

# ***Eberspächer high-pressure hydraulics***

## ***Incremental launching equipment***



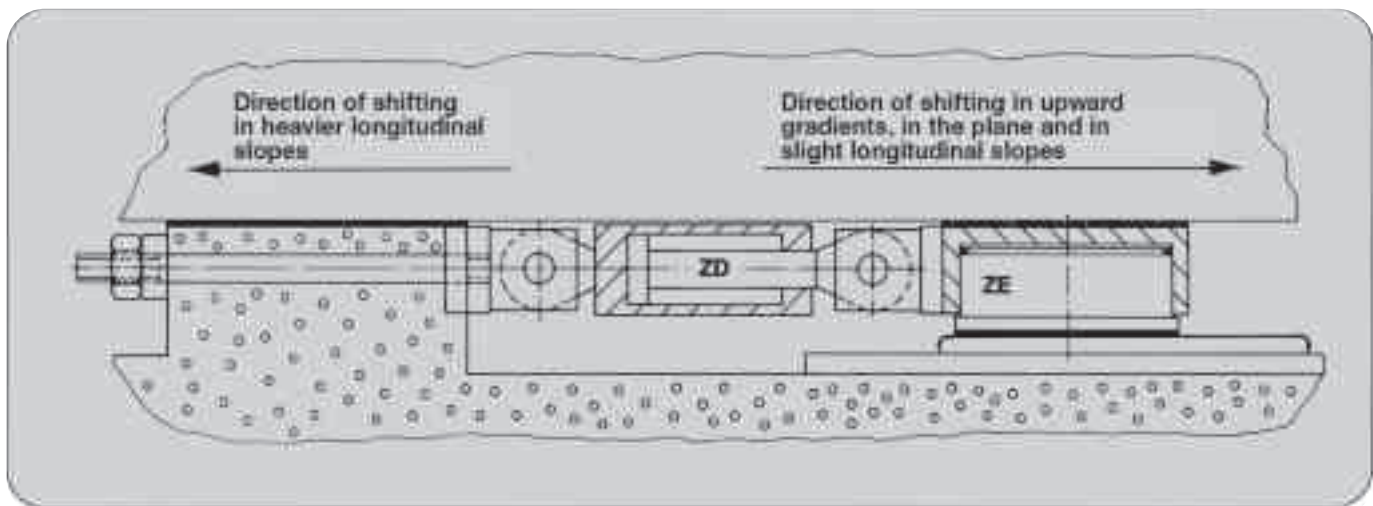
Lifting force  
up to 2600 t



Shifting force  
up to 12610 kN

Up to now applied for: Bridge length up to 2000 m  
Total weight of superstructure up to 42500 t  
Pier height up to 90 m

# Principle of operation



The lifting jack (ZE) has hardened, checkered steel plates on its top which permit a horizontal force (H) of  $H = 0.5 V$  to be applied in transverse direction to a contact force (V). (Experiments conducted at Stuttgart University have shown that breaking away only occurs at  $H = 0.7 V$ ).

The bottom of the lifting jack is provided with Teflon sheets which serve as a sliding support. The whole jack slides on a polished stainless-steel surface. (Note: The same material combination – Teflon/polished stainless steel – is also used on the individual piers during the sliding operation. The existing coefficient of friction is assumed to be  $\mu = 0.04$ ).

Brackets to accommodate the jack are bolted to the side of the lifting jack from which two shifting jacks are suspended from universal joints movable to all sides. The two or three shifting jacks are supported on a rear wall (abutment) through universal joints and jack brackets. The fixing of the jack brackets is tension and pressure-resistant.

For installation of the bridge shifting system, an opening must be available as specified in the installation drawing. The sliding stainless steel surface must be embedded in concrete as plane-parallel to the superstructure bottom as possible. It can be expected that the friction between concrete bed and surface is greater than between Teflon and stainless steel.

Along the shifting axis, steel tubes are concreted into the abutment as permanent formwork. Shifting operation: With the shifting jack retracted, the lifting jack is moved out to the required lifting force or by the required travel by operating the hydraulic control.

