






FRANK & DVORAK
ELEKTROMOTOREN

FFD

®

CE DEKRA DEKRA

ELECTROMAGNETIC DISC BRAKES
H 2 S H

Spring actuated and electromagnetically released disk brake type HPS powered by direct current. Designed for braking rotating machine parts and their precise positioning. Used as positioning and safety brakes. The brakes are characterized by a lack of the need for adjustment, a simple design, a high IP protection rating, and the possibility of AC power supply after connecting a rectifier system, which is supplied to the customer upon request together with the brake. An additional advantage is stable operation – particularly important when the device is operated by several drives working additionally with a high switching frequency.

The brake's design guarantees simple and trouble-free installation. Various design options are available in terms of equipment, brake power supply, and climatic conditions, allowing for the selection of a suitable option for individual user needs.

They are designed for braking rotating parts of machines and their task is:

- ❖ emergency stopping in order to ensure drive safety functions,
- ❖ immobilizing machine actuators, acting as a positioning device,
- ❖ o minimizing run-on times of drives to meed safety requirements according to Office of Technical Inspection (UDT) regulations
- ❖ built onto an electric motor, the brake provides a self-braking motor, a drive unit meeting the requirements of utilisation safety and positioning.

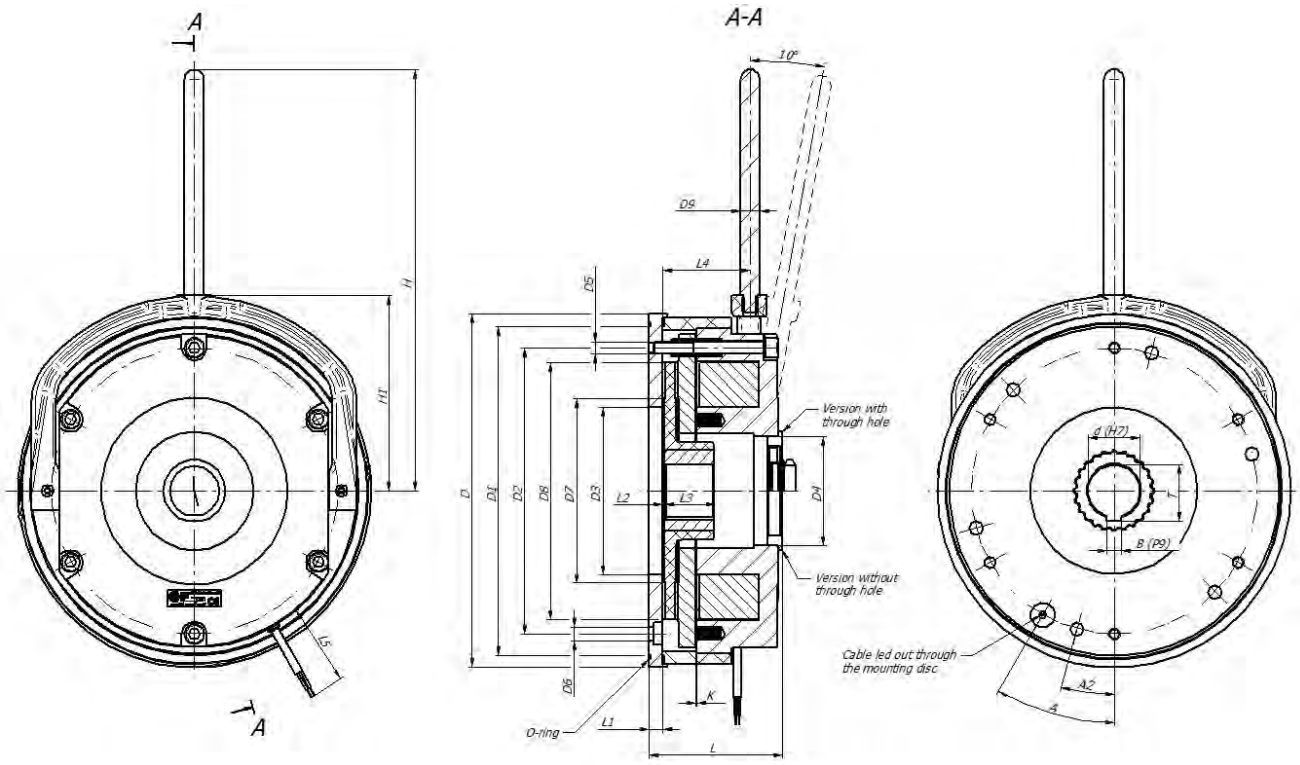
Brakes can be manufactured in variants suitable for various direct-current voltages: 24, 104, 180, 207 VDC, which allows them to be supplied from standard alternating current sources through appropriate rectifier.

