Rubber Bumpers / Cellular Bumpers Program 0170 / 0180

General Information

Stop bumpers are essentially damping units that absorb energy, for example at the end of a crane runway, to prevent damage and allow for smaller structural dimensions. In general, “energy before geometry” applies to bumpers because load diagrams, precisely defined characteristic curves, physical dimensions, and mathematical formulae are used when dimensioning the bumpers. Geometrical dimensions are of secondary importance here. Stop bumpers are not to be used as vibration dampers or supports.

Safety, quality, and know-how are our main focus!

Modern production methods, constantly increasing working speeds, and increasing demands for ergonomic working environment, make greater demands on existing bumper systems. Due to the wide variety of available bumper designs, we can offer a solution for every application. We have a large standard range of rubber bumpers and cellular bumpers to provide for individual solutions. Special designs are always possible by request.

Applications:

- Travel limitation
- Energy absorption
- End stops
- End position dampening

Rubber Bumpers: Program 0170

Since rubber bumpers are made from cost-effective, basic materials, our program offers an economic solution for most technical requirements. The energy absorption of a rubber bumper is limited due to the compression limits of the material.

Rubber-Metal Elements: Program 0170

Rubber-metal elements are used to support dynamic loads and isolate them from vibration. As a rule, the rubber-metal elements in this catalog are calculated based on construction attributes, as opposed to energy absorption or vibrational characteristics, given their usual application as a support member and isolation element.

Cellular Bumpers: Program 0180

Due to their excellent energy absorption properties the cellular bumper program is a suitable complement to the rubber bumper program. Their volume compressibility allows long compression lengths and very good deceleration values.

Rubber Bumpers and Cellular Bumpers at a glance

- Highest dynamic and mechanical capacity
- Versatile resilience against demanding environmental conditions
- Compression travel up to 50% bumper height

- High energy absorption abilities make cellular bumpers a maintenance-free and inexpensive alternative to complex bumper systems.
- Low delay values and very good damping qualities
- Lightweight design
- Compression travel up to 80% bumper height

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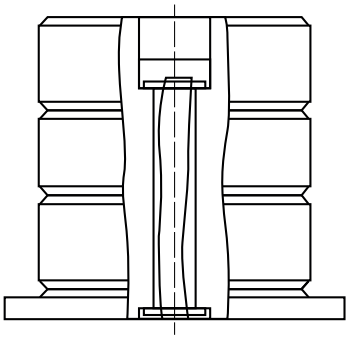
Fall Protection

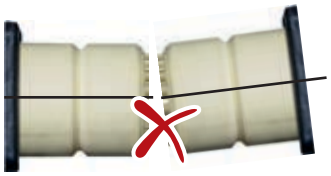
Accidental falling of the stop bumpers is prevented by safeguard measures – so-called "fall protection" – which provides comprehensive safety for man and machine. Cellular bumpers with integrated safety rope and form-fitting, foam-covered cap are used for installation heights > 3 m. Fall protection is a standard feature for all cellular bumpers. The reliable vulcanization process, permanently joining the fastening element to the rubber bumper body, adds to the overall safety of the bumpers.
We take special care when choosing the raw material for our bumpers, using only the best quality materials. This results in homogenous base compounds, very high durability, and consistently excellent energy absorption of the bumpers. Years of experience and continued development by the inventor of stop bumpers, Manfred Wampfler, still form the knowledge base of bumper manufacturing to this day.

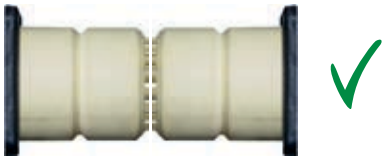


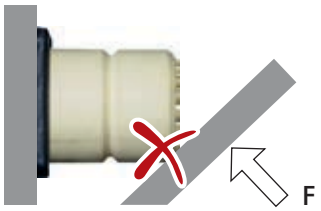
Integrated safety rope
(250 mm bumper diameter or higher)

Placement

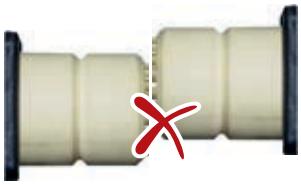
Mounting surfaces and counter-pressure surfaces must be level and parallel with the bumper. This avoids lateral forces and ensures a concentric, linear application of force and impact over the whole reception area of the bumpers.

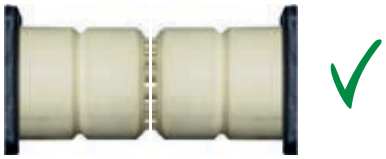






Vertical eccentricity of oppositely mounted bumpers must not be higher than 10% of the bumper's diameter:



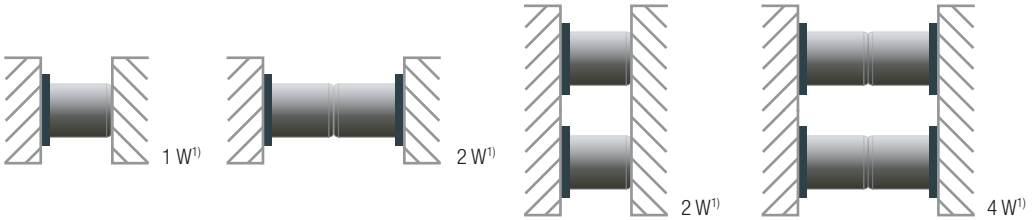


Rubber Bumpers / Cellular Bumpers
Program 0170 / 0180

Project Planning

- Determine the effective mass and impact velocity.
- Calculate the basic energy formula: **$W = \frac{1}{2} m \times v^2$** .
- Determine the energy distribution for each single bumper.
- Select the needed bumper (cellular or rubber material), depending on general requirements.
- Select the bumper geometry according to maximum bumper energy W_{max} from the tables on pages 11, 26, and 27 depending on bumper type.
- Calculate the expected compression length (from load diagrams – see catalog “Bumper Load Diagrams - Rubber (KAT0170-0003-US) or "Bumper Load Diagrams - Cellular (KAT0180-0001-US" on www.conductix.us
- Calculate the resulting reacting force
- Check the resulting deceleration

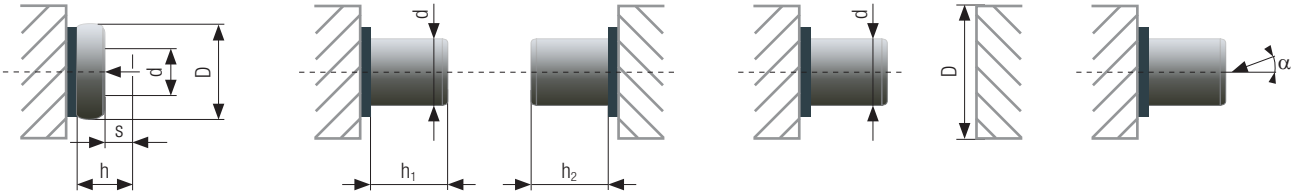
Possible Bumper Arrangements



1) Absorption of energy $W_{zul.}$

Bumper Loads

The load on the bumper has to be central and perpendicular to the bumper base plate. Do not weld the bumper base plate to the host surface. Use mounting screws according to DIN 6912 or DIN 7984.



Diameter expansion with maximum load:

- Rubber bumper:
  $s = 0.5\ h \triangleq D = 1.4\ d$
- Cellular bumper:
  $s = 0.5\ h \triangleq D = 1.25\ d$
  $s = 0.8\ h \triangleq D = 1.4\ d$

Bumper against bumper arrangement (cellular bumpers):

- Permissible:
  $h_1 + h_2 \leqq 2\ d$
- Not permissible:
  $h_1 + h_2 > 2\ d$

Because of variations in guiding and impact accuracy, the impact surface must be at least 25% greater than the bumper diameter: $D > 1.25\ d$

D = impact surface
d = bumper diameter

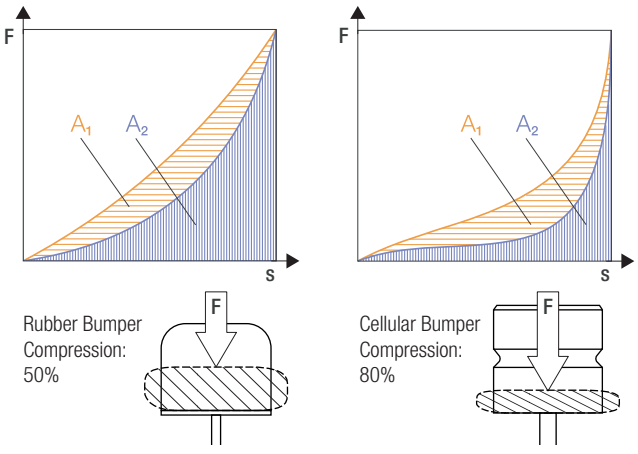
Impact direction:

$\alpha_{max} = \pm 4°$

The bumper characteristics are shown by the load-length curves. With rubber bumpers the shape of the curves mainly depends on the shape and the shore hardness.

