

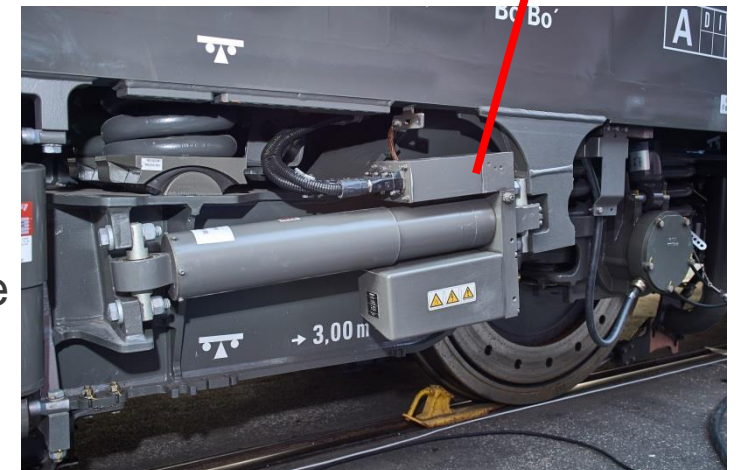
Bogie Steering Device (BSD)

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**LIEBHERR**

# Bogie Steering Device (BSD)

- MOTIVATION
  - Reduce lateral forces (track vs. wheel) and reduce tread / flange wear
  - Increased traction performance
- CONFIGURATION
  - Substitution of original inter-car damper
  - 4x compact actuator + BK4 Controller
  - Two functions : 1) Actuator = in active mode 2) Damper = in passive mode
- STATUS
  - 2006 start of development
  - 2007: first test on locomotive / freight-engine
  - 2015: 4 Locomotives Type BR189 of ÖBB in passenger service since
  - 2017: BSD-Systems for the Vectron Locomotive Platform
  - 2019: BSD-Systems for Prima H4



# Bogie Steering Device (BSD)

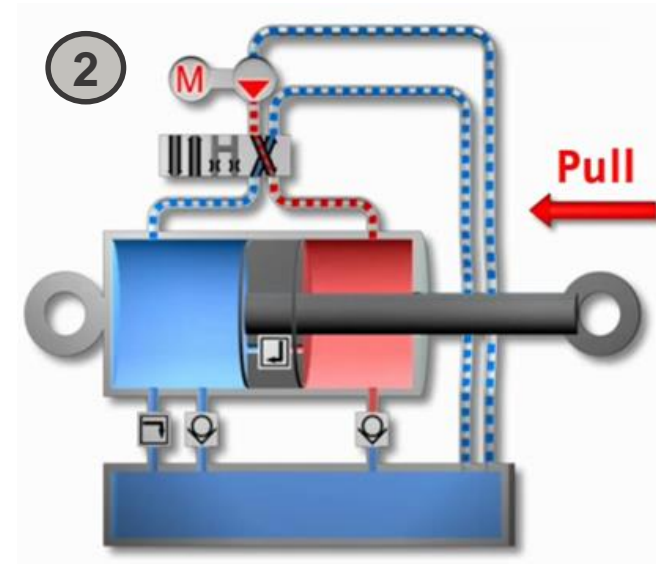
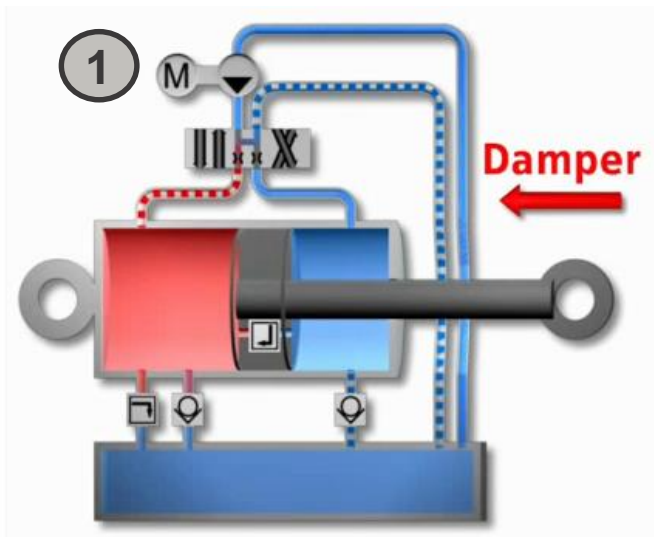
## Configuration of the BSD Actuator:

