

$$F_H = F_s \times \mu \times 2 \times \eta \text{ [N]}$$

$$M_H = i \times \frac{F_H \times D}{2} \text{ [Nm]}$$

$$D = D_H - b \text{ [m]}$$

F_s spring force [N]

μ coefficient of friction – 0,39

D theoretical braking diameter [m]

F_H braking force [N]

η system efficiency – 0,85÷0,95

D_H brake disc diameter [m]

M_H braking torque [Nm]

i number of calipers on the brake disc

b width of the brake shoe [m]

ZH-1 BRAKE CALIPER

The braking force is generated by a set of 2 springs located in the caliper cylinder. If there is no hydraulic oil pressure, the springs apply axial pressure to the brake disc from the brake shoes with a bonded friction lining. The brake is released by compressing these springs by means of oil pressure acting on the piston. The amount of braking force is determined by the deflection of the springs. The braking force, which decreases as the friction linings wear out, is adjusted manually by the operator. The caliper is equipped with a puller that allows manual release of the caliper in the absence of hydraulic oil supply. It can also be equipped with brake release sensors and sensors indicating the need for brake force adjustment due to friction lining wear. The caliper is equipped with clamps which stabilise the position of the brake shoes during arm movement and prevent the linings from rubbing against the rotating brake disc.

The ZH-1 caliper is designed to cooperate with a hydraulic aggregate with a minimum working pressure of 150 bar and maximum working pressure of 190 bar.

Size of caliper	Braking force F_H [N]	Width of the brake shoe b [m]
ZH-1	8900	0,08

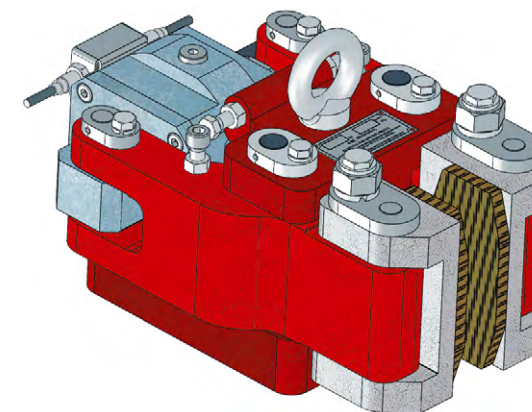
ZH-3 BRAKE CALLIPER

The ZH-3 brake caliper is a ZH-1 caliper additionally equipped with an automatic hydraulic brake lining wear compensation system, so that it does not need to be adjusted manually due to lining wear. Instead, the adjustment is done automatically. It is necessary to use a hydraulic aggregate suitable for this system.

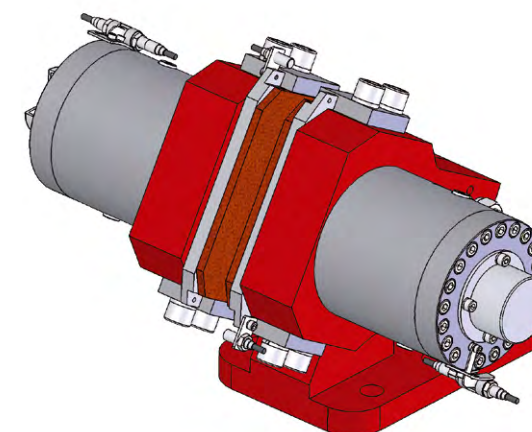
Size of caliper	Braking force F_H [N]	Width of the brake shoe b [m]
ZH-3	8900	0,08

ZH-2 AND ZH-2M BRAKE CALIPERS

The braking force is generated by a set of disc springs located in the caliper cylinder. If there is no hydraulic oil pressure, the springs apply axial pressure to the brake disc from the brake shoes with a bonded friction lining. The brake is released by



ZH-1 Brake caliper



ZH-2 Brake caliper

compressing these springs by means of oil pressure acting on the piston cylinder. The caliper can be equipped with brake release sensors, sensors indicating the need for adjustment due to brake lining wear and sensors indicating the need for shoe replacement. In the standard ZH-2 version the caliper consists of two cylinders and a base fixed to the horizontal plane. When pressurised oil is fed into each of the two cylinders, the pistons are moved in them and both brake shoes are moved away from the brake disc. In the ZH-2M version the caliper consisting of one cylinder and a base is fixed to the vertical plane with two screws. The caliper body is slidably mounted on two shaft ends and when pressurized oil is fed, one (movable) shoe is moved and springs move the whole body on the shaft ends so that a gap is created between both shoes and the brake disc.