Parameters			Unit	Brake type						
				H2SH 80	H2SH 100	H2SH 112	H2SH 132	H2SH 160	H2SH 180	H2SH 200
Supply voltage		U_n	[V]	24, 104, 180, 207						
Power		$P_{20°}$	[W]	30	40	50	55	75	90	145
Braking torque		M_h	[Nm]	20	32	60	100	150	240	500
Max. speed		n_{max}	min^{-1}	3000						
Weight		G	[kg]	4,6	6,7	9,2	13,5	18,5	31,0	48,0
Ambient temperature		T	^0C	-25 ÷ +40						
Level of protection				IP 66						
Operating time *	On DC side	$t_{0,1}$	ms	90	120	150	180	300	400	500
		$t_{0,9}$		40	50	65	90	110	200	270
	On AC side	$t_{0,1}$	ms	90	120	150	180	300	400	500
		$t_{0,9}$		Brake disconnection on alternating current side causes about five-times growth in braking time t09 with respect to disconnection on direct current side						

$t_{0,1}$ - releasing time (from switching on current to drop in braking torque to 10% M_{nom}.)

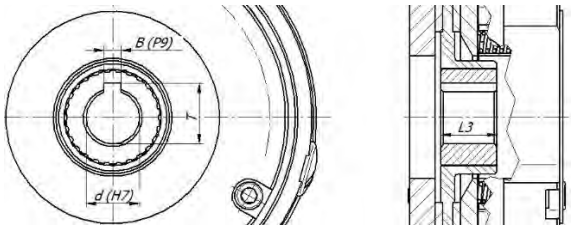
$t_{0,9}$ - braking time (from switching off current to attaining 90% M_{nom})

* Values of releasing and braking times are given as approximations, since they depend on mode of assembly/installation, temperature and power supply.



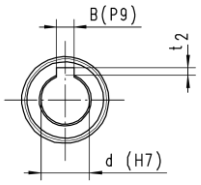
Type	M_h [Nm]	D (h9)	D1	D2	D3	D4	D6	D5	D7	D8	D9	L	L1	L2	L3	L4	L5	A*	A2	K	H	H1
H2SH 80	20	145	135	112	44	40,4	3xM6	3xΦ6,4	61	95	10	57,5	10	2	20	34	450	20°	0°	0,2	160	73
H2SH 100	32	172	160	132	45	48,4	3xM6	3xΦ6,4	74	114	10	68	11	2	25	38,5	450	20°	0°	0,3	182	95
H2SH 112	60	190	180	145	55	58,3	3xM8	3xΦ8,4	90	124	12	75	12	2	30	39,5	450	20°	0°	0,3	193	103
H2SH 132	100	216	200	170	84	66,4	3xM8	3xΦ8,4	100	152	12	86	12	2	30	46	450	20°	0°	0,3	207	117
H2SH 160	150	242	230	196	104	82,8	6xM8	4xΦ9	130	176	12	92	13	2	35	50	450	30°	45°	0,3	237	129
H2SH 180	240	284	265	230	134	87,8	6xM10	6xΦ11	148	207	16	107,5	11	2	40	70,5	800	30°	15°	0,5	339	157
H2SH 200	500	332	318	278	120	132,8	6xM10	6xΦ11	198	255	16	123	12,5	3,5	50	91,5	800	20°	30°	0,5	466	182

Geared bushing hole diameters



Type	d	B	T	d_{max}	d_{smax} **	L3
H2SH 80	19	6	21,8	25		20
H2SH 100	25	8	28,3	25		25
H2SH 112	25	8	28,3	35***		30
H2SH 132	35***	8	38,3	35***		30
H2SH 160	40	12	43,3	45	50	35
H2SH 180	42	12	45,3	45	50	40
H2SH 200	42	12	45,3	45	75	50

Normalized hole diameters ranges



Hole diameter [mm]	B	t_2
Above-to		
10 - 12	4	1,8
12 – 17	5	2,3
17 – 22	6	2,8
22 – 30	8	3,3
30 – 38	10	3,3
38 – 44	12	3,3
44 – 50	14	3,8
50 – 58	16	4,3
58 - 65	18	4,4
65 - 75	20	4,9
75 - 85	22	5,4

d - standard geared bushing hole diameters
d smax - maximum geared bushing hole diameters
d** smax - at extra charge it is possible to manufacture the brakes with the specially increased diameter of the gear hub
*** - for the H2SH112 i H2SH132 brakes and for the geared bushing hole diameters from d 32mm to 35 mm the key groove with the width of 8 mm (the width of the groove is incompatible with PN/M-85005 and DIN 6885 standards)
A* - For the H2SH 80 brake in the KZ KO version and with the cable led out on the brake's outline, the value of $A=0^0$.

ELECTRONIC SUPPLY SYSTEMS

A number of modules, ranging from simple circuits with classic designs, to complex assemblies ensuring quick action and drives positioning have been designed to drive the brakes. Relevant brake applications with switching in the primary or secondary circuits are ensured by half- or full-wave rectifiers and fast electronic circuits. The manufacturer recommends to use as low alternating current voltages as possible to supply the brakes. Appropriate choice of the control voltage will prevent or at least limit surges that may occur in power supply circuits. It is not recommended to use extensively long control wiring, which would be a source of harmful surges.

Rectifier B2-1P

The B2–1P rectifiers series forms a complete wave rectifier unit for direct installation. The terminal strip provided facilitates installation and connection to the circuit.

Rectifier B2-1P cooperates with the brakes H2SH80 ÷ H2SH200

RECTIFIER PARAMETERS			
		B2-1P-400	B2-1P-600
Maximum input voltage (alternating voltage AC)	U_{IN}	400 VAC	600 VAC
Maximum output voltage (direct voltage DC)	U_{OUT}	0,45 U_{IN}	0,45U_{IN}
Maximum continuous output current rectifier	I_{OUT}	2A	2A

Example:

Maximum input voltage(alternating voltage) - *U*IN = 230VAC,

The resulting output voltage of the rectifier (direct voltage) - 0,45*U*IN= 0,45 x 230=104VDC

Rectifier B5-1P

The B5–1P rectifiers series forms a complete wave rectifier unit for direct installation. The terminal strip provided facilitates installation and connection to the circuit.

Rectifier B5-1P cooperates with the brakes H2SH80 ÷ H2SH200

RECTIFIER PARAMETERS			
		B5-1P-400	B5-1P-600
Maximum input voltage (alternating voltage AC)	U_{IN}	400 VAC	600 VAC
Maximum output voltage (direct voltage DC)	U_{OUT}	0,45 U_{IN}	0,45U_{IN}
Maximum continuous output current rectifier	I_{OUT}	4A	4A

Example:

Maximum input voltage(alternating voltage) - *U*IN = 230VAC,

The resulting output voltage of the rectifier (direct voltage) - 0,45*U*IN= 0,45 x 230=104VDC

Rectifier B2-2P

The B2–2P rectifiers series forms a complete full-wave rectifier unit for direct installation. The terminal strip provided facilitates installation and connection to the circuit. The rectifier allows feeding input voltage max. 400VAC, 2A which after rectification provides DC voltage of value equal to 0,9 input voltage.