With cellular bumpers, volumetric density is the decisive factor for their physical behavior. Due to the spring characteristic curve of rubber and cellular bumpers (load **F** depending on the compression length **s**) the bumper final pressures, which are required for the specification of the neighboring components, can only be determined with static tests.

A1 = energy loss (hysteresis)
A2 = restoring energy
A1 + A2 = energy absorbed by the bumper



Rubber Bumper
Compression:
50%

Cellular Bumper
Compression:
80%

Rubber Bumpers / Cellular Bumpers
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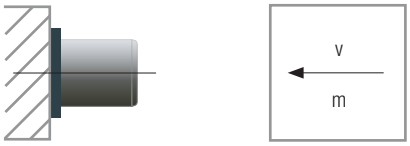
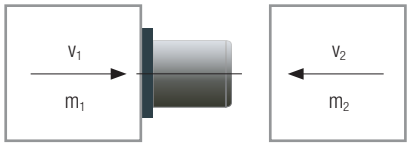
Basic Calculation Formulas

• Mass against limit stop



$W = \frac{1}{2} m \cdot v^2$

• Mass against mass

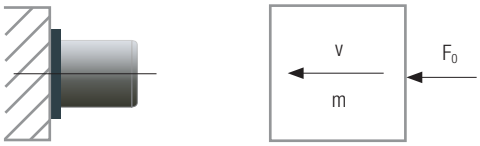


$$W = \frac{m_1 \cdot m_2 (v_1+v_2)^2}{2(m_1+m_2)}$$

$m_1 = m_2$ and $v_1 = v_2$

$W = m \cdot v^2$

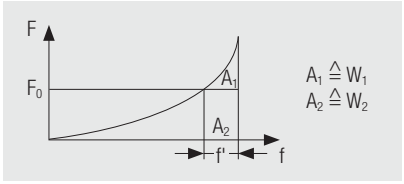
• Driven mass against limit stop



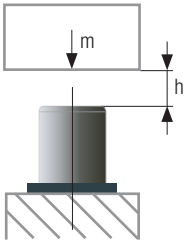
$W = \frac{1}{2} m \cdot v^2$

$W_2 = F_0 \cdot f'$

Bumper force-travel diagram

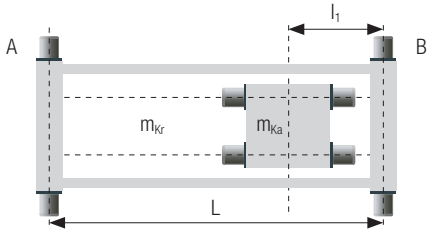


• Free fall (this formula does not apply for elevators)



$W = m \cdot g \cdot h$

• Calculation of bumpers for cranes



$W_B = \frac{1}{2} m_B \cdot v^2$

$$m_B = \frac{m_{Kr}}{2} + \frac{m_{Ka}(L-l_1)}{L}$$

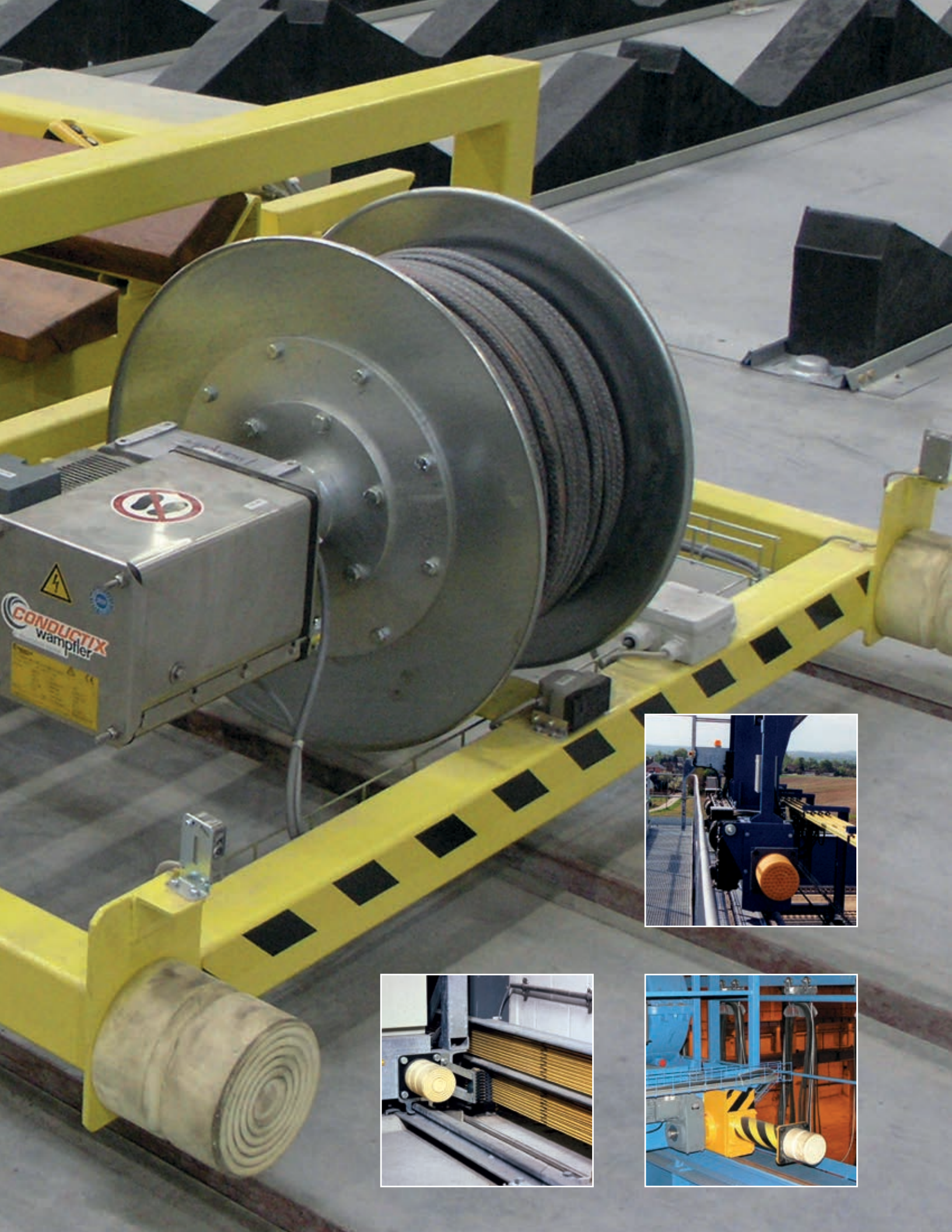
- Oscillating masses need not be taken into account
- Centrifugal moment of rotating parts must be taken into account
- Velocity must be reduced according to DIN 15018:
  v = 100% rated velocity on trolleys
  v = 85% rated velocity on cranes
  v = 70% rated velocity on cranes with brakes

• Formulas for calculating the deceleration

$$a_{mitt} = \frac{v^2}{2f}$$

$$a_{max} = \frac{F}{m}$$

a_{mitt}:	Median deceleration	(m/s^2)	h:	Drop height	(m)	m_B:	Mass on rail B	(kg)
a_{max}:	Maximum deceleration	(m/s^2)	L:	Rail spacing	(m)	v:	Velocity	(m/s)
F_0:	Driving force	(kN)	l:	Distance m_{Ka} to B	(m)	$v_{½}$:	Velocity body 1 / body 2	(m/s)
F:	Maximum bumper force	(kN)	m:	Mass	(kg)	w:	Kinetic energy	(kNm)
f:	Compression length	(mm)	m_{Kr}:	Mass crane without trolley	(kg)	w_1:	Kinetic energy	(kNm)
f':	Acting compression	(mm)	m_{Ka}:	Mass of trolley	(kg)	w_2:	Work acting through F_0	(kNm)
g:	Gravity acceleration	(9.81 m/s^2)	m_1/m_2:	Mass body 1 / body 2	(kg)	w_{zul}:	Max. energy absorption	(kNm)


CONDUCTIX
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Cellular Bumpers
Program 0180

General Information

Cellular bumpers have high absorption capacity with long compression lengths. This results in small end loads and favorable deceleration values. Cellular bumpers have a compression body made of cellular polyurethane elastomer with high structural stability. Their outstanding characteristic is their volume compressibility, which produces a short transverse elongation under pressure. Cellular bumpers are resistant to aliphatic hydrocarbons, such as oils and greases, as well as ozone, UV-radiation, and aging. Technically, you can expect generally high durability. When exposed to hydraulic oil, hot water, or water vapor over longer periods, the cellular body has limited durability. Cellular bumpers are not resistant to strong acids and leaches. The operating temperature is between -20ºC and +80ºC. Temporary temperature peaks of +100°C are practicable and do not harm the bumper. When exposed to -20°C the material becomes harder, but this does not affect the consistency of the material. The mounting structure must be flat and rigid. A mounting area of at least 1.5 x the diameter of the cellular bumper is required to accommodate the diameter increase of the bumper during compression.

Example Part Number

Part No.: **018121-080x040**

- **018121** – Bumper type
- **080** – Diameter d_1 [mm]
- **040** – Height h_1 [mm]

Application Examples

- Cranes
- Transfer cars
- Smelter and rolling mill machines
- Handling technology
- Plant construction and engineering
- Conveyor, transport and gate systems that are equipped with form-locking drives (e.g. chain or toothed rack).

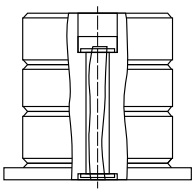
Conductix-Wampfler Standard Cellular Bumper Quality

Cellular polyurethane elastomer with a volumetric weight of 0.53 g/cm³

- Highly elastic and tear-resistant
- Aging resistant
- Material is volume compressible
- Operating temperature: -20°C to +80°C (characteristics may change depending on ambient temperature)

Fall Protection

We recommend using 018112 series bumpers for installation heights of 3 m or higher. All series 018112 bumpers have an integrated fall arresting device. Bumpers with diameters up to 200 mm have base plates made of glass fiber reinforced plastic and an integrated fall arresting device. Bumpers with diameters of 250 mm or higher (optionally from 200 mm) have primed steel base plates. These bumpers are glued to the base plate and have a fall arresting device in case of failure of the bond seam due to environmental conditions. For use as a safety component, please consider the applicable regulations for the final product and the recommendations from the risk analysis for this case. Bumpers should be replaced every five years for safety-relevant applications.



Quality Degrees

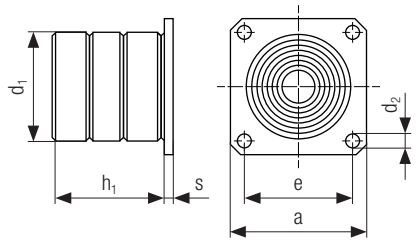
Abrasion resistance	++
Breaking elongation	++
Tear resistance	++
Rebound resistance	++
Tensile strength	++
Temperature resistance hot air	+80 °C
Temperature resistance coldness	-20 °C
Alkali resistance	○
Aging resistance	++

Gasoline resistance	○
Electrical insulation resistance	+
Oil and grease resistance	++
Ozone resistance	+++
Acid resistance	---
Hot water	+

Quality degrees of the individual material properties (depending on interactions and exposure time): +++ = Very good; ++ = Good; + = Satisfactory;
○ = Sufficient; -- = Deficient; --- = Insufficient
International abbreviation: PUR (cellular polyurethane elastomer)

Cellular Bumpers
Program 0180

Cellular Bumpers with Base Plate



With Plastic Base Plate

Part No.	W_{max} [kJ] static	W_{max} [kJ] 4 m/s**	F [kN]	Weight [kg]	d_1 [mm]	h_1 [mm]	a [mm]	d_2 [mm]	e [mm]	s [mm]	PU 1) [Qty.]
018112-080x040* +	0.37	0.80	31	0.4	80	40	110	ø 14	80	10	1
018112-080x080* +	0.70	1.52		0.6		80					1
018112-080x120* +	1.08	2.33		0.7		120					1
018112-100x050*	0.69	1.50	50	0.6	100	50	125		100		1
018112-100x100* +	1.42	3.10		0.9		100					1
018112-100x150* +	2.10	4.50		1.15		150					1
018112-125x063* +	1.33	2.90	65	1.2	125	63	160	ø 18	125	12	1
018112-125x125* +	2.61	5.70		1.65		125					1
018112-125x188* +	3.94	8.60		2.25		190					1
018112-160x080*	2.30	6.00	125	2.2	160	80	200		160		1
018112-160x160* +	4.70	11.40		3.1		160					1
018112-160x240* +	7.10	18.00		4.0		240					1
018112-200x100*	5.50	12.20	190	4.0	200	100	250	ø 22	200	14	1
018112-200x200* +	10.80	24.00		5.8		200					1
018112-200x300* +	15.80	35.00		7.5		300					1