The lifting force, which is controlled by a pressure-relief valve, is indicated on a pressure gauge. The travel of the lifting jack can be limited by an electro-hydraulic travel stopping device. The shifting jacks will then be moved out with the lifting jack applied. After the travel has been completed, the lifting jack will be lowered and the shifting jacks will be retracted again.

Installation position:

Two installation positions are possible.

1. For upward gradients, in the plane and for slight longitudinal slopes:

In these cases, the lifting jack is installed in front of the shifting jacks, as seen in direction of shifting. Shifting forces must also be expected, if longitudinal slopes are slight. In this installation position, braking at half capacity is possible in addition.

2. For heavier longitudinal slopes:

In this case, the lifting jack is installed behind the shifting jacks, as seen in direction of shifting. These can then be used for braking at full piston area capacity and, under positive shifting forces, they act as pulling jacks of half piston area.

A brake valve is required for the braking function of the jacks. A brake saddle may be required for supporting the superstructure with the lifting jack lowered.

The control circuit for stopping the pump can be run on all piers by using an extension cable of suitable length, so that it will be possible to immediately stop the system from any point in case of emergency.

# Design

Required shifting force  $F \text{ (kN)} = G \text{ (t)} \cdot (0,04 \text{ }^{+ \text{upward gradient}} \text{ }_{- \text{downward gradient}}) \cdot 10$

Example:

Box-section type bridge  $A = 8,2 \text{ m}^2$ ;  $L = 380 \text{ m}$ ;  $\text{weight/m}^3 = 2,5 \text{ t}$ ;  $\text{downward gradient} = 1,7\%$

$$F = 8,2 \cdot 380 \cdot 2,5 (0,04 - 0,017) \cdot 10 = 1791 \text{ kN}$$

Load required to generate friction  $G1 = \frac{F}{5} = \frac{1791}{5} = 358 \text{ t}$

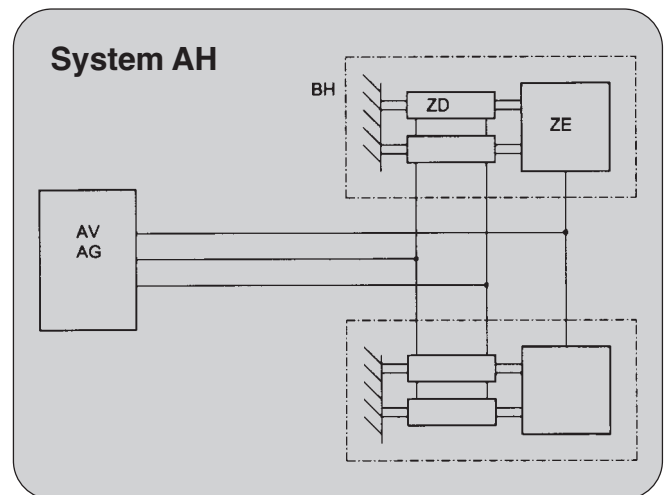
(The lifting force must be sufficient to lift the superstructure from the bearing block. This force can be calculated from the static data.)

# Selection

The standard systems AH 124, AH 123 and AH 317 listed below will be sufficient for all common bridge structures. We also design and supply special systems for greater lifting and shifting forces and multiple systems for parallel operation. Under conditions with insufficient bridge loads, additional pull rods and pulling jacks may be used. We would be pleased to advise you in all questions.

