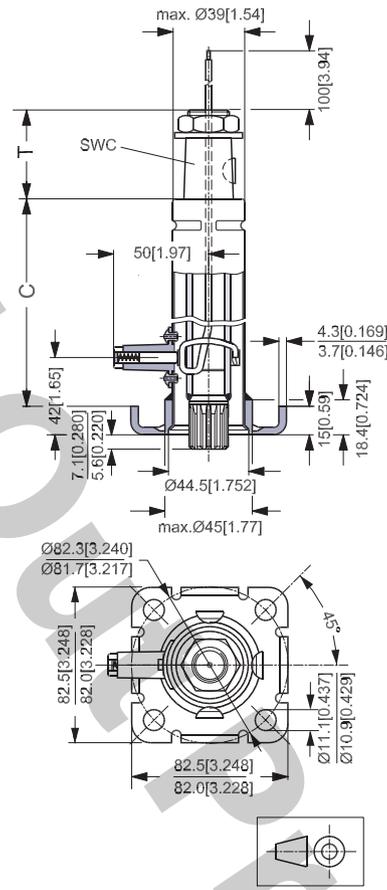
Your company	Name	Vehicle	Potential, pcs/year	Completed by	Date					
For steering unit type	OTPB for: OSPB, OSPC, OSPD, OSPF, OSPL, OSPQ and TAD				OTPM for: OSPM					
Steering wheel connection see page 7 - 9	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type M1	Type M2	Type M3	Customer defined
Body tube	∅38 • 1.5 mm, standard		∅38 • 2.5 mm			∅45 • 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, straight splines		With O-ring		Spherical		Standard M			
Surface protection	Yellow chromate (not for OTPM)					Black chromate				
Horn button	None	Standard for ∅38mm body tube		Standard for ∅45 mm body tube		Flat version		Double for ∅38 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 ∅45 mm body tube only)								
Prepared for steering wheel sensor	No	Yes (for ∅38 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



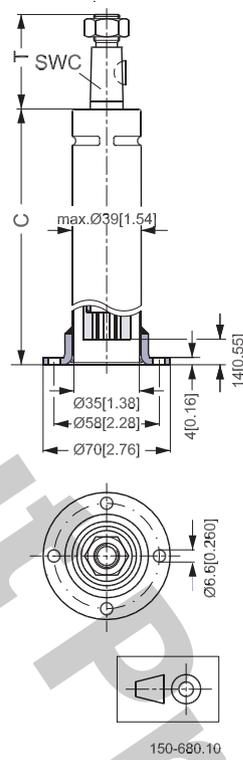
150-660.10

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]

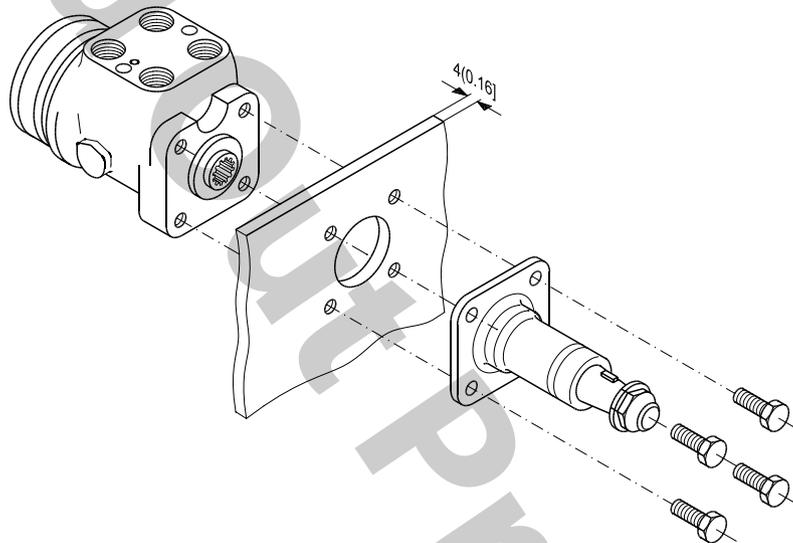
Installation**Installation of steering column with A-flange**

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 = .041 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.