Rectifier B2-2P cooperates with the brakes H2SH80 ÷ H2SH200

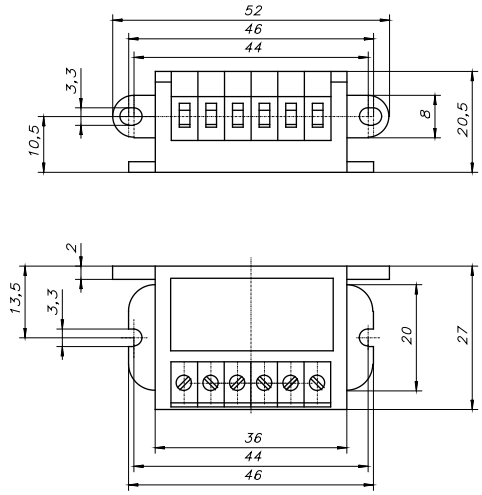
RECTIFIER PARAMETERS		
Maximum input voltage (alternating voltage AC)	U_{IN}	250 VAC
Maximum output voltage (direct voltage DC)	U_{OUT}	0,9U_{IN}
Maximum continuous output current rectifier	I_{OUT}	2A

Example:

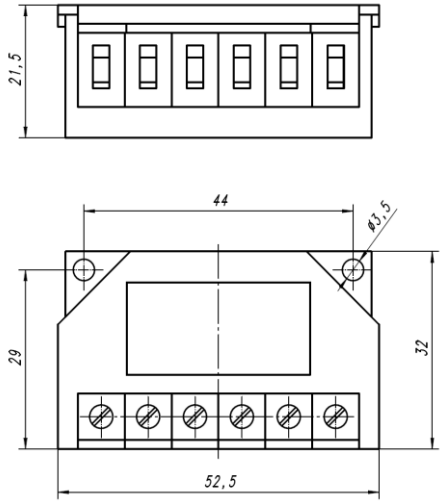
Maximum input voltage (alternating voltage) - *U*IN = 230VAC,
The resulting output voltage of the rectifier (direct voltage) - 0,9*U*IN= 0,9 x 230=207VDC

Rectifiers dimensions

B2-1P-400,
B5-1P-400,
B2-2P

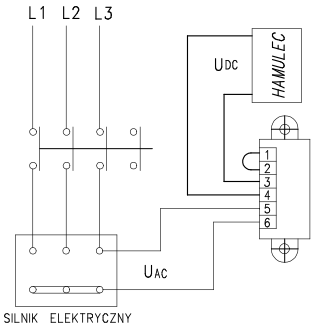


B2-1P-600,
B5-1P-600



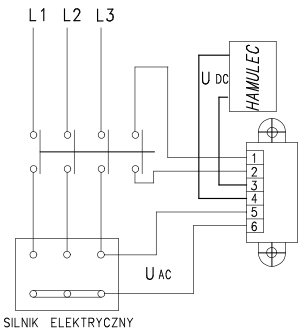
Disconnection of power supply on AC side

The diagram presents connection of rectifiers to supply circuit of motor. When disconnecting the voltage, the magnetic field causes the coil current to flow further through the rectifying diodes and drops slowly. The magnetic field reduces gradually **causing prolonged time of braking action and consequently delayed increase of braking torque**. If action time is irrelevant, brake should be connected on the AC side. When switching off, the supply circuits act as rectifying diodes.

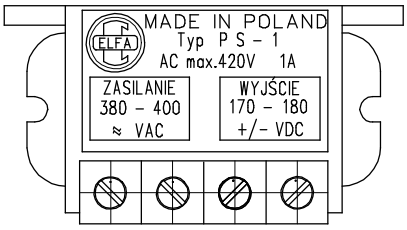


Disconnection of power supply on DC

The diagram presents connection of rectifiers into electric motor circuit. The coil current is interrupted between the coil and supply (rectifier) circuit. The magnetic field reduces very quickly, **giving short time of braking action and consequently rapid growth of braking torque**. When switching off on DC voltage side, a high peak voltage is generated in the coil causing faster wear of contacts due to sparking. For protecting the coil against peak voltages and protecting the contacts against excessive wear, the rectifier circuit is provided with protective facility allowing brake connection on DC voltage side.



Rectifier PS-1



Circuit PS-1 is built on the basis of MOSFET type semiconductor technique which enabled achieving effects not available in traditional designs. The brake electromagnet energized through circuit of this construction enables the brake to achieve connection and disconnection time parameters analogous to breaking of circuit on direct current side. The parameters obtained are not however gained through utilization of additional electrical circuits and switches.

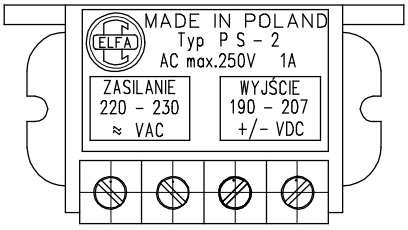
Simplicity of installation and parameters achieved enable very wide application, particularly in cases requiring positioning of drives, operation with high frequency of actuations compounded with repeatability of brake connecting and disconnecting times.

The PS–1 power supply unit is a complete assembly for direct mounting. Equipped with a four-terminal strip, it allows for free adaptation in any cooperating circuit. The unit is adapted for power supply from an AC source with a value of 380 ÷ 400VAC max. 420VAC, which, after rectification and appropriate shaping, allows for obtaining a DC voltage of 170 ÷ 180VDC to power the brake.

The diagram shows how to connect the PS-1 unit in the power supply circuit of a brake cooperating with a 3x400VAC electric motor with a star-connected winding.

Rectifier PS-1 cooperates with the brakes H2SH80 ÷ H2SH180.

Rectifier PS-2



Circuit PS-2 is built on the basis of MOSFET type semiconductor technique which enabled achieving effects not available in traditional designs. The brake electromagnet energized through circuit of this construction enables the brake to achieve connection and disconnection time parameters analogous to breaking of circuit on direct current side. The parameters obtained are not however gained through utilization of additional electrical circuits and switches.

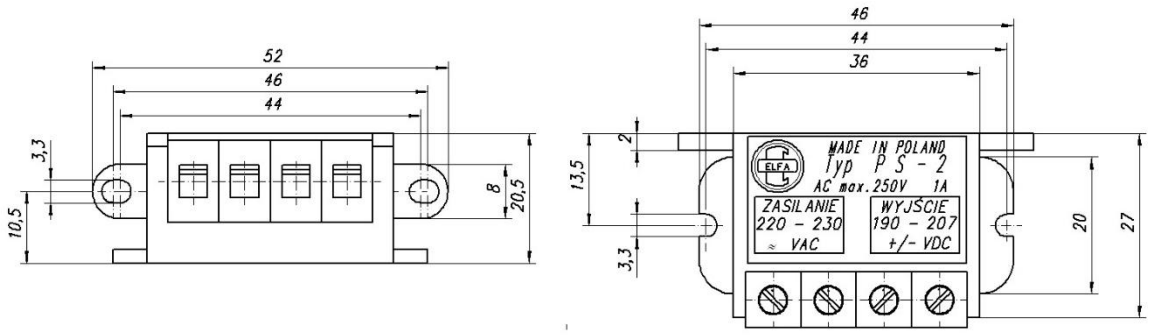
Simplicity of installation and parameters achieved enable very wide application, particularly in cases requiring positioning of drives, operation with high frequency of actuations compounded with repeatability of brake connecting and disconnecting times.

The PS–2 power supply unit is a complete assembly for direct mounting. Equipped with a four-terminal strip, it allows for free adaptation in any cooperating circuit. The unit is adapted for power supply from an AC source with a value of 220 ÷ 230VAC max. 250VAC, which, after rectification and appropriate shaping, allows for obtaining a DC voltage of 190 ÷ 207VDC to power the brake.