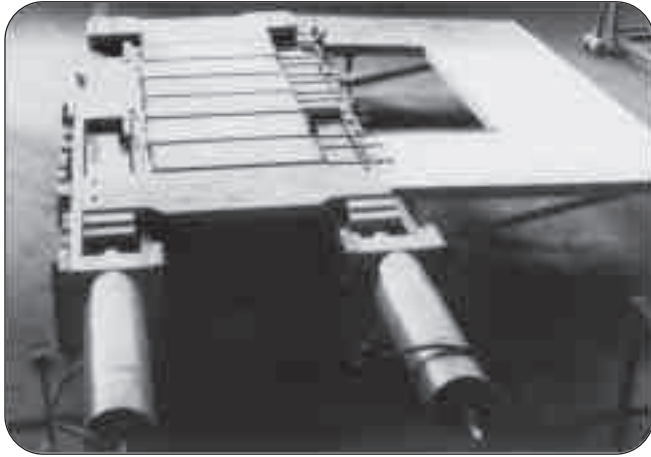
Note:

A complete system includes two lifting/shifting elements, a hydraulic drive unit with hydraulic control and a set of hoses.



System				Lifting/Shifting element			Hydraulic power pack					
AH	Lifting load t	Shifting force kN	Breaking force kN	BH	Lifting load t	Shifting force kN	AV	AG	Q l/min	p bar	v* m/h	P kW
124	1000	4060	2100	16	500	2 x 1015	140	123	32	400	10	22
123	1570	6080	2860	15	785	2 x 1520	135	123	40	400	9	30
557	1570	9120	4290	147	785	3 x 1520	320	123	48	400	7	37
317	2200	9120	4290	89	1100	3 x 1520	320	123	48	400	7	37
558	2200	12160	5720	148	1100	4 x 1520	439	240	64	400	7	45
190	2600	9120	4290	57	1300	3 x 1520	320	123	48	400	7	37
559	2600	12160	5720	149	1300	4 x 1520	439	240	64	400	7	45

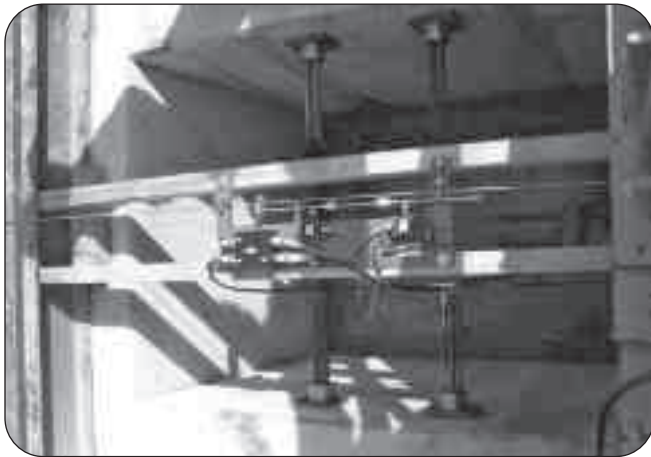
\* The built-in rapid-motion circuit permits double speed at half shifting force.



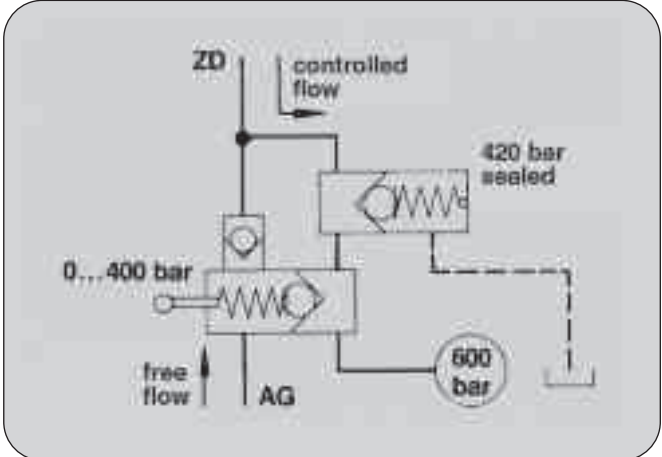
**Pier shifter**  
for high, slender piers.



**Hydraulic flat jack**  
for working on piers.



**Pier deflection control**



**Brake valve VN 3.2**  
stepless adjustment and reading the brake condition during shifting in downward gradients.



**Hydraulic jack**  
with adjustable locking ring.



**Launching-nose lifting unit**  
hydraulic lifting unit bolted to nose.



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