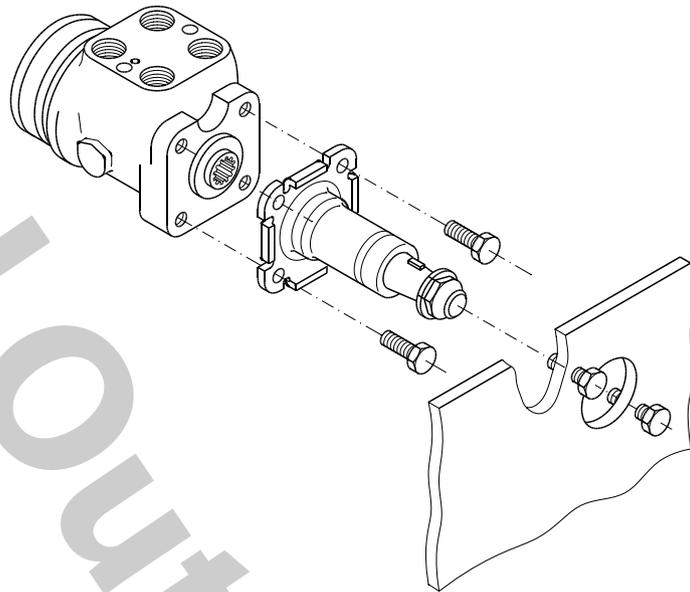
Max tightening torque for fixing screws is 30 N·m [265.5 lbf·in]. Recommended tightening torque for the steering wheel connection is 40 ± 5 N·m [354 ±44 lbf·in].



150-607.10

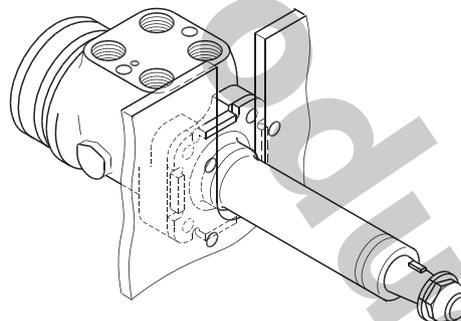
Installation (continued)**Installation of steering column with B-flange**

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 radially. Max. tightening torque for fixing screws is 30 N·m [265.5 lbf·in].



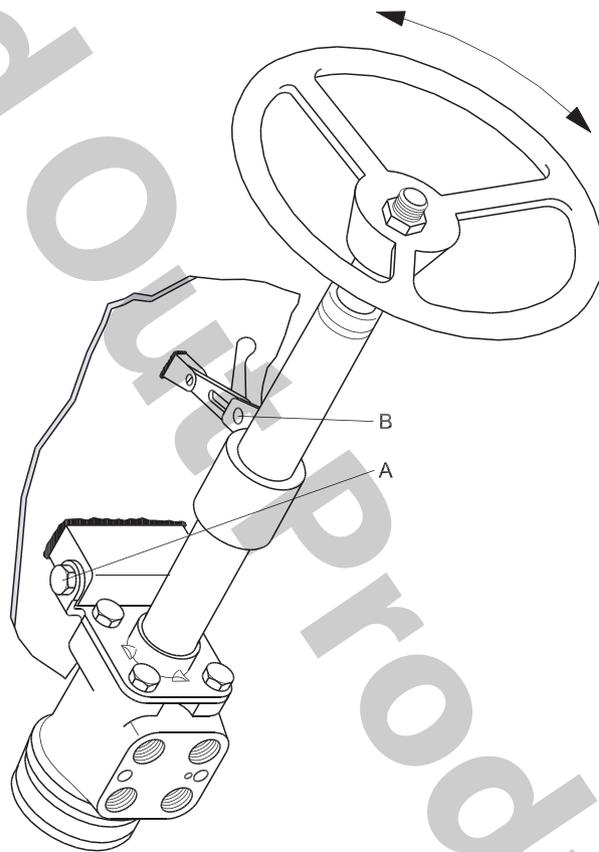
150-261.10

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 $\varnothing 13.6 +0.3/-0$ 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.



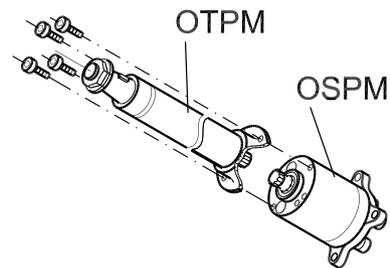
150-608,11

Installation (continued)

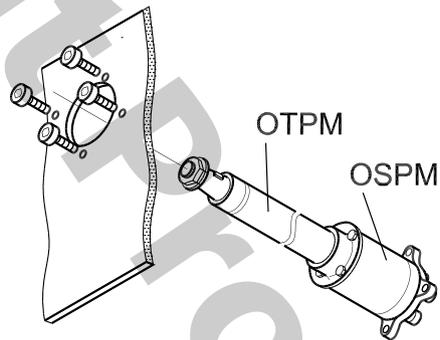
Installation of steering column OTPM

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



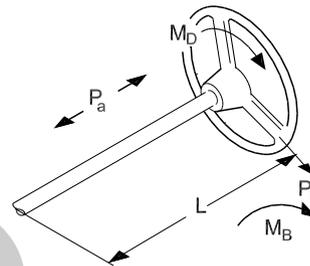
150-640.10

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, $M_B = P_r \cdot L$



150-271.12

When L exceeds 150 mm [5.91 in], the standard steering column with body tube $\varnothing 38 \cdot 1.5$ mm [1.50 · 0.06 in] must be supported, and when using standard body tube $\varnothing 38 \cdot 1.5$ 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]

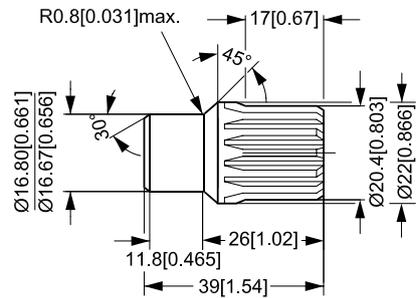
If $L > 150$ mm [5.91 in] and no support is possible, Sauer-Danfoss recommends columns with body tube $\varnothing 38 \cdot 2.5$ mm [1.50 · 0.10 in] or $\varnothing 45 \cdot 2.5$ mm [1.77 · 0.10 in].

Installation (continued)

Axle journals for customer made columns

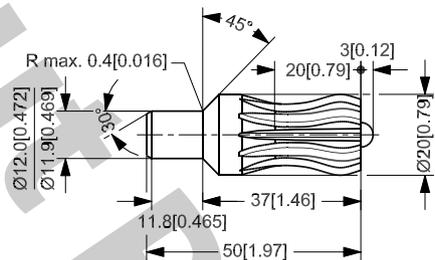
Customers, who wish to construct their own steering columns, can purchase axle journals from Sauer-Danfoss.

Standard axle journal, code number 150-0674.



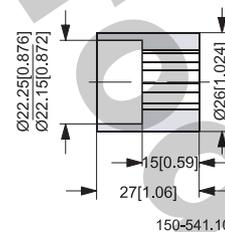
150-208.10

Spherical axle journal, code number 150-4036



150-648.10

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



150-541.10

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

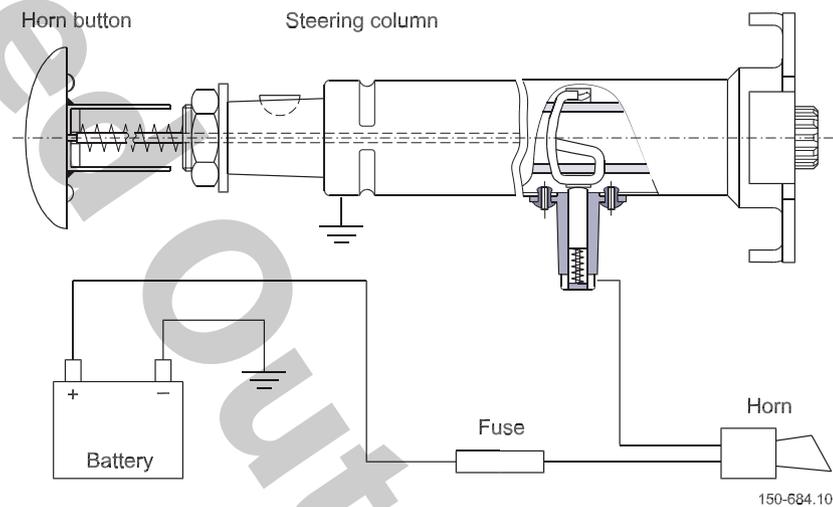
1. Make sure that length and other dimensions of the axle journal part protruding from the mounting surface are correct to ensure the right engagement with the Sauer-Danfoss steering unit (See page 24 - 25).
2. The steering column must only be provided with one bearing (in the top).
3. The welded journal must be coaxial with the steering column.
- 4a. The steering column must be coaxial with the spigot hole $\varnothing 44.6$ mm [$\varnothing 1.76$ in] (see page 24 for OSP except OSPM).
- 4b. The steering column must be coaxial with the spigot hole $\varnothing 35$ mm [$\varnothing 1.38$ in] (see page 25 for OSPM).
5. As the axle journal material is chrome alloy steel, we recommend CO₂ welding.

Installation (continued)

Horn button

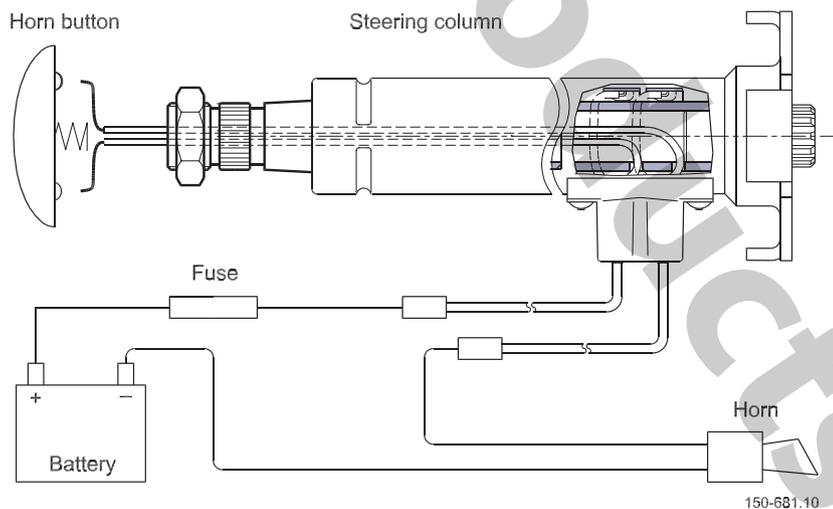
The figure below illustrates a proposal of an electrical circuit with single horn button on steering column.

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

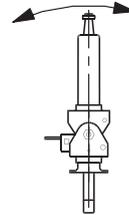
Adjustable Steering Columns

Versions

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

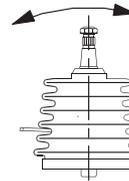
Four different kinds of adjustable steering columns are available:

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



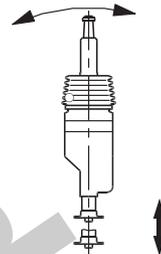
150-668.10

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



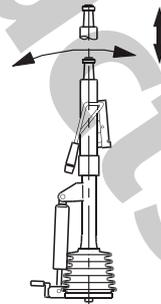
150-665.10

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:

Type / Feature	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.

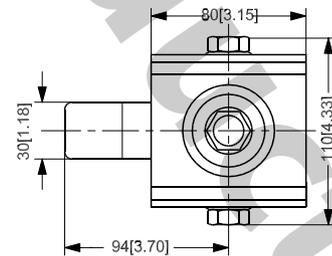
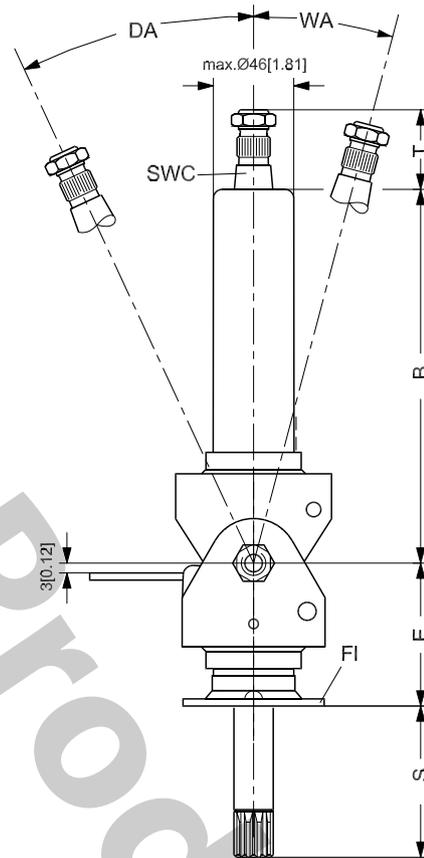
Tilting: Maximum tilt angle from lock to lock is 40°. Adjusting principle and area: see the specific types.

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

**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 $DA_{max} = 25^\circ/WA_{max} = 15^\circ$ or $DA_{max} = 15^\circ/WA_{max} = 25^\circ$.
DA = degrees towards the driver, WA = degrees towards the windscreen/away from the driver.

*Dimensions
OTP-ST standard tilting*



150-661.11

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

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

**OTP-MT, Mini Tilting
Steering Columns**

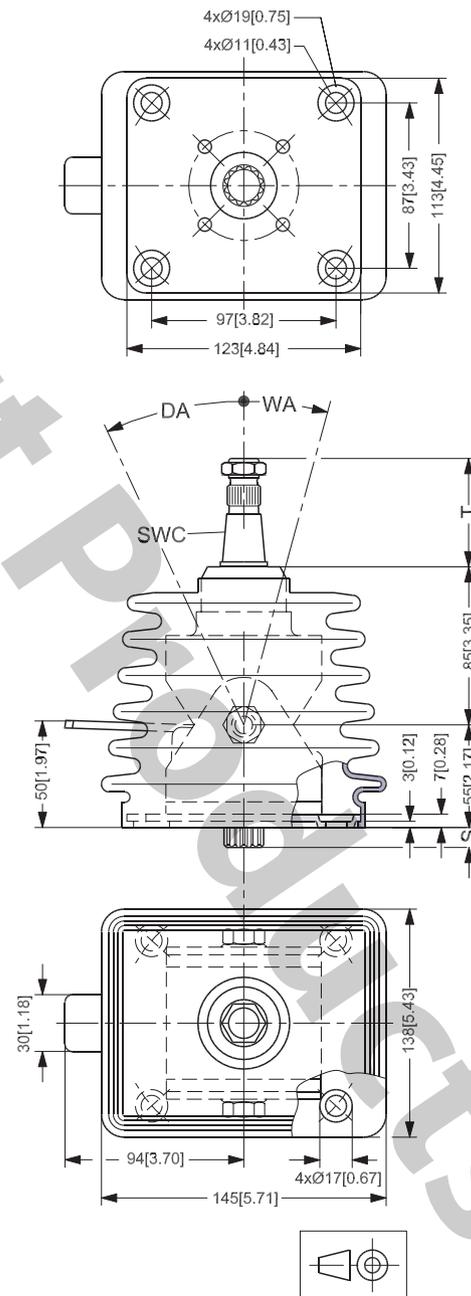
When using mini tilt columns, the steering unit except OSPM must be flanged onto a flange in the cabin by means of special Allen screws with flat heads, M10x16 mm, see page 42. These screws are included in the steering column delivery.

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 $DA_{max} = 25^\circ/WA_{max} = 15^\circ$ or $DA_{max} = 15^\circ/WA_{max} = 25^\circ$.

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

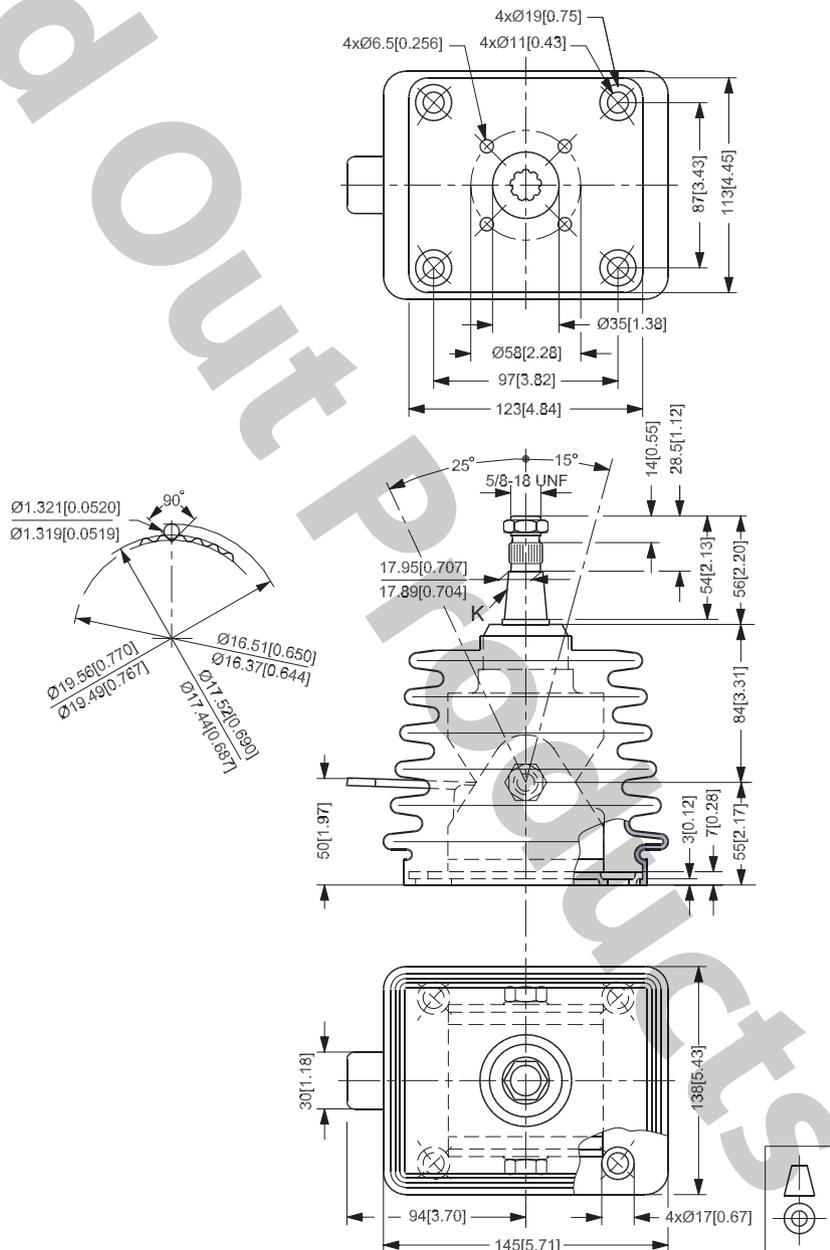
OTP-MT, Mini Tilting Steering Columns

When using OTP-MT together with OSPM, the OSPM is mounted directly on the bottom plate of the steering column by means of 4 pieces of standard M6 • 12 mm Allen screws (not included 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
 $d_{min} = 17.89 \text{ mm [0.704 in]}$
 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.

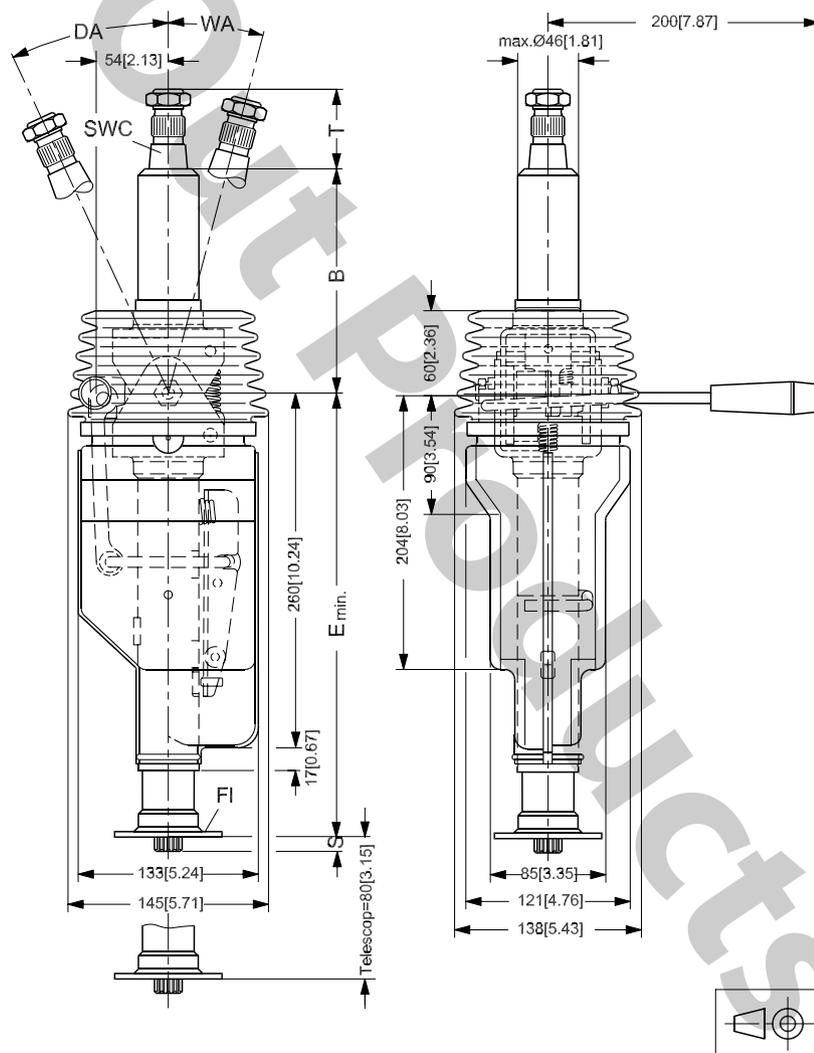
OTP-STT standard columns are provided with a mechanical incremental locking system for the tilting function. The tilt angles are adjusted in steps of 5°.

The maximum tilt angles can be selected between $DA_{max} = 25^\circ/WA_{max} = 15^\circ$ or $DA_{max} = 15^\circ/WA_{max} = 25^\circ$.

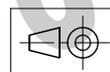
DA = degrees towards the driver, WA = degrees towards the windscreen/away from the driver.

Dimensions

OTP-STT, standard tilt and telescope



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



150-662.11

Adjustable Steering Columns
 (continued)

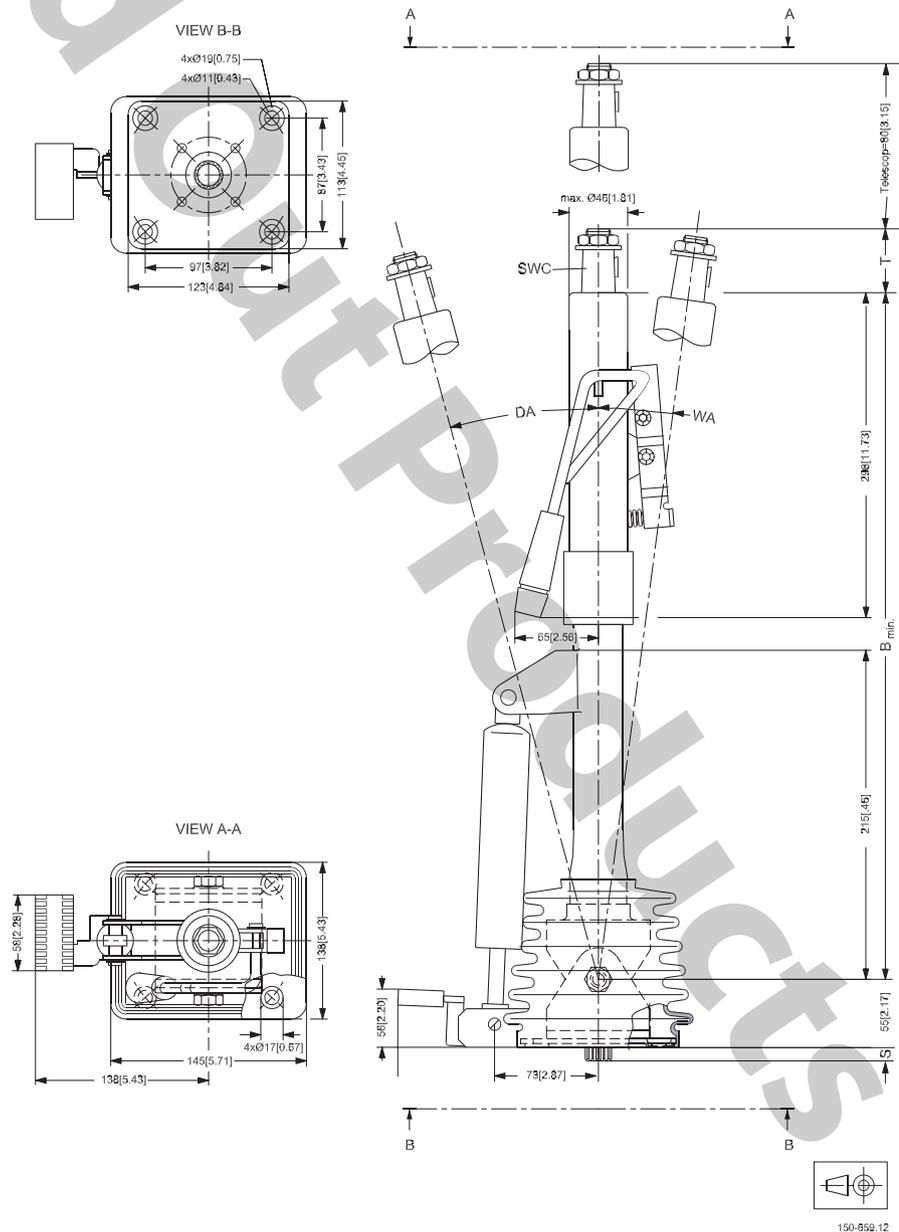
OTP-BTT, bottom tilt and telescope steering columns

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 $DA_{max} = 25^\circ / WA_{max} = 15^\circ$. 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 Standard 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		
Axle journal	Standard straight splines		With O-ring		Spherical		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)					

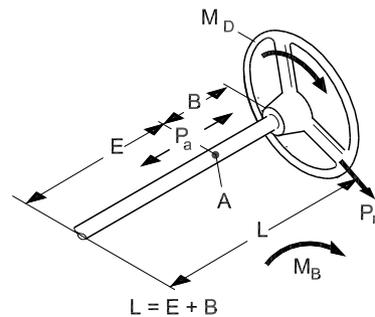
* Tilt angle: Sum of DA and WA must not exceed 40°

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

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, $M_B = P_r * L$



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

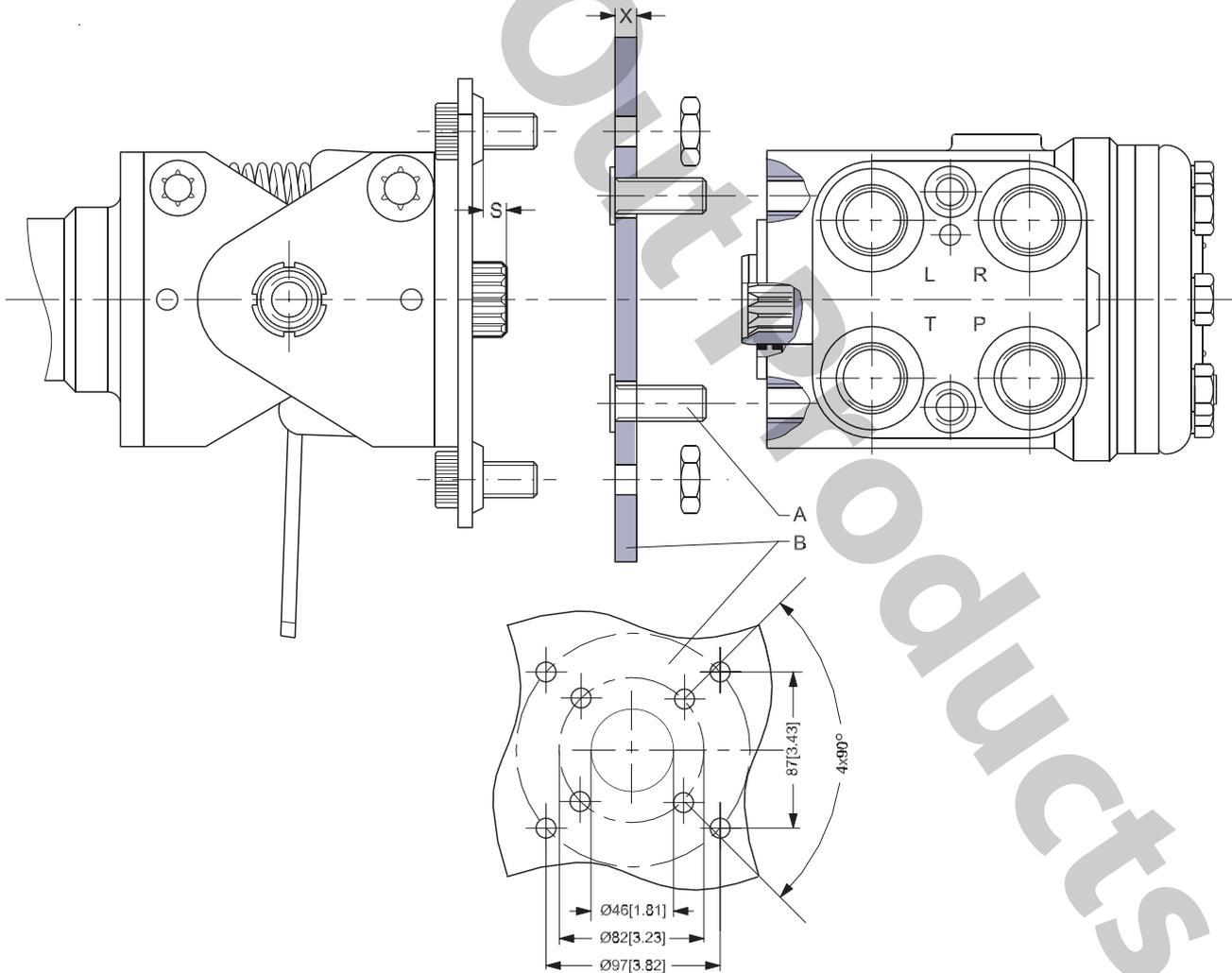
Installation of OTP-MT and OTP-BTT

- 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: $\varnothing 11$ 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].



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Please contact the Sauer-Danfoss representative nearest you.

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