The diagram below shows how to connect the PS-2 unit in the power supply circuit of a brake cooperating with a 3x400VAC electric motor with a star-connected winding.

Rectifier PS-2 cooperates with the brakes H2SH80 ÷ H2SH200.

Rectifiers PS-1, PS-2 dimensions:

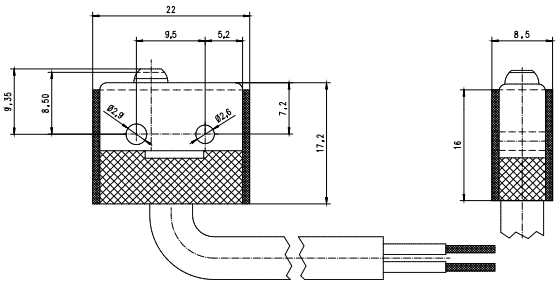


CONTROL AND SIGNAL CIRCUITS – microswitches and inductive sensors

Having in mind the user who requires the control of the brake, we have designed special signalling and control circuits, which enable to control the state of the brake (engaged, disengaged) and the wear of the plate lining. The usage of these circuits enables to control the brake with the use of automatic elements, which ensure high level of safety and reliability. Due to its compact design, the microswitches or inductive sensors can be used in any other applications, as long as its parameters meet design requirements.

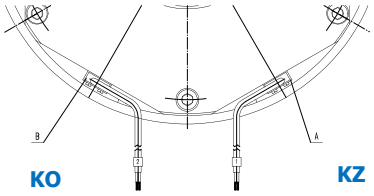
SIGNALING CIRCUTS – ELECTRIC PARAMETERS			
Switch parameter	Switch KZ Switch KO Inductive sens	Switch KZ Switch KO Inductive sens	Switch KZ Switch KO Inductive sens.
Max. voltage AC	250 V AC	250 V AC	-
Max. AC switching current	5 A	6 A	-
Max. Voltage DC	28V DC	220V DC	10 ÷ 30 VDC
Max. DC switching current	3 A / 28V DC	6A / 12V DC 3A / 24V DC 1A / 60V DC 0,5A / 110V DC 0,25A / 220V DC	100mA
Protection rating	IP 66	IP 66	IP 67
Terminals	NO /NC	NO /NC	NO

MICROSWITCH DIMENSIONS



Brake response monitoring – **KZ** or **IKZ** (KZ – microswitch, IKZ – inductive sensor) - control of the state of brake (engaged, disengaged),

Brake lining control – **KO** or **IKO** (KZ – microswitch, IKZ – inductive sensor) – the microswitch indicates approaching the maximum wear of the brake disc and the necessity of the brake's regulation or replacement of the disc brake, which enables further work of the brake. The regulation procedure is described in the brake operating manual.



SAMPLE INSTALATION

Brake response monitoring and brake lining control – **KZ KO** or **IKZ IKO**
(KZ KO – microswitches, IKZ IKO – inductive sensors)

PROCTECTIVE CIRCUITS – thermal protection

To protect electromagnet windings against heat build-up (slow-changing overloads) thermal sensor are used. In our offer we have PTC thermistors, which feature high resistance gradients when their rated temperature is reached -posistors - P or bimetallic thermal sensor - B.

Posistor-based sensors are made in the form of an insulated pill with connecting wires extending inside a teflon insulation, installed directly on the electromagnet windings. Sensor circuit terminals are routed outside the brake to the terminal box and connected to a separate connection block or terminal strip. So-called resistance relays are intended for thermistor-based PTC temperature sensors. When temperature of at least one of the sensors rises above the rated value, the circuit resistance suddenly increases triggering the relay.

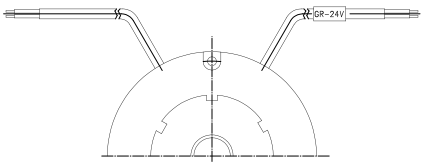
Posistor thermal protection – P

Note! PTC sensor terminals must not be connected directly to the contactor.

The brake protection has the form of a bimetallic sensor. Brake operation is controlled by a sensor or by a set of sensors, which ensure its safe operation; excessive temperature indication is obtained from the thermal switch installed inside the brake electromagnet's housing rated for a specific temperature. When the limit temperature for the sensor is exceeded, the information for the automatic control equipment is sent or the brake circuit is disconnected.

Bimetallic thermal protection – B

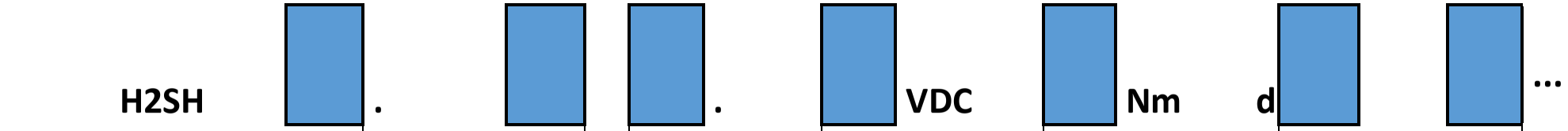
AUXILIARY CIRCUITS – anti-condensation heaters



The so-called parking heating is used to prevent vapours condensation inside the brake. The equipment is particularly useful in negative temperatures or in high humidity environments. The heater is supplied through its dedicated pair of wires. The standard supply voltage of the heater is 230VAC. The heater power supply voltage matches customer requirements – the need to define the voltage during order.

Anti-condensation heaters – GR ….. VAC

Please note that simultaneous power supply to the heater and the brake electromagnet is not permissible.



MECHANICAL SIZE
80; 100; 112; 132; 160; 180; 200

CONFIGURATION	
WITHOUT FITTING / ACCESSORIES	1
LEVER FOR MANUAL RELEASE	2
MOUNTING FLANGE	3
LEVER FOR MANUAL RELEASE + MOUNTING FLANGE	4

Execution version at the customer's request :

- non-standard diameter of the sleeve gear brake d(H7)
- equipped with heating elements in the winding (need to define the voltage supply) – e.g. **GR___VAC**
- work at low temperatures -40^{0}C - **Z**
- posistor thermal protection - **P**
- bimetallic thermal protection - **B**
- other voltage brake
- brake response monitoring (engaged, disengaged) – **KZ** or **IKZ** (KZ – microswitch, IKZ – inductive sensor)
- brake lining control – **KO** or **IKO** (KO – microswitch, IKO – inductive sensor)
- microswitches or inductive sensors set (available from type H2SH 80 inclusive) – **KZ KO** lub **IKZ IKO**

EXAMPLE:

H2SH 112. 11. 104VDC 32Nm d25 GR230VAC
H2SH 200. 32. 180VDC 12Nm d19 Z
H2SH 71. 22. 24VDC 60Nm d25 KZ+KO

DIAMETER OF SLEEVE GEAR d(h7)

CLIMATIC VERSION
ACCORDING TO NORM: eg. MT, TH

NOMINAL BRAKING TORQUE [Nm]						
H2SH 80	H2SH 100	H2SH 112	H2SH 132	H2SH 160	H2SH 180	H2SH 200
20	32	60	100	150	240	500
16	24	45	80	120	180	420
12	16	30	60	75	120	360
6						

OPERATING VOLTAGE [VDC]
24, 104, 180, 207

WYKONANIE	
VERSION WITHOUT HOLE – CABLE GUIDED THROUGH THE FLANGE	0
VERSION WITH HOLE – CABLE GUIDED THROUGH THE FLANGE	1
VERSION WITHOUT HOLE – CABLE GUIDED ON THE BRAKE OUTLINE	2
VERSION WITH HOLE – CABLE GUIDED ON THE BRAKE OUTLINE	3

The producer reserves the right to modify as a result of developing the product.
It is possible to realize special versions.