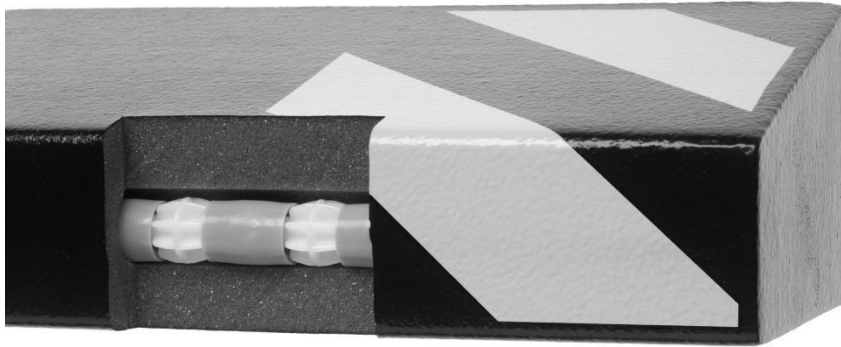


# Operating Manual

# HSB<sup>®</sup>

## Bumper

(Translation of original operating manual)



The illustration may differ from the actual product.

**Read the entire operating manual including the section "Maintenance" before beginning any work!**

# HAAKE<sup>®</sup>

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## 1 Scope

This operating manual is intended for persons who have been authorised to carry out tasks involving the bumper of the HSB-series. International, national and, where appropriate, regional regulations are to be observed when handling bumpers.

If you have any questions which are not answered in this manual, please get in touch with your regional customer service centre or else make direct contact with

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## 2 Intended use

The bumpers HSB are used to protect joints and shear and pinch edges on machinery and equipment in accordance with the provisions of sections 20, 21 and 23.

They are used to protect the hands, arms, legs, head and persons near e.g. machine hoods, lifting tables, lifting and tilting equipment, theatre stages and automated guided vehicle systems (AGVs).

Other applications are prohibited.

## 3 Symbol explanation

Warnings are indicated by symbols. The notices are introduced by signal words to indicate the extent of the hazard.



### Attention!

... indicates a potentially hazardous situation, which may lead to personal injury and damage to property if it is not avoided.



### NOTE!

... highlights useful tips and recommendations as well as information for efficient and fault-free operation.

## 4 Disposal



The device must be properly disposed of in accordance with national laws and regulations.

## 5 Foreseeable misuse

Examples for reasonably foreseeable misuse

- Bumpers may not be used as climbing aids.
- Bumpers may not be connected to voltage  $\geq 50$  V AC, 75 V DC.
- Bumpers may not be stressed by voltages greater than 0.5 A.
- Bumpers may not be equipped with additional covers.
- Bumpers may not be used on fire doors.
- Connection lines may not be installed without protection.

## 6 Identification

For an accurate identification, you will find the type designation, serial number and year of construction on the type labels of the bumper.

Note these details (prior to installation, if necessary), so that they can be provided in case of questions or for ordering spare parts.

## 7 Safety relevant function

The bumper implements the following safety functions:

1. Interruption of the closed circuit through force application on the sensor surface
2. The interruption of the closed circuit is maintained as long as the force is applied to the sensor surface.

## 8 Fault exclusions

Due to the design, materials, and components used for the bumper, the faults listed in the table can be excluded:

Potential Fault	Exclusion of Fault	Limitations of Use	Reason
Deformation by overload	Admissible in accordance with table A.4 of DIN E ISO 13849-2.	See: <b>Intended use</b> in section 2 and <b>technical data</b> in section 20.	Use of carefully selected materials and manufacturing procedures; use of special types of fastening.
Modifications of the geometry or breakage of the contact elements	Admissible in accordance with table A.4 of DIN E ISO 13849-2.	See: <b>Intended use</b> in section 2 and <b>technical data</b> in section 20.	Use of carefully selected materials and manufacturing procedures; use of special types of fastening; over-dimensioning.
Short circuit in the lines and line connections	Admissible in accordance with table D.4 of DIN E ISO 13849-2.	See: <b>Installation</b> in section 12	Use of doubly insulated sheathed cables and protected cable installation
Fusing of the contacts	Admissible in accordance with table D.8 of DIN E ISO 13849-2.	See: <b>Installation</b> in section 12 and <b>technical data</b> in section 20.	Use of a fuse (0.5 A) in the supply circuit of the bumper.