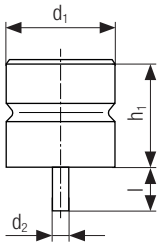
With Steel Base Plate

Part No.	W_{max} [kJ] static	W_{max} [kJ] 4 m/s**	F [kN]	Weight [kg]	d_1 [mm]	h_1 [mm]	a [mm]	d_2 [mm]	e [mm]	s [mm]	PU 1) [Qty.]
018112-200x200-A	10.80	24.00	190	5.8	200	200	250	ø 22	200	14	1
018112-200x300-A	15.80	35.00		7.5		300					1
018112-250x125*	10.54	23.00	275	12.9	250	125	315	ø 21	250	12	1
018112-250x250* +	21.13	46.00		16.2		250					1
018112-250x375*	31.71	69.00		19.6		375					1
018112-315x158*	13.30	47.00	650	22.2	315	158	400		315		1
018112-315x315*	26.60	93.00		29.0		315					1
018112-315x475	39.84	140.00		35.9		475					1
018112-400x200*	31.13	94.00	1050	43.8	400	200	500	ø 25	400	15	1
018112-400x400	50.00	190.00		57.6		400					1
018112-400x600	80.00	282.00		70.4		600					1
018112-500x250	50.00	190.00	1700	74.6	500	250	600		500		1
018112-500x500	100.00	370.00		101.1		500					1
018112-500x750	150.00	555.00		128.0		750					1
018112-600x300	87.50	317.00	2500	130.0	600	300	730		600	20	1
018112-600x600	175.00	633.00		176.0		600					1
018112-600x900	250.00	950.00		222.0		900					1

* Standard Range + Usually stocked in the USA 1) = Packing Unit = Minimum Order Quantity

Cellular Bumpers
Program 0180

With Threaded Bolt



Part No.	W_{max} [kJ]		F	Weight	d_1	h_1	d_2	l	PU [1]
	static	4 m/s**	[kN]	[kg]	[mm]	[mm]	[mm]	[mm]	[Qty.]
018121-080x040	0.37	0.80	31.5	0.21	80	40	M12	35	1
018121-080x080 +	0.7	1.52		0.31		80			1
018121-080x120 +	1.08	2.33		0.42		120			1
018121-100x050*	0.69	1.50	50	0.31	100	50	M12	35	1
018121-100x100*	1.42	3.10		0.52		100			1
018121-100x150*	2.10	4.50		0.72		150			1
018121-125x063*	1.33	2.90	65	0.51	125	63	M12	35	1
018121-125x125* +	2.61	5.70		0.91		125			1
018121-125x188*	3.94	8.60		1.32		188			1
018121-160x080*	2.30	6.00	125	0.95	160	80	M12	35	1
018121-160x160*	4.70	11.40		1.80		160			1
018121-160x240*	7.10	18.00		2.66		240			1
018121-200x100*	5.50	12.20	190	1.76	200	100	M12	35	1
018121-200x200*	10.80	24.00		3.43		200			1
018121-200x300*	15.80	35.00		5.09		300			1
018121-250x125*	10.54	23.00	275	5.40	250	125	M24	80	1
018121-250x250*	21.13	46.00		8.47		250			1
018121-250x375*	31.71	69.00		11.53		375			1
018121-315x158*	13.30	47.00	650	8.49	315	158	M24	80	1
018121-315x315*	26.60	93.00		14.64		315			1
018121-315x475	39.84	140.00		20.79		475			1
018121-400x200	31.13	94.00	1050	16.48	400	200	M30	80	1
018121-400x400	50.00	190.00		29.04		400			1

* Standard Range + Usually stocked in the USA 1) = Packing Unit = Minimum Order Quantity

Tolerances of cellular bumpers according to ISO 3302-1M3 ISO 3302-1M4

** Lower speeds reduce the maximum energy absorption. See Load Diagrams KAT0170-0003-US and KAT0180-0001-US on www.conductix.us.