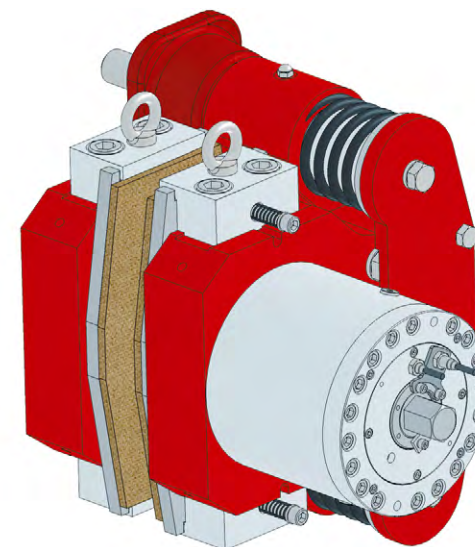
Size of caliper	Spring force F_s [N]	Width of the brake shoe b [m]
ZH-2-28	2800	0,07
ZH-2-450	45000	0,2
ZH-2-740	74000	0,2
ZH-2-1200	120000	0,2

ZHA ACTIVE CALIPER

The braking force is generated by hydraulic oil fed into the cylinders which are a part of the calipers. Its pressure value can be used to vary the amount of the braking force. When the supply oil pressure decreases, the shoes spread apart under the influence of the return springs built into them, allowing the disc to rotate freely. The calipers may be equipped with release and brake lining wear sensors.

Oil pressure [bar]	60	80	100	120	130
Braking force F_H [N]	18 600	25 300	32 000	38 600	41 950
Width of the brake shoe b [m]	0,105				

The ZHA active caliper can also be designed as a pneumatic caliper (powered by compressed air) ZHA-P.



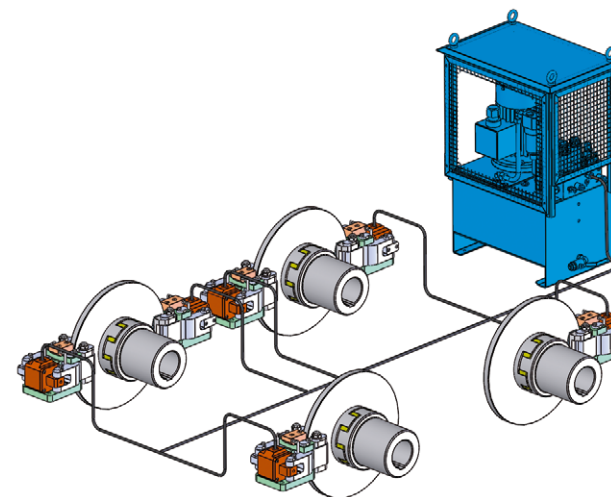
ZH-2M Brake caliper



ZHA Active caliper

ZHT-1 DISC BRAKE SYSTEM

The ZHT-1 disc brake system consists of a hydraulic aggregate and several ZH-1 brake calipers connected to it. It is mainly used in belt conveyor drive systems. The springs mounted in the calipers cause the calipers to clamp on the brake disc and the supply of pressurised oil from the aggregate causes the calipers to spread apart and allow the brake disc to rotate freely. The use of a single hydraulic aggregate supplying several calipers enables their braking process to be controlled simultaneously. Depending on the version of the aggregate, single-stage fast or smooth braking or 2-stage braking with the possibility of setting the threshold between stages and the possibility of setting (by supplying voltage to the relevant solenoid valve) the starting moment of the 2nd braking stage is possible. The calipers may be equipped with a brake release sensor and a lining wear sensor to indicate when the caliper needs to be adjusted or when the minimum thickness of the friction lining is reached, to indicate when it needs to be replaced. The aggregate can also be equipped with a threshold pressure sensor indicating that the pressure value set on the sensor has been reached or exceeded (which can also be used indirectly as information about the release of the calipers).



ZHT-1 Disc brake system

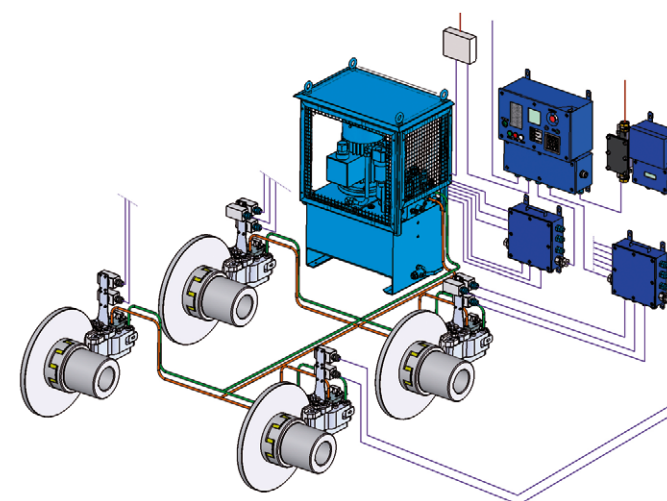
ZHT-3 DISC BRAKE SYSTEM

The ZHT-3 disc brake system consists of a hydraulic aggregate, several ZH-3 brake calipers connected to it and the ATHamulec control system.

This set is designed for braking a conveyor in a specified time (set by the operator in the control system), irrespective of its loading.

The correct operation of the ZHT-3 set is controlled by the ATHamulec control system cooperating with the belt conveyor automation system and it enables the implementation of the braking and brake release process and checks whether the system functions correctly.

The control system reads the current speed of the brake disc from a speed sensor placed on one of the calipers at the moment when braking commences (it is also possible to use the reading of the linear speed of the conveyor belt) and on the basis of the set braking time decides on the appropriate braking stage and controls the operation of the hydraulic distributors, and consequently the value of oil pressure in the calipers, in such a way that the actual braking time equals the set one.



ZHT-3 Disc brake system