## 9 Scope of delivery

1 x bumper



### NOTE!

Means of attachment and fuse (0.5 A) are **not** included in the scope of the delivery.

## 10 Structure and function

### 10.1 Description

The bumpers are basically of the same design, independent of their dimensions and shape. They consist of the components:

- Haake safety contact chain HSB® (normally closed type)
- PU-foam as a support element for the sensor
- PU-coating as a protective skin
- Carrier plate made of aluminium, steel or MDF to mount the bumper on the item to be safeguarded
- A variety of line connection arrangements depending on the application
- Double insulated connection lines to the machine control

When the bumper (sensor) is actuated, the current flow is interrupted by the special geometry of the chain links in the interior of the sensor. This interruption represents the OFF state of the output signal switching device and thus transmits the safety output signal to the downstream machine control. The bumper meets the requirements for automatic resetting because it switches to the ON state when the actuating force is removed.



### Attention!

If applicable, a reset function may be required.

Should work with a manual reset be required, this should be implemented by means of the machine control in accordance with DIN EN ISO 13856-3:2013-12, Section 4.2.6.3.

Bumpers can be joined together as often as required up to a length of 50 m.

Due to the closed circuit principle (forced interruption of the contact chain) no separate evaluation unit is necessary for provision of the output signal.

The bumper and downstream machine control must together meet the performance level that was determined by the risk assessment.

### 10.2 Example

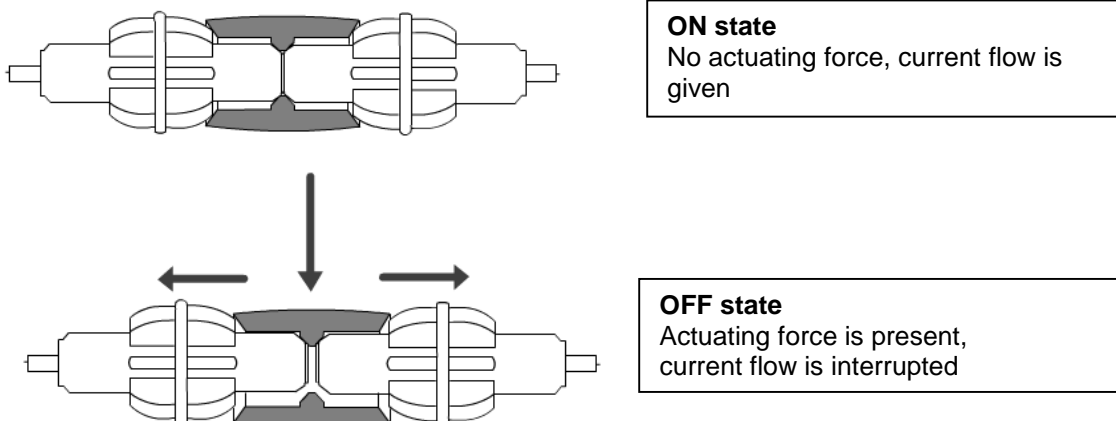


Figure shows HSB as a functional principle (sensor profile is not shown)

## 11 Safety measures

### 11.1 Organisational measures

Persons who have been authorised to carry out tasks involving the installation or de-installation of the bumper must have read and understood this manual prior to commencing such tasks. The operator of the plant or machine has an obligation to ensure the installation and de-installation is carried out safely and with no hazards by implementing appropriate safety measures.

### 11.2 Safety of persons

Personnel responsible for installation or de-installation tasks have to be suitably skilled or else have to be instructed by suitably skilled persons. On account of their technical training and experience, such skilled persons have sufficient knowledge of the installation or machine. These persons are sufficiently familiar with the applicable country-specific occupational safety and health provisions and accident prevention regulations applicable on site so that they are able to assess the operational safety of the installation or machine.

It is necessary to implement accident- and fall-prevention measures, whenever tasks are performed or areas are traversed at height.

### 11.3 Avoiding property damage

Please note the **intended use** (cf. section 2) and the **installation** (cf. section 12) described in this manual.

### 11.4 Operating conditions and limitations of use

Please note the **intended use** (cf. section 2), **foreseeable misuse** (cf. section 5) and the **technical data** (cf. section 20) described in this operating manual. The bumper and downstream machine control must in their entirety comply with the performance level to be determined by means of a risk assessment. The overall system must be validated according to DIN EN ISO 13849-1. This must be guaranteed by the machine manufacturer producing the overall application.



#### **Attention!**

**The machine must not be restarted in case of existing danger.**

### 11.5 Assembly

Assembly work may only be carried out by skilled workers or personnel qualified by the manufacturer. Perform the assembly as described in section 12 and always carry out a function test afterwards. Do not make any alterations to the installation after the function test has been successfully carried out.

### 11.6 Repairs / Alterations

Do not carry out any repairs to the bumper. Do not replace or exchange any parts. Send damaged or faulty components to Haake Technik GmbH to be repaired. Do not make any alterations to the bumper. Otherwise, this could lead to malfunctions, which can cause serious personal injury and irreparable damage to property.

In the event of non-compliance, the guarantee is invalidated and Haake Technik GmbH does not accept any liability.

### 11.7 Electrical equipment

Electrical connections may only be executed by qualified electricians who are familiar with all international, national and, where appropriate, regional electrical engineering regulations. Work must only be carried out when the power supply has been shut off. Always ensure external protection of the bumper with an overcurrent fuse of 0.5 A (rated value).

## 12 Installation



### Attention!

Always select a fastening means for installation that is sufficiently secured against loosening. The overall safety of the machine depends on the proper execution of the installation.

### 12.1 Preparation

When installing the bumper, you will need the following hardware that is **not** included in the scope of delivery:

- Mounting material: Screws, threaded nuts (M6 / M8) depending on the bumper type
- Screw locking (e.g. gear wheels, disc springs, wave washers or screw glue)



### Attention!

When fastening the bumper with the screws the thread engagement of the internal thread of the bumper has to be considered. The maximum is 12 mm.

The following tools are needed to install the bumper:

- Drilling machine, and drill bit 6.6 mm; 9.0 mm
- Countersink 90°
- Key ring / open-end spanner or socket spanner AF 7mm, AF 8 mm, AF 10 mm, AF 13 mm, depending on the bumper type
- Crosstip screwdriver
- Voltage tester

Clean the work environment by removing dirt, grease and oil.

### 12.2 General approach

Use suitable tools when installing the bumper. Otherwise, bolts and nuts may become damaged and unusable.

Do not exceed the max. torque when tightening the nuts.

Always use one of the screw locks specified in section 12.1.

### 12.3 Installation instructions

Make the mounting holes according to the design of the bumper. The location of the mounting holes is specified by and can be gathered from the customer's order or read off the bumper.

The installation procedure depends on local circumstances.

Observe the following basic instructions:



### Attention!

The bumper may only be installed on a completely even surface. Cavities underneath the bumper may lead to permanent deformations and influence the safety functions of the system. During installation, pay attention that any ineffective areas of the bumper are arranged in a concealed manner.



### Attention!

**It is not permitted to shorten the bumper!**

**If a bumper edge must be shortened for operational reasons, this must be done exclusively by the manufacturer.**

No liability is accepted in the event of improper installation!

## 12.4 Electrical connection

The integration of the bumper in the control circuits of the machine control is performed according to EN 60204-1 "Electrical equipment of machines". Core component of the control unit is e.g. a logical unit for safety functions which realises the required performance level in conjunction with the bumper.

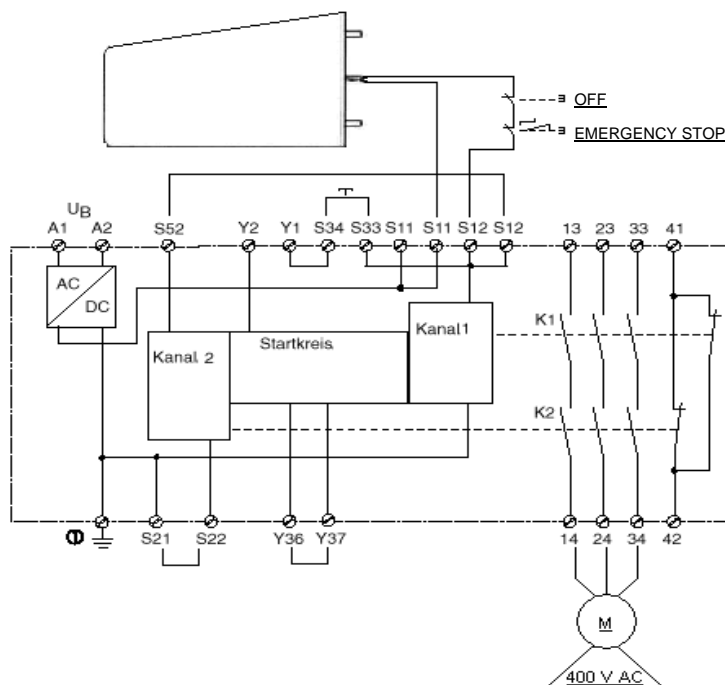
Because the bumper is operating according to the normally closed contact principle, it can be directly connected to a logical unit for safety functions (e.g. safety switchgear), which processes the output switching signal of the bumper in the machine control.

The electrical connection of the bumper must be carried out according to the following specifications:

Rated voltage: < 50 V AC, 75 V DC (with safe disconnection to the grid).  
A voltage source for SELV or PELV systems according to  
DIN VDE 0100-410 must be used.

Rated current: < 0.5 A

The power supply of the bumper must be protected externally!  
Overcurrent protection of 0.5 A (rated value)



Connection example (symbolic representation).

For information on the respective safety switchgear, please refer to the operating instructions of the respective product.



Additional installation instructions for cable connections:

- After cutting to the required length, all cable ends must be provided with crimp contacts.
- The surface on which the bumper is mounted must be flat and clean.
- The bumper surface and the connection cables must not be damaged.
- All lines must be laid with protection against external mechanical influences.
- Depending on the type of cable connection, protection rating IP 65 must be ensured also at connection points, e.g. by appropriate sheaths or enclosures (control cabinet installation).
- Connection lines and connections must be laid and fastened across their entire length such that external mechanical damage is avoided (e.g. internal space of profile, cable ducts, protective tubes, etc.), see also DIN EN ISO 13849-2:2013-02, tab. D4, D6, D7.



**Attention!**

The overall safety of the machine significantly depends on carefully executed line installation and line connections.

No liability is accepted in the event of improper installation!

### 13 Regular performance check



**Attention!**

**The protective effectiveness of the bumper must be checked regularly**  
- at least once a year  
or  
- at intervals according to national operating instructions

**Once installed, do not loosen any bolts or nuts or remove any pins; otherwise, the effectiveness of the safety-related functions is no longer guaranteed.**

Run the following tests after installation and at regular intervals and document the results in the acceptance report (section 22):

- Check all wire connections on the machine control for terminal assignment and tight connection.
- Check the mounting orientation and mounting of the bumper
- Check the bumper surface thoroughly for external damage (visual inspection).
- Check the safety function of the overall system by repeated actuation of the bumper at different points of the effective actuation area, preferably by a test body of Ø 80 mm with a maximum force of 150 N.
- Check the reset function, if available.

With a high degree of pollution or at temperatures below freezing point, short test intervals (at least once before each shift) are advisable.

### 14 Commissioning, operation

After the bumper has been properly installed, connected and tested, the technical equipment on which the bumper edge was installed can be turned on and operated in accordance with its intended use.

No further work on the bumper is required.

## 15 Maintenance / repair



### Attention!

Adapt the maintenance intervals to the environmental conditions at the application site.

No maintenance of the internal parts of the bumper is required.

Damaged or defective bumper must be replaced.

After reassembly, all dismantled / removed parts (e.g. covers, clamps, profiles, fastenings) must be re-installed.

## 16 Cleaning

As a rule, no cleaning is required. Bumpers can be cleaned by wiping with a cloth and neutral soap suds.



### Attention!

Only use other cleaning methods after prior consultation with the manufacturer.

## 17 De-installation



### Attention!

Only dismantle the bumper when the electrical system is de-energised.

- Disconnect the electrical connection (section 12.4).
- Loosen the attachment of the bumper, depending on the design version (section 12.3).

## 18 Troubleshooting

Fault	Possible cause	Remedy
No interruption of the signal	Connection cable is damaged, short-circuit	Contact Haake Technik GmbH.
No ON signal.	Defective connecting terminals	Check terminals and tighten if necessary
	Cable break	Contact Haake Technik GmbH.
	Damaged contact chain	Contact Haake Technik GmbH.
Bumper cannot be mounted.	Wrong mounting plate	Contact Haake Technik GmbH.
	Mounting plate is damaged.	Contact Haake Technik GmbH.

## 19 Transport, handling, unpacking, storage



**Attention!**

**Note the total weight of a packaging unit and always use a suitable transport means.**

Dimensions and mass of the packing arise from the scope of the order. The products are placed in an overpack. Depending on the number of parts to be shipped, cardboard boxes, crates, pallets or containers are used for packaging. Wooden boxes are provided with a lid.

### 19.1 Transportation and handling

If weight is unevenly distributed, the centre of gravity is indicated on the wooden box. Depending on their length, bumpers must be handled by one or two people.

In each transport container, goods are provided with filling material to line any clearances. This ensures that goods are protected during transport.

Returned goods must be similarly packed to avoid transport damages.

Goods damaged due to improperly packed returns will be invoiced.

### 19.2 Unpacking

Special care is needed when opening the packaging.

Open **products in cartons** with a knife at the points where adhesive tape was used. When opening, make sure you cut with the knife away from your body.

**Cardboard rolls** have plastic covers on the end faces attached with clamps to the rolls. Pull out the clamps on one side of the roll with a pair of pliers and remove the plastic cover.

The lid of **wooden boxes** is attached by nails or screws to the box. Therefore use a claw or screwdriver when opening. Always pull nails or screws entirely out of the wood to avoid injuries.

Remove goods from the filling material and place on a clean surface.

### 19.3 Storage

Never bend or roll up sensors, always store them flat; bumper must fully rest on the surface.

If bumpers are to be stored for an extended period of time, they should be placed in the original packaging. A dry environment temperatures ranging between +5 and +55 °C must be chosen for storage. This prevents damage caused by external interferences or environmental influences.

## 20 Technical Data

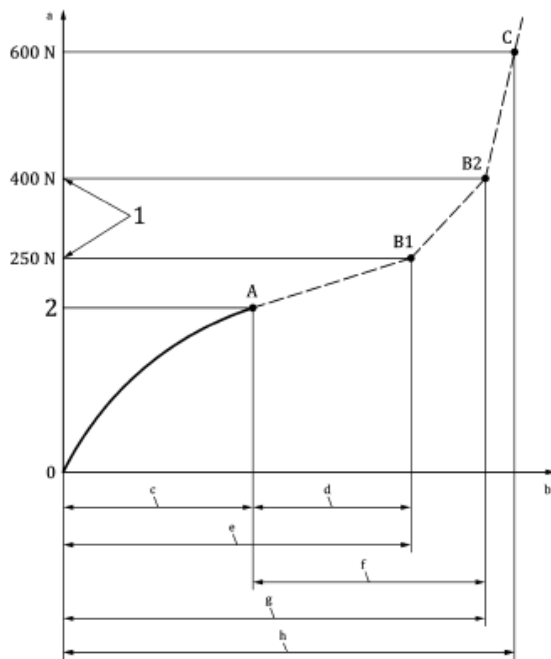
Environment:	indoors / outdoors
Temperature range:	+5° C to +55° C
Humidity:	up to 100% (standard climate)
Installation position:	all
Material:	
Sensor profile:	Polyether foam, PU skin
Mounting profile:	Mounting plate
Connecting line:	PVC, double insulated, highly flexible single core cables, d=3.5 mm Max. line length 50 m Other lines are possible after consultation with the manufacturer.
Ambient atmosphere:	industrial environments
Resistance of the sensor surface:	
Ozone resistance:	good
UV resistance:	good
Acids	good
Alkaline solutions	good
Water	good
Oil resistance:	low
Resistance to detergents:	good
Ammonia, liquid:	good
Salt fog:	good
Service life:	10 years
Values according to DIN EN ISO 13849-3:2013-12:	
B10d value:	
HSB 3700-10 (sample bumper):	51444
Category:	3
Performance level:	up to d is feasible
Mean Time To Failure (MTTF <sub>d</sub> ):	Application-dependant
Protection class:	IP 54 IP 65 (as a special version)
Dimensions:	Application-dependant
Weight:	Application-dependant
Overall length with assembled sensors:	max. 50 m
Rated voltage:	<50 V AC, 75 V DC (with safe disconnection to the grid) A voltage source for SELV or PELV systems according to DIN VDE 0100-410 must be used.
Rated current:	≤ 0.5 A
Load:	max. 500 N within the effective operating angle
Deformation > 24 h:	suitable

## 21 Actuating forces and response times:

Sample bumper	Operating speed 10 mm/s	Operating speed 100 mm/s	Actuating force (at 100 mm/s)
HSB 3700-10	Response time 1875 ms	Response time 183 ms	37 N

### Force-displacement diagrams:

Force-displacement diagrams in accordance with DIN EN ISO 13856-3 for individual operating speeds can also be obtained from the manufacturer.



#### Legend:

- A response distance (operating point and actuation force at maximum operating speed)
- B deformation (for example, the force-displacement points B1 and B2 occur at a force of 250 N and 400 N at an operating speed less than or equal to 10 mm \* s<sup>-1</sup>)
- C total distance (for example at 600 N at an operating speed less or equal to 10 mm \* s<sup>-1</sup>)
- 1 reference force
- 2 lowest actuation force
- a force in Newtons (N)
- b distance in millimeters (mm)
- c response distance
- d overtravel distance at 250 N
- e deformation at 250 N
- f overtravel distance at 400 N
- g deformation at 400 N
- h total distance

Test parameters:

T=20°C, mounting orientation B and measurement location (see DIN EN ISO 13856-3; Fig. B1).  
Operating speed of 100 mm / sec

The following values with regard of the above diagram are to be used for the selection process for the sample bumper HSB 3700-10 (cf. section 21).

Bumper	Force (N)	c response distance (mm)	d at 250 N overtravel distance (mm)	f at 400 N overtravel distance (mm)	e at 250 N deformation (mm)	g at 400 N deformation (mm)	h total distance (mm)
HSB 3700-10	37	18.3	90	96	108.3	114.3	116.3

## 22 Selection procedure

The three most important parameters for selecting the appropriate bumper are:

- Determination of the required performance level
- Speed of the dangerous movement
- Stopping distance of the dangerous elements
  
- Legend:
  - $V_B$  = Operating speed [m/s]
  - $V_G$  = Dangerous movement [m/s]
  - $S_N$  = Overtravel distance [m]
  - $S_A$  = Stopping distance [m]
  - $F$  = Safety factor, min. 1.2

For the selection, proceed as follows:

Step	Action	Remark
1	Determination of the required PL according to DIN ISO 13849-1	a) Results from the information in the C standard b) Results from the risk assessment to be carried out, based on the particular application
2	Determining the required operating speed ( $V_B$ )	a) Measurement or calculation of the maximum speed of the hazardous movement ( $v_G$ ) b) Selection: $V_B > V_G$
3	Determining the required overtravel ( $S_N$ )	a) Measurement of the stopping distance ( $S_A$ ) of the hazardous elements b) Determining the safety factor ( $F$ ); at least 1.2 c) Formula: $S_N[m] = S_A[m] \times F$ d) Calculation
4	Determining the max. permissible force	a) Determining what kind of people (e.g. elderly, people, children, etc.) and what body parts are to be protected b) Selection: maximum permissible force as low as possible
5	Selecting the system	a) Select a system using the determined values and respective force-displacement diagram. In doing so, ensure the overtravel force is smaller than the maximum permissible force in step 4.



### NOTE!

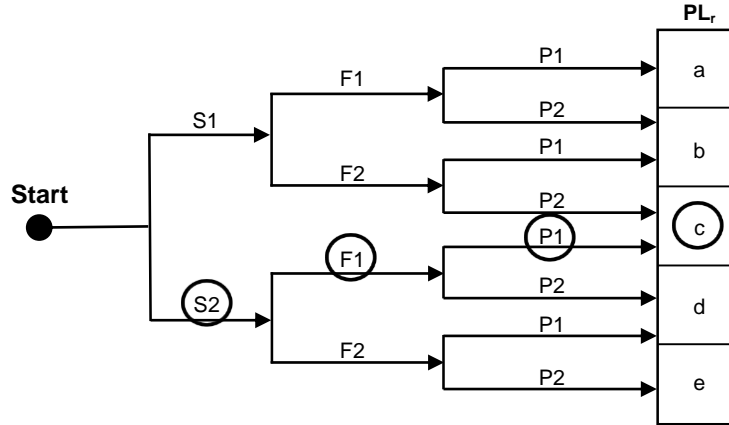
*Category and performance level of the bumper must correspond to the information obtained from the risk assessment of the machine.*

*The user has to determine the performance level for his particular application.*

### 23 Application example

In order to secure the pinch point of a lifting table a bumper is required.  
 The lifting table moves automatically at a speed of 50 mm / s  
 The lifting table is operated 8 hours per day, on 240 working days per year.  
 The lifting table moves 6 times per hour.

#### Determining the PL<sub>r</sub> according to DIN EN ISO 13849-1:



#### Risk parameters:

S	Severity of injury	F	Frequency of and/or duration of exposure to hazard	P	Possibility of avoiding the hazard
S1	slight (normally reversible injury)	F1	seldom-to-less-often and/or exposure to hazard time is short	P1	Is possible under specific conditions
S2	serious (normally irreversible injury or death)	F2	frequent-to-continuous and/or exposure to hazard time is long	P2	Is scarcely possible

#### Calculating the Mean Time Between Failures (MTTF<sub>d</sub>) within the application according to DIN EN ISO 13849-1:

Mean operating time in days per year (d <sub>op</sub> ):	$240 \frac{\text{days}}{\text{year}}$
Mean operating time in hours per day (h <sub>op</sub> ):	$8 \frac{\text{h}}{\text{day}}$
Mean time between the start of two consecutive cycles of the safety mat (t <sub>cycle</sub> ):	$600 \frac{\text{s}}{\text{cycle}}$
Mean number of annual actuations (n <sub>op</sub> ):	$n_{op} = \frac{d_{op} \times h_{op} \times 3600 \frac{\text{s}}{\text{h}}}{t_{cycle}} = 11520 \frac{\text{cycles}}{\text{year}}$
B10 <sub>d</sub> – Value of sample safety mat HSM 3817-00-S:	51,444 cycles
MTTF <sub>d</sub> :	$MTTF_d = \frac{B10_d}{0.1 \times n_{op}} = 44 \text{ years}$


#### Determining the PL according to DIN EN ISO 13849-1:2008-12:

Category:	3
MTTF <sub>d</sub> :	44 years = high (limited according to DIN EN ISO 13849-1)
Performance Level:	d

The use of the safety mat in PLd applications depends on a high MTTF<sub>d</sub> (min. 30 years). The availability depends on the actuation cycles. For applications with short cycle times, we recommend visual control measures at short intervals to keep up availability. Short cycle times have no influence on the safety function.

## 24 Acceptance report

The acceptance report must be completed by the operator:

Haake Technik GmbH Vreden		<b>Acceptance report Bumper HSB®:</b>				
Operator:		Object:		Company:		
		Bumper:		Name:		
		Logic unit:		Date:		
Order number:		Serial No.:		Signature:		
No.	Activity	Measurement		Free of defects		Remark
		Target	Actual	Yes	No	
1.0	Visual inspection, if appropriate also of the deformation chamber, with regard to penetrated objects					
1.1	Attachment of bumper					
1.2	Damage to the bumper					
1.3	Damage to the connection lines					
1.4	Damage to the line connection points (if several bumpers are linked)					
1.5	Connection of connection line					
1.6	Reset button / function					
1.7	Protective effect overall system					



## 25 EC Declaration of Conformity

**EC Declaration of Conformity**  
**in accordance with EC Directive 2006/42/EC Annex II 1. A**  
(Translation of the original declaration)

The company: **Haake Technik GmbH**  
**Master Esch 72**  
**48691 Vreden**

hereby declares  
that the safety component: **Safety bumper**

Series: **HSB**

Serial number: **See identification plate**

in the delivered version is in accordance with the following relevant regulations:

EC Directives: **Directive on machinery 2006/42/EC**

Harmonised standard: **DIN EN ISO 13856-3**

HSB safety bumpers are used to provide protection at pinching and shearing points, e.g. at machinery with long over-travel distances, automatically-guided vehicles, theatre-type stages, etc.

Our quality assurance system ensures that all safety components are manufactured with the same quality.

Therefore the Declaration of Conformity issued applies for all safety components of the above types produced from serial number 1552544.

Authorized representative to compile the technical documentation is:

HAAKE Technik GmbH  
Mr. Heinrich Chrusch  
Master Esch 72  
48691 Vreden

Vreden, den 07.09.2015



André Haake  
(Geschäftsführer)







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