OLEO INTERNATIONAL

LEADING THE WORLD IN ENERGY ABSORPTION

INDUSTRIAL
GAS HYDRAULIC PRODUCTS

INDUSTRIAL

OLEO INTERNATIