As the market leader worldwide, Robert Bosch Automotive Steering offers a comprehensive range, which includes all the principal components between the steering wheel and the wheels (wheel-to-wheel), meets all the requirements of our customers.

**Strength of Innovation Plus Know-How**

The linking of the vehicle’s electrohydraulic steering system and power steering systems requires a high level of coordination. From the look alone and the perception, the steering system not only needs to meet the requirements in the area of safety and reliability, but also should be optimized to its maximum. RB-Servoline®, a linear steering system that includes modern steering pumps, continuously adjustable steering columns, and low-cost connecting shafts between steering gears and steering columns, as well as making sure that drivers can work ergonomically and comfortably on long hauls. As a supplier of individual components and complete steering systems for medium-duty and heavy-duty commercial vehicles, Robert Bosch Automotive Steering offers a comprehensive range of wheel-to-wheel components between the steering wheel and the wheels (wheel-to-wheel), meets all the requirements of our customers.

**Roadmap**

Steer into the future – with Bosch steering systems

**System Supplier with Comprehensive Expertise**

And network competence. We offer our customers not just components, but also complete systems that are perfectly matched, and which incorporate our expert knowledge of areas of steering systems for commercial vehicles. Part of our business is to network solutions with the wide spectrum of steering systems, such as steering wheels and columns, to the benefit of our customers.

**Achieving More with Less**

Our innovative products contribute in many ways to the increased weight efficiency (power-on-demand principle). Through its weight and energy-optimized design, each Bosch steering system can reduce the number of components required.

**Assistance Systems and Automated Driving**

The linking of the vehicle’s electrohydraulic steering system and power steering systems requires a high level of coordination. From the look alone and the perception, the steering system not only needs to meet the requirements in the area of safety and reliability, but also should be optimized to its maximum. RB-Servoline®, a linear steering system that includes modern steering pumps, continuously adjustable steering columns, and low-cost connecting shafts between steering gears and steering columns, as well as making sure that drivers can work ergonomically and comfortably on long hauls. As a supplier of individual components and complete steering systems for medium-duty and heavy-duty commercial vehicles, Robert Bosch Automotive Steering offers a comprehensive range of wheel-to-wheel components between the steering wheel and the wheels (wheel-to-wheel), meets all the requirements of our customers.

**Hold the Lane over the Long Haul and Pull Together as One**

Long-term performance of the steering systems is a fundamental requirement for steering systems, power steering pumps and components for commercial vehicles. Robert Bosch Automotive Steering is an experienced and capable partner to the automotive industry. Our customers appreciate us, because we are technically reliable and competitive, in a stable price range, and because we are able to achieve the high level of satisfaction of our customers.

**Perfect Steering Feel in our Core Expertise**

Robert Bosch Automotive Steering benefits from decades of experience and proficiency in the worldwide market for steering systems. Our products define the state of the art in the steering sector and are characterized by the highest level of satisfaction of our customers.

**High-revenue**

Robert Bosch Automotive Steering is the market leader internationally in the sector of steering systems for commercial vehicles. Our products define the state of the art in the steering sector and are characterized by the highest level of satisfaction of our customers. Thanks to the many linking features available, intelligent steering systems incorporate a wide range of technologies, including automated steering functions.

**Reliable and Robust on the Highway or Off-Road**

Ensuring quality and reliability. Manufacturing throughout the world. Our high-quality products ensure that our steering systems, components and services reach us. Whether it is the steering wheel or the drive, we make sure that the products arrive on schedule and in good condition, and they have proven their quality and robustness under all conditions.

**Innovative Driver and Technology Leader**

Robert Bosch Automotive Steering is the market leader in steering systems for commercial vehicles. Our products define the state of the art in the steering sector and are characterized by the highest level of satisfaction of our customers. Thanks to the many linking features available, intelligent steering systems incorporate a wide range of technologies, including automated steering functions.

**System Supplier with Comprehensive Expertise**

And network competence. We offer our customers not just components, but also complete systems that are perfectly matched, and which incorporate our expert knowledge of areas of steering systems for commercial vehicles. Part of our business is to network solutions with the wide spectrum of steering systems, such as steering wheels and columns, to the benefit of our customers.

**Steering systems for commercial vehicles**

Robert Bosch Automotive Steering is the market leader internationally in the sector of steering systems for commercial vehicles. Our products define the state of the art in the steering sector and are characterized by the highest level of satisfaction of our customers.
As the market leader worldwide, Robert Bosch Automotive Steering provides a comprehensive range of steering systems, including rack-and-pinion and electric units. This range is particularly suitable for heavy-duty commercial vehicles with independent suspension. The range from Robert Bosch Automotive Steering is a combination of a ball-and-nut power steering and an electric drive, making sure that drivers can work ergonomically and comfortably on long hauls.

Achieving more with less: Our innovative products contribute in many ways to the increased efficiency of commercial vehicles. For example, fail-safe steering technology reduces the number of components required.

Achieving more with less: Our innovative products contribute in many ways to the increased efficiency of commercial vehicles. For example, fail-safe steering technology reduces the number of components required.

The linking of the vehicle’s electrohydraulic steering system and on-demand steering systems, such as fail-safe, fail-operational* steering, makes sure that drivers can work ergonomically and comfortably on long hauls.

Robust connecting shafts between steering gears and steering columns, power steering pumps, continuously adjustable steering columns, and low-wear bevel boxes.

Roadmap

Highly automated

Automated

Basic

On-demand

Fail safe*

Fail operational*

On the highway or off-road

Power-on-demand*

Reliability and robustness: Our products are in daily use on hundreds, thousands, and millions of vehicles, and they have proved their quality and reliability in all areas.

Connected mobility

Automated mobility

Powertrain systems and electrified mobility

With comprehensive expertise

Innovation driver and technology leader: Robert Bosch Automotive Steering is an established benchmark in terms of steering systems for commercial vehicles. Our products define technical progress in action and innovation. The success for our products is the result of decades of experience and proficiency in the world’s marketed state-of-the-art systems for commercial vehicles.

Perfect steering feel: In our core expertise

Growth and efficiency for the future

System and network competence: We offer our customers not just components, but also complete systems that are perfectly matched, and which incorporate our expert knowledge in areas of steering systems for commercial vehicles. As part of the Industry Solutions organization, we ensure that these systems are matched to the worldwide supply of spare parts.

Steering systems for commercial vehicles

Bosch – your partner for steering systems on commercial vehicles

System supplier with comprehensive expertise

Steering systems for commercial vehicles

Bosch – your partner for steering systems on commercial vehicles

Steering systems for commercial vehicles

Bosch – your partner for steering systems on commercial vehicles

System supplier with comprehensive expertise

Steering systems for commercial vehicles

Bosch – your partner for steering systems on commercial vehicles

Steering systems for commercial vehicles

Bosch – your partner for steering systems on commercial vehicles

Steering systems for commercial vehicles

Automated driving

Power-on-demand

Bosch Mobility Solutions

Steering systems for commercial vehicles

Automated and efficient for the future
Steering systems from Robert Bosch Automotive Steering make it possible to have driver assistance systems and partly-automated driving in commercial vehicles.

**-1,600 g**

When compared with conventional dual-circuit steering systems, Servotwin® reduces the CO₂ emissions of commercial vehicles by an average of 1,600 g / 100 km.

**-0.6 l**

When compared with conventional dual-circuit steering systems, Servotwin® reduces the fuel consumption of commercial vehicles by an average of 0.6 l / 100 km.

**-0.6 l**

The rear axle steering system only consumes energy, when steering is actually taking place. When driving in a straight line, the energy consumption is virtually zero.

The rear axle steering system reduces fuel consumption by an average of 0.6 l / 100 km (depending on the usage profile).

**Benefits of electric steering systems**

- Assistance functions and partly-automated driving are possible through the linking of the steering to the on-board network
- Increases safety, efficiency and comfort
- Saves fuel and CO₂ emissions
- Speed-dependent assistance for steering
- Maintenance-free

**Connected mobility**

The linking of the steering system with other components, such as sensors, brakes, battery and the vehicle’s control unit enables innovative driver assistance systems to be implemented for increased safety and more comfort.

**Automated mobility**

Electronically controlled steering is the basic requirement for implementing automated driving. Thanks to the integration of the control unit in the on-board network, partly-automated driving functions are possible for the first time in commercial vehicles.

**Powertrain systems and electrified mobility**

Electrically assisted and electronically controlled steering systems are a key technology for electrified drivetrains. They enable fuel consumption and CO₂ emissions to be reduced significantly.

**SYSTEM BENEFITS**

- Assistance functions and partly-automated driving
- Increased safety
- Increased efficiency
- Reduced fuel consumption
- Reduced CO₂ emissions
- Reduced maintenance
- Increased comfort
- Increased economy

**POWERTRAIN SYSTEMS**

- Electric drive components
- Mechanical drive components
- Electric components
- Hybrid components
- Electric control unit for driver assistance functions
- On-board network
- Sensors
- Actuators
Steel systems

Servotwin®

PRODUCT BENEFITS

- Enables semi-automated driving
- Relieves stress on the driver
- Fuel savings
- Active steering return
- Speed-dependent steering assistance
- High damping of pavement effects
- Modular lightweight electric servounit

1. Steering spindle connection
2. Electric motor
3. Control unit
4. RB-Servocom®
5. Worm gear
6. Sensor unit
Reduced driver exertion

Thanks to lower steering forces when maneuvering and parking in conjunction with active steering return, driver exertion is reduced noticeably.

Task

The Servotwin® electrohydraulic steering system for heavy commercial vehicles is the result of the innovative combination of the RB-Servocom® recirculating ball-gear power steering system with an electronic control unit. The system offers speed-based steering assistance with active return as well as a variety of driver assistance functions. The electrical circuit replaces the previously needed second hydraulic circuit for commercial vehicles with two steered axles.

Function

Servotwin® consists essentially of two components: the time-tested RB-Servocom® ball-gear power steering system and a platform-based combination of an electric motor with control unit and worm gear. The ball-gear power steering system provides most of the steering assistance. Its design is based on the principle employed in a classic hydraulic power steering system. Here, an oil circuit and a power cylinder provide the hydraulic steering assistance for the steering wheel motions of the driver. Using an electric motor and worm gear, an additional turning moment can be applied to the input shaft of the RB-Servocom® in parallel to the steering wheel’s moment. In this way, the manual force needed for steering can be varied depending on the driving situation. The mechanical connection from the steering wheel to the steering linkage is preserved. A turning motion of the steering wheel and the applied steering moment are sensed by turning angle and torque sensors and transmitted to the electronic control unit (ECU). By taking other vehicle parameters into account – for instance, speed and load – the ECU determines the required additional steering moment and actuates the electric motor. On the basis of the specific driving situation, the electric motor assists the steering motion by adding or subtracting a steering moment and in this way electronically optimizes the process of steering. The steering feel can thus be optimized for the driver at any time through the additional, electrically generated steering moment. To protect the steering system against overload when the wheels are turned to the full-lock position, an electronic stop can be freely programmed. In addition to comfort functions and driver assistance functions (e.g. side wind compensation, lane keeping function, traffic jam assist) Servotwin also enables automated driving functions in heavy commercial vehicles by connecting the steering system with the on-board electronics.

Technical characteristics

<table>
<thead>
<tr>
<th>Model size</th>
<th>8298</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steering axle load</td>
<td>5,500 – 8,500 kg</td>
</tr>
<tr>
<td>Hydraulic torque (η = 0.9)</td>
<td>7,050 – 8,294 Nm</td>
</tr>
<tr>
<td>Electric torque</td>
<td>65 Nm</td>
</tr>
<tr>
<td>Max. oil pressure</td>
<td>185 bar</td>
</tr>
<tr>
<td>Max. oil delivery rate</td>
<td>25 dm³/min</td>
</tr>
<tr>
<td>Dry weight</td>
<td>49 kg</td>
</tr>
</tbody>
</table>

Semi-automated driving

For greater safety and more convenience

−0.6 l/100 km

Compared to conventional dual-circuit steering systems (depending on application profile)

Reduced driver exertion

−0.6 l/100 km compared to conventional dual-circuit steering systems (depending on application profile)
Steering systems

RB-Servocom®

PRODUCT BENEFITS
- Optimal steering feel and precision
- Light weight
- Compact design packaging
- High performance
- High stiffness
- Low energy consumption
- Low wear and maintenance-free

1. Steering spindle connection
2. Sector shaft
3. Housing
**TASK**
The RB-Servocom® hydraulic steering system is the compact solution for heavy commercial vehicles. The recirculating ball gear hydraulic steering principle has been developed continuously in the RB-Servocom® and as a result satisfies a wide variety of customer requirements.

**FUNCTION**
The essential characteristics of the RB-Servocom® are a rugged cast iron housing with integrated, mechanical steering gear assembly, control valve and power cylinder. A turning motion of the steering wheel is transmitted to the worm gear by the steering spindle connection and converted into an axial motion of the piston by means of a recirculating ball thread. At the same time, the sector shaft, which is perpendicular to the axis of the piston, is put into rotational motion by a gear arrangement. The drop arm attached to the sector shaft moves the steering linkage connected to the control arms, causing the wheels to turn. The oil from the steering pump flows through the supply channels to the control grooves of the rotary valve, and when the valve is in the neutral position, it flows back into the return line and oil reservoir over the open control edges. When the steering wheel is turned, the rotary valve rotates with respect to the control sleeve. This directs the oil flow into the cylinder chamber that assists the rotating motion, where it acts on the piston surface in the power cylinder and provides the desired hydraulic assistance to the axial motion of the piston. To protect the steering linkage, wheel stops, and steering pump, the RB-Servocom® is equipped with integrated hydraulic steering limiter. Just before the piston reaches its end position, the steering limit valve opens and reduces the hydraulic assistance substantially. Various special versions of the RB-Servocom® are available to meet a wide variety of customer requirements, for instance, dual-circuit designs or versions with an attached bevel box assembly.

**TECHNICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Model size</th>
<th>8090</th>
<th>8095</th>
<th>8097</th>
<th>8098</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front axle load</td>
<td>&lt;4.2*</td>
<td>&lt;6.5*</td>
<td>&lt;7.3*</td>
<td>&gt;6.0*</td>
</tr>
<tr>
<td>Transmission ratio</td>
<td>i-variable</td>
<td>i-variable</td>
<td>i-variable</td>
<td>i-variable</td>
</tr>
<tr>
<td>Pressure (bar)</td>
<td>190+10</td>
<td>170+15</td>
<td>185+15</td>
<td>185+15</td>
</tr>
<tr>
<td>Max. output torque [Nm (η=0.9)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at α = 0°</td>
<td>2,589</td>
<td>4,375</td>
<td>5,751</td>
<td>7,049</td>
</tr>
<tr>
<td>at α = 47°</td>
<td>3,059</td>
<td>5,148</td>
<td>6,794</td>
<td>8,294</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>17</td>
<td>28</td>
<td>36</td>
<td>43</td>
</tr>
</tbody>
</table>

*Values depend on various axle parameters.

---

**best power-to-weight ratio**

of all hydraulic block steering systems

**high steering precision**

The RB-Servocom® hydraulic steering system provides excellent handling and thus safe, sensitive steering of heavy commercial vehicles.
Steering systems

Rear axle steering system

PRODUCT BENEFITS
- Smaller turning circle
- Reduced tire wear
- Compact construction
- Light weight
- Fuel savings
- Increased maneuverability
- Easy installation

1. Power unit with integrated control unit
2. Steering cylinder with integrated position sensor
Power-on-demand

The electrohydraulic rear axle steering system only uses energy when steering is actually occurring.

TASK

The electrohydraulic rear axle steering system is a stand-alone power-on-demand system for steering the pusher axle or the tag axle of heavy commercial vehicles. It is the result of an innovative combination of a hydraulic cylinder unit and an electronic power unit. The system makes it possible to steer pusher and trailing axles on vehicles with three or more axles.

FUNCTION

The rear axle steering system consists essentially of two components: the cylinder unit with integrated position sensor and valve system, and the power unit, consisting of a motor-driven pump and control unit. The ever more demanding requirements faced by commercial vehicles in today’s transportation industry can only be satisfied on the rear axle through use of an innovative steering system with electronic interface. With the system, the linking of the rear axle steering to the vehicle’s electrical system is now possible. The available vehicle signals (e.g. steering angle of the front axle) on the CAN bus are transmitted to the integrated control unit (ECU). From these signals, the rear axle steering system determines the desired steering angle of the rear axle and controls the pump by means of the electric motor on the basis of the target-actual comparison. The volume-flow generated acts on the particular piston surface of the cylinder unit and moves the cylinder’s piston rod in or out, until the integrated position sensor gives the return signal, that the target position has been reached. The wheels on the axle are turned to the desired angle by coupling the cylinder unit to a control arm, which transmits the steering forces via the tie rods. With its freely programmable and plug-and-play capability, the independent and compact construction makes it possible to steer several axles on a vehicle through use of several rear axle steering systems.

To protect the steering system against overloading when the wheels are turned to the full-lock position, an electronic stop can be programmed. The control unit then decreases the flow from the pump as soon as the programmed end stop is reached so that the mechanical stops are not damaged.

TECHNICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston rod force</td>
<td>41/52 kN (retract/extend)</td>
</tr>
<tr>
<td>Max. pressure</td>
<td>185 bar</td>
</tr>
<tr>
<td>Installed length</td>
<td>1,000 mm +/- 95 mm</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-32°C to +80°C</td>
</tr>
<tr>
<td>Surface treatment</td>
<td>DIN EN ISO 9227–480 h</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Weight</td>
<td>24 kg</td>
</tr>
</tbody>
</table>

21 W

are required, on average, for operation of the rear axle steering system.

-0.6 l/100 km

lower fuel consumption – compared to conventional electrohydraulic rear axle steering systems.

TASK

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<td>Operating voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Weight</td>
<td>24 kg</td>
</tr>
</tbody>
</table>
Steering systems

Electrohydraulic power steering pump (EHPS)

PRODUCT BENEFITS

- Full functionality independent of internal combustion engine
- Fail-operational functionality due to redundant power pack
- Significantly reduced power consumption due to power on demand
- No need for high voltage protection (24 volts)
- Reduced system temperature

1. Power electronics with ports for energy and data
2. Electric motor
3. Pump with suction port and pressure port
**Power on demand**

Energy intake varies according to the driving situation

**TECHNICAL CHARACTERISTICS**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement volume [l/min]</td>
<td>4 to 18</td>
</tr>
<tr>
<td>Max. pressure [bar]</td>
<td>185</td>
</tr>
<tr>
<td>Suction port thread</td>
<td>1 1/16&quot; – 12UN 2B M26 × 1.5</td>
</tr>
<tr>
<td>Pressure port thread</td>
<td>3/4&quot; – 16UNF 2B M18 × 1.5</td>
</tr>
<tr>
<td>Operating temperature [°C]</td>
<td>~40 to +100</td>
</tr>
<tr>
<td>Rated current (max. current consumption) [A]</td>
<td>150 (184)</td>
</tr>
<tr>
<td>Rated voltage (voltage range) [V]</td>
<td>24 (16 to 32)</td>
</tr>
<tr>
<td>Electrical rated output (max. power consumption) [W]</td>
<td>1800 (2200)</td>
</tr>
<tr>
<td>E-motor type</td>
<td>2 × BLDC</td>
</tr>
<tr>
<td>Power electronics</td>
<td>integrated</td>
</tr>
<tr>
<td>Sensors for positioning (per motor)</td>
<td>1 × AMR 1 × hall sensor</td>
</tr>
<tr>
<td>Communication</td>
<td>CAN bus</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>11.5</td>
</tr>
</tbody>
</table>

**TASK**
The electrohydraulic power steering pump provides the demand-oriented amount of oil and pressure that is needed to operate the hydraulic steering systems of commercial vehicles at any given time.

**FUNCTION**
The EHPS consists of two electric motors, each equipped with an electronic control unit, a vane pump and an optional customer-specific mounting bracket. The integrated power electronics controls the speed of the motors synchronously in accordance with the requirements of the steering maneuver (setpoint setting). The motors rotate in opposite directions here. The motors are permanently excited brushless direct current motors (BLDC motors) – consisting of a housing, a stator and a rotor.
The vane pump is driven simultaneously by both motors via a common shaft. The speed of the motors and pump is identical. The volumetric oil flow generated by the pump is directly proportional to the speed and displacement volume of the pump. The vane pump essentially consists of the housing, cover, front plate, shaft and rotor set. The rotor set consists of the rotor, radially directed vanes in the rotor and the cam ring. The pump is designed as a dual-circuit pump.

**VARIANTS**
The electrohydraulic power steering pump EHPS with two power packs is designed for use in medium-duty and heavy-duty commercial vehicles and busses. An EHPS with just one power pack may be suitable for use in light commercial vehicles.

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**Energy saving compared to conventional power steering pump with constant displacement volume**

up to

**70 %**

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1. Suction port
2. Housing
3. Rotor with vanes
4. Shaft
5. Cam ring
6. Pressure connection
Steering systems

e-Varioserv® power steering pump

PRODUCT BENEFITS
- Demand-based volumetric flow control
- Power consumption reduced even further than that of the Varioserv® power steering pump
- Lower operating temperature in the steering system
- Reduced fuel consumption compared to a conventional as well as a Varioserv® power steering pump
- Lower CO₂ emissions
- The same flange pattern as conventional and Varioserv® power steering pumps

1. Electronically controlled orifice (ECO)
2. Pressure port
3. Housing with integrated flange
4. Driveshaft
5. Suction port
The e-Varioserv® power steering pump provides the amount of oil needed at any time for operation of hydraulic steering systems in commercial vehicles. The pump is designed primarily for connection to the air compressor or a power take-off on an engine. The shaft connects by means of a cross-slotted disk or splines.

**FUNCTION**

The e-Varioserv® power steering pump consists essentially of the housing with integrated control valve, cover, front plate, shaft, rotor set, and an ECO (electronically controlled orifice). Depending on the vehicle-specific requirements, the ECO permits a further demand-based reduction of the volumetric flow compared to that of a Varioserv® pump. The rotor set consists of the rotor, eleven radial vanes installed in the rotor, the cam ring and the outer ring. The cam ring in the e-Varioserv® is positioned eccentrically and hydraulically adjustable. Until a fixed control point is reached, the e-Varioserv® operates like a conventional power steering pump. Once this control point is reached, the geometric delivery volume is decreased by repositioning the cam ring to provide the defined flow. The ECO provides a further reduction of the specified flow. Control of the ECO is based on vehicle-specific requirements. The lower flow compared to that of a Varioserv® power steering pump translates into reduced power consumption and, in turn, a lower system temperature.

**VARIANTS**

Gear or pulley drive. A pressure of up to 200 bar is available if necessary. The e-Varioserv® can be combined in tandem with other pump types (e.g. fuel pre-supply pumps).

**TECHNICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Theor. displacement volume (cm³/rev)</th>
<th>Max. rotational speed (rpm)</th>
<th>Max. pressure (bar)</th>
<th>Controlled volumetric flow (l/min)</th>
<th>Suction port thread</th>
<th>Pressure port thread</th>
<th>Drive direction of rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7654</td>
<td>22</td>
<td>5,000</td>
<td>185</td>
<td>5/25</td>
<td>1 1/16” – 12UN 2B</td>
<td>3/4” – 16UNF 2B</td>
<td>clockwise or counterclockwise</td>
</tr>
<tr>
<td>7655</td>
<td>25</td>
<td>5,000</td>
<td>185</td>
<td>5/25</td>
<td>M26 x 1.5</td>
<td>M18 x 1.5</td>
<td></td>
</tr>
<tr>
<td>7656</td>
<td>28</td>
<td>5,000</td>
<td>185</td>
<td>5/25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7657</td>
<td>34</td>
<td>5,000</td>
<td>185</td>
<td>5/25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TASK**

The e-Varioserv® power steering pump helps to regulate the amount of oil used at any time for operation of hydraulic steering systems in commercial vehicles. It is designed to connect with an air compressor or power take-off on an engine. The connecting shaft can be equipped with a cross-slotted disk or splines.

**FUNCTION**

The e-Varioserv® power steering pump consists of the housing, an integrated control valve, a cover, a front plate, a shaft, a rotor set, and an ECO (electronically controlled orifice). Based on vehicle-specific requirements, the ECO enables a further demand-driven reduction of the volumetric flow compared to that of a Varioserv® pump. The rotor set consists of the rotor, eleven radial vanes installed in the rotor, the cam ring, and the outer ring. The cam ring in the e-Varioserv® is positioned eccentrically and hydraulically adjustable. Until a fixed control point is reached, the e-Varioserv® functions like a conventional power steering pump. Once this control point is reached, the geometric delivery volume is reduced by repositioning the cam ring to provide the defined flow. The ECO offers an additional reduction of the specified flow. Control of the ECO is based on vehicle-specific requirements. The resulting lower flow compared to a Varioserv® power steering pump translates into reduced power consumption and, consequently, a lower system temperature.

**VARIANTS**

Gear or pulley drive. A pressure of up to 200 bar is available if necessary. The e-Varioserv® can be integrated with other pump types (e.g., fuel pre-supply pumps).

**TECHNICAL CHARACTERISTICS**

- **Model**: 7654 7655 7656 7657
- **Theor. displacement volume (cm³/rev)**: 22 25 28 34
- **Max. rotational speed (rpm)**: 5,000 5,000 5,000 5,000
- **Max. pressure (bar)**: 185 185 185 185
- **Controlled volumetric flow (l/min)**: 5/25 5/25 5/25 5/25
- **Suction port thread**: 1 1/16” – 12UN 2B M26 x 1.5
- **Pressure port thread**: 3/4” – 16UNF 2B M18 x 1.5
- **Drive direction of rotation**: clockwise or counterclockwise

**ECCENTRICAL AND CONCENTRICAL BEARINGS OF CAM RINGS**

- **Eccentrical bearing of cam ring for maximum delivery capacity**
- **Concentrical bearing of cam ring for minimum delivery capacity**

**ADVANTAGES**

- **15 °C lower temperature in the steering system**, which means less cooling required and improved system efficiency
- **65% lower fuel consumption and CO₂ emissions compared to a conventional power steering pump** (depending on vehicle type, up to 0.31/100 km or 7.8 g CO₂/100 km)
Steering systems

Varioserv® power steering pump

PRODUCT BENEFITS
- Reduced power consumption compared to a conventional power steering pump
- Reduced fuel consumption compared to a conventional power steering pump and lower CO₂ emissions
- Lower operating temperature in the steering system
- Same flange pattern as a conventional power steering pump
- Tandem-capable power steering pump

1 Control valve
2 Housing with integrated flange
3 Pressure port
4 Suction port
5 Driveshaft
The Varioserv® power steering pump provides the amount of oil needed at any time for operation of hydraulic steering systems in commercial vehicles. The pump is designed primarily for connection to the air compressor or a power take-off on an engine. The shaft connects by means of a cross-slotted disk or splines.

**FUNCTION**

The Varioserv® power steering pump consists essentially of the housing with integrated control valve, cover, front plate, shaft and rotor set. The rotor set consists of the rotor, eleven radial vanes installed in the rotor, the cam ring and the outer ring. The cam ring in the Varioserv® is positioned eccentrically and hydraulically adjustable. Until a fixed control point is reached, the Varioserv® operates like a conventional power steering pump. Once this control point is reached, the geometric delivery volume is decreased by repositioning the cam ring to provide the defined flow. The fixed flow is controlled on the basis of the engine rpm and pressure requirement. The lower flow compared to that of a conventional power steering pump translates into reduced power consumption and, in turn, a lower system temperature. The maximum system pressure must be limited by a pressure-limiting valve installed on the pump or in the system.

**VARIANTS**

Gear or pulley drive. A pressure of up to 200 bar is available if necessary. The Varioserv® can be combined in tandem with other pump types (e.g. fuel pre-supply pumps).

**TECHNICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Model</th>
<th>7654</th>
<th>7655</th>
<th>7656</th>
<th>7657</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theor. displacement volume (cm³/rev)</td>
<td>22</td>
<td>25</td>
<td>28</td>
<td>34</td>
</tr>
<tr>
<td>Max. rotational speed (rpm)</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Max. pressure (bar)</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>185</td>
</tr>
<tr>
<td>Controlled volumetric flow (l/min)</td>
<td>16/25</td>
<td>16/25</td>
<td>16/25</td>
<td>16/25</td>
</tr>
<tr>
<td>Suction port thread</td>
<td>1 1/16”-12UN 2B M26 × 1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure port thread</td>
<td>3/4”-16UNF 2B M18 × 1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drive direction of rotation</td>
<td>clockwise or counterclockwise</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Steering systems

Power steering pump FN4

PRODUCT BENEFITS
- Compact construction
- High efficiency with low weight
- High component flexibility through modular system concept
- Integrated volume flow control
- Optionally with integrated pressure limiting

1. Casing with integrated flange
2. Pressure connection
3. Suction connection
4. Shaft
rugged
design
The proven design ensures a reliable supply of oil to the steering system.

TASK
The power steering pump FN4 provides the amount of oil needed for operation of hydraulic steering systems in commercial vehicles at all times. The pump is designed primarily for connection to the compressed-air compressor or the power take-off on an engine. The shaft connects by means of a cross-slotted disk or splines. The pump can be driven by either a gear or belt. For these cases, an anti-friction bearing is used for the driveshaft. The ball bearing needed for the above instances can be incorporated into the housing. In addition, an oil reservoir can be mounted directly to the pump. This eliminates the hose and assembly costs at the vehicle manufacturer.

FUNCTION
The power steering pump FN4 consists essentially of housing with integrated volume flow control, cover, faceplate, shaft and rotor set. The rotor set consists of the rotor, ten radial vanes installed in the rotor, and the cam ring. The cam ring has two symmetrically positioned suction and pressure zones. The design of the cam ring defines the fixed geometric delivery volume of the pump. The integrated volume flow control limits the volumetric flow delivered to a fixed value. The maximum system pressure must be limited by a pressure-limiting valve installed on the pump or in the system. If required by the steering system design, a pressure level of up to 200 bar is available as a special version.

TECHNICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Model</th>
<th>7683</th>
<th>7684</th>
<th>7685</th>
<th>7686</th>
<th>7687</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery volume (cm³/U)</td>
<td>14</td>
<td>17</td>
<td>21</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>Max. rotational speed (rpm)</td>
<td>4,500</td>
<td>4,500</td>
<td>4,000</td>
<td>4,000</td>
<td>3,500</td>
</tr>
<tr>
<td>Max. pressure (bar)</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>165</td>
</tr>
<tr>
<td>Controlled volumetric flow (l/min)</td>
<td>9 – 16</td>
<td>12 – 16</td>
<td>12 – 25</td>
<td>16 – 25</td>
<td>16 – 25</td>
</tr>
<tr>
<td>Suction connection</td>
<td>1 1/16” – 12UN 2B</td>
<td>M26 x 1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure connection</td>
<td>3/4” – 16UNF 2B</td>
<td>M18 x 1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. oil temperature (°C)</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>2.3 – 2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drive direction of rotation</td>
<td>clockwise or counterclockwise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rugged design
The proven design ensures a reliable supply of oil to the steering system.

High power density
with low weight

Casing with integrated flange
Shaft
Pressure connection
Suction connection
Steering systems

Steering column

PRODUCT BENEFITS
- High transversal stiffness
- Low turning torque
- Minimal displacement forces
- High clamping force
- Minimal rotational nonuniformity through optimal placement of universal joints and pivot points
- Integration of clamping device, steering column switch, contact unit, and steering angle sensor

1. Upper steering spindle housing
2. Steering wheel connection
3. Support, including fastening means
continuously adjustable

For an ergonomic driving position, the steering column is continuously adjustable in terms of height and angle.

lower weight

through use of lightweight components made of magnesium and plastic

TASK
Steering columns hold the steering wheel, switches, etc. and provide the connection between the steering wheel, the steering shaft, and the steering gear. They are used on medium and heavy commercial vehicles and buses. The steering column, which provides continuously adjustable positioning of the steering wheel in terms of height and angle, offers particular benefits along with additional convenience functions.

FUNCTION
A modular system ensures maximum variability. The support is manufactured from a lightweight alloy or steel as required by the individual application. A gas spring or cylindrical compression spring integrated into the ball-joint shaft balances the weight distribution between the steering unit and the steering wheel, steering column, switch and, possibly, instrument panel during the adjustment procedure. It is also possible to place the gas spring between the support and board wall.

TECHNICAL CHARACTERISTICS*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>–40 °C to +80 °C</td>
</tr>
<tr>
<td>Turning torque</td>
<td>&lt; 0.3 Nm</td>
</tr>
<tr>
<td>Displacement force</td>
<td>Extension: ≤ 200 N</td>
</tr>
<tr>
<td></td>
<td>Retraction: ≤ 60 N</td>
</tr>
<tr>
<td>Min. pressure for clamping cylinder</td>
<td>7.8 bar</td>
</tr>
<tr>
<td>Height adjustment</td>
<td>82 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>6.1 kg</td>
</tr>
<tr>
<td>Swivel angle</td>
<td>21° (10°/11°)</td>
</tr>
<tr>
<td>Center position to vertical</td>
<td>30°</td>
</tr>
<tr>
<td>Stalling torque</td>
<td>≤ 10 Nm</td>
</tr>
</tbody>
</table>

*Depends on customer specifications; enhanced specifications possible depending on customer requirements
Steering systems

Steering shaft

PRODUCT BENEFITS
- Precision ball guide
- High torsional stiffness
- Compact universal joints
- Low displacement forces
- Galvanic corrosion protection, Cr VI-free
- Modular system

1 Universal joint
2 Outer tube
**TASK**
Steering shafts are the connection between the steering gear and steering column, and are used on medium and heavy commercial vehicles and buses. The ball-guide principle used is continuously undergoing further development to meet the requirements of our customers for minimal play and maximum service life.

**FUNCTION**
The major components of the Bosch steering shaft are an outer tube with ball-guide grooves inside and a profiled shaft with outer ball-guide grooves. Two axially positioned rows of balls provide a noise-free connection. This design guarantees zero-play radially, but easy axial repositioning with a usable travel of +/–28 mm. The overall length of the low-wear and maintenance-free component can be matched to vehicle requirements. Incorporation of a cylindrical compression spring further provides a comfortable weight compensation in conjunction with an adjustable steering column.

**VARIANTS**
The steering shaft is available in different tube lengths and angular joint positions.

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### TECHNICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed length</td>
<td>min. 281 mm (retracted)</td>
</tr>
<tr>
<td></td>
<td>max. 3,915 mm (extended)</td>
</tr>
<tr>
<td>Bending angle</td>
<td>max. 35°</td>
</tr>
<tr>
<td>Enveloping circle diameter</td>
<td>tube 38.6 mm</td>
</tr>
<tr>
<td></td>
<td>joint 66 mm</td>
</tr>
<tr>
<td>Displacement force</td>
<td>max. rolling friction 20 N</td>
</tr>
<tr>
<td></td>
<td>max. sliding friction 60 N</td>
</tr>
</tbody>
</table>

---

**up to**

**35°**
maximum bending angle for comfortable and safe steering

lower weight than conventional steering shafts

**1.2 kg**

---

1. Adjustable steering column
2. Steering shaft
3. RB-Servocom® steering gear
4. Bevel box
Steering systems

Bevel box

PRODUCT BENEFITS

- Low weight
- Low wear
- Maintenance-free due to continuous lubrication

1. Drive shaft/driven shaft
2. Light-metal housing
2,000,000 km lifetime

The Bosch bevel box offers a high level of reliability thanks to its robust design – tried and tested many times in all markets and for all applications.

TASK
Bevel boxes for commercial vehicles are used, when direct linkage by means of a ball-track telescopic shaft is not possible due to the arrangement of the steering gears in relation to the steering column. Bosch bevel boxes are available in several designs, which are adapted to the familiar installation positions. They can be flanged directly onto the RB-Servocom® or installed separately in the vehicle. The usual standard is a shaft angle of 90°.

FUNCTION
The bevel box consists essentially of a drive or drive shaft including the bevel gearing, the appropriate bearing and the housing. The drives or drive shafts have roller bearings. Generally both shafts carry a straight-toothed bevel gears with the same number of teeth, and these give a 1:1 transmission. The oil filling provides continuous lubrication, and this has a particularly beneficial effect on the noise level and wear performance. The robust light-metal housing contributes to weight reduction. A wide range of special designs up to 120° shaft angle is also available to meet the requirements of customers.

TECHNICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Transmission</th>
<th>1:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>−40 °C to +80 °C</td>
</tr>
<tr>
<td>Static breaking torque</td>
<td>&gt; 500 Nm</td>
</tr>
<tr>
<td>Weight</td>
<td>2.2 kg</td>
</tr>
</tbody>
</table>

The Bosch bevel box offers a high level of reliability thanks to its robust design – tried and tested many times in all markets and for all applications.

due to precision gearing and low friction torque
As the market leader worldwide, Robert Bosch Automotive Steering offers a comprehensive range, which includes all the principal components between the steering wheel and the wheels (wheel-to-wheel) as well as making sure that drivers can work ergonomically and comfortably on long trips. As a partner of individual companies and commercial vehicle manufacturers for many decades, we have ensured that our steering systems, components, and services are the perfect match for commercial vehicles, among them a high-performance steering system which incorporates our expert knowledge in all areas of steering systems for commercial vehicles. As part of the mobility solutions business unit of Robert Bosch, we provide steering systems with the entire spectrum of vehicle systems, such as control and assistance, to the benefit of our customers.

COMPREHENSIVE RANGE FOR THE IDEAL STEERING FEEL

As the world’s leading manufacturer of steering systems, Robert Bosch Automotive Steering offers a comprehensive range of wheel-to-wheel components and services. Our products are in daily use on endless highways, in urban rush hours and on tracks far removed from everyday life. In millions of times over, our electrohydraulic steering system is the innovative key technology in implementing automated driving functions in commercial vehicles.

STRENGTH OF INNOVATION PLUS KNOW-HOW

As the market leader worldwide, Robert Bosch Automotive Steering offers a comprehensive range, which includes all the principal components between the steering wheel and the wheels (wheel-to-wheel) as well as making sure that drivers can work ergonomically and comfortably on long trips. As a partner of individual companies and commercial vehicle manufacturers for many decades, we have ensured that our steering systems, components, and services are the perfect match for commercial vehicles, among them a high-performance steering system which incorporates our expert knowledge in all areas of steering systems for commercial vehicles. As part of the mobility solutions business unit of Robert Bosch, we provide steering systems with the entire spectrum of vehicle systems, such as control and assistance, to the benefit of our customers.

ACHIEVING MORE WITH LESS

Our innovative products contribute in many ways to the increased level of customer satisfaction. To achieve this goal, our new product range is the result of a weight reduction (power-on-demand principle) through its components and optimized design, and is also reflected in the number of components required.

ROADMAP

Bosch – your partner for steering systems on commercial vehicles

HOLD THE LANE OVER THE LONG HAUL AND FULL TOGETHER AS ONE

Long-term partnerships with the automotive industry manufacturers of steering systems, power steering pumps and components for commercial vehicles. Robert Bosch Automotive Steering is an experienced and capable partner to the automotive industry. Our customers appreciate us, because we are trustworthy, reliable and innovative. We not only synthesise know-how in the development and production of steering systems, but also in the entire life cycle of the vehicle – from the joint development project to the worldwide supply of spare parts.

RELIABLE AND ROBUST

Ensuring quality and reliability. Manufacturing throughout the world: 14,500 people worldwide. Our teams are located in Europe, Asia, and Latin America. Combined, our teams have more than 100 years of experience in the steering sector. They have proved their quality and robustness solutions all over the world.

Bosch Mobility Solutions

Steering systems for commercial vehicles

Automated and efficient for the future

System supplier with comprehensive expertise

We offer our customers not just components, but also complete systems that are perfectly matched, and which incorporate our expert knowledge in all areas of steering systems for commercial vehicles. As part of the mobility solutions business unit at Robert Bosch, we provide steering systems with the entire spectrum of vehicle systems, such as control and assistance, to the benefit of our customers.

Perfect steering feel is our core expertise

Combination portfolio...