- Closed hydraulic system
  - Actuator
  - Oil Tank
  - Motor
  - Pump
  - Valves
  - Sensors
- Two functions
  - Actuator in active mode
  - Damper in passive mode (or forceless if required)



# Function of Bogie Steering Device (BSD) - I

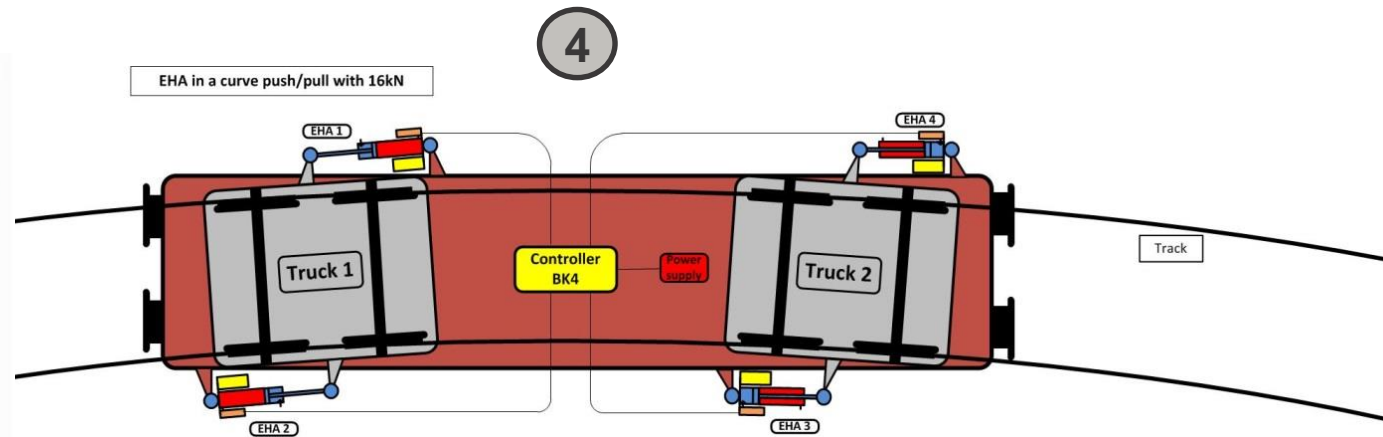
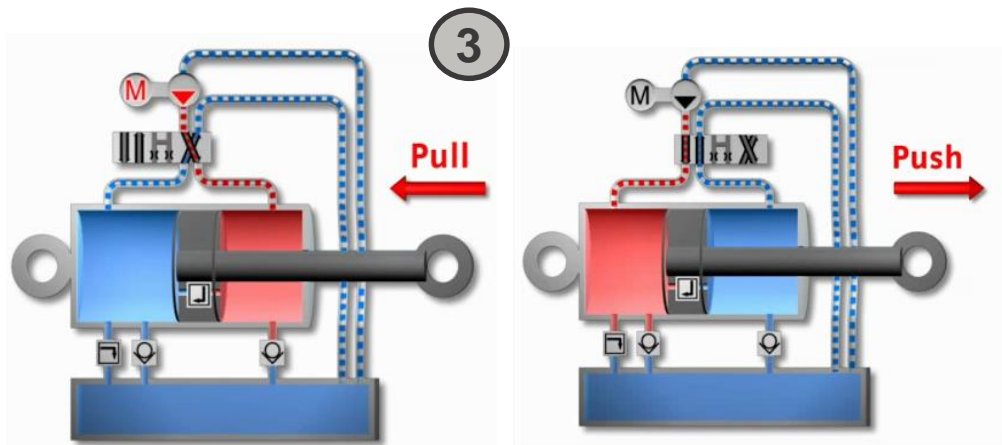
- Each BSD has a double-acting cylinder hydraulically connected to a 4/3-way valve.
- On track that is straight or slightly curved, this valve in its center position achieves the characteristic of a conventional rotational damper (picture 01).
- Its function as an active actuator takes effect in tight curves as of a preset curve radius (picture 02).



[Link to Video](#)

## Function of Bogie Steering Device (BSD) - II

- In the case of smaller curve radii, individual changes in the length of the BSD inform a central electronic control unit as to whether a tight curve angles to the left or right.
- The control unit then sets the 4/3-way valve to the corresponding end position and causes an electrically operated gear pump to apply high-pressure oil to the surface of either the piston. The BSD generates a compressive force (picture 3; Pull or Push).



- The force couple arising between the locomotive body and the bogie increases the rotating motion of the leading bogie and reduces that of the trailing bogie, thereby reducing the guiding forces in curves and increases the traction (picture 4).



# Feature -BSD

## Easy Retrofit:

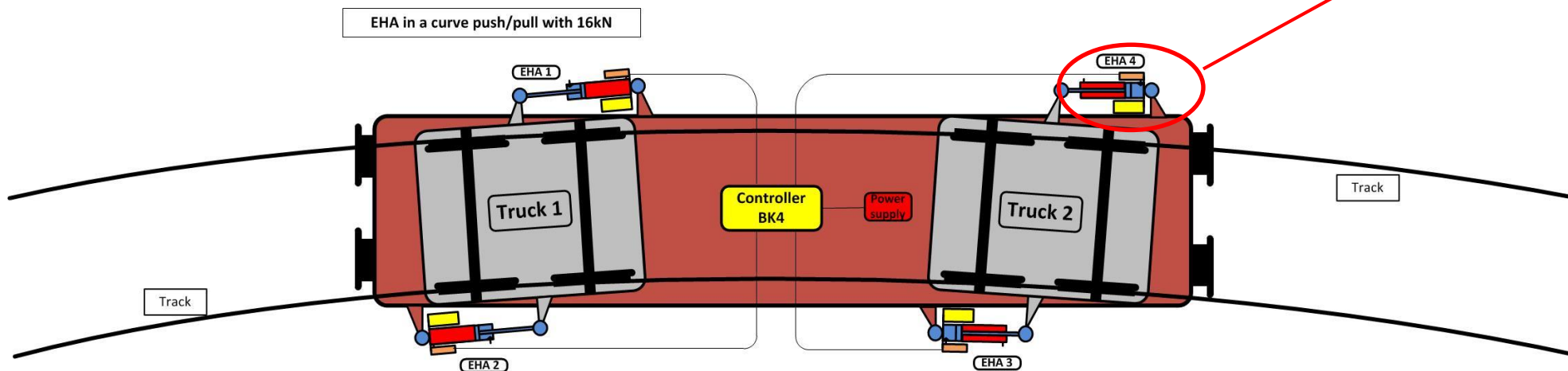
- The BSD-Actuator is a fully closed, maintenance-free hydraulic system with a cylinder, control valve, valve block, hydraulic valves, position sensor, electromotor, pump, and oil reservoir.
- It is mounted on the existing damper brackets and connected to the car body using only pluggable electrical cables for the pump drive, valve control, and sensors.
- The retrofitted BSD component replaces the conventional rotational damper (two per bogie = "four per" locomotive)



# Bogie Steering Device (BSD)

Configuration of a BSD actuator on the car:

- 4 actuators per Locomotive
- 1 BK4 Controller in the Lokomotive
- Maintenance free until the first overhaul
- Easy retrofit: Exchange the standard damper to the BSD-Actuator
- Works as a standard yaw damper on straight track



# Bogie Steering Device (BSD)

## General Technical Data :

- Force: 15kN (changeable)
- Stroke: ~ -/+ 120 mm (scalable)
- Weight: ~ 55kg
- Stroke Speed: 14mm/s

## Electrical Data:

- Voltage BK4 controller: 24V
- Electrical Motor: 440V-AC/60Hz; 400V-AC/50Hz
- E. consumption per Loc: 2kW in active mode (peak)
- E. consumption per Loc average: ~400W (dependent on active time of the actuators)





# Advantages of Bogie Steering Device (BSD)

## BSD Advantages:

- Reduction of lateral forces
- Track increase in curve
- No maintenance until the first overhaul (typically 8 years)
- Autonomous, totally closed hydraulic system (no hydraulic handling activities for the customer)
- Decrease of track fee if applicable (~7% in Swiss)
- Simple installation (component replaces the conventional rotational damper)
- Simple failsafe concept with the fallback solution of a conventional yaw damper (or forceless mode if no yaw damper is required)

# Test at ÖBB: Bogie Steering Device (BSD/ADD)

## Test status of ÖBB test - August 2016

- 4 locomotives, class 1116, retrofitted with BSD since January 2015
- Replacement of yaw dampers by BSD actuators
- Active impact of the displacement angle of bogie and car body
- Reduction of lateral forces up to 20%
- Increase of traction up to 20kN
- **November 2016: Contract for more than 200 Vectron locomotives with BSD—delivery start was August 2017!**




# References: Bogie Steering Device (BSD/ADD)

- 4 locomotives, class BR189, retrofitted with BSD – 2015
- 200 Vectron locomotives with BSD—delivery of 50 Loc sets in Service since 2017!
- 40 Prima H4 Locomotives for SBB – delivery start by end of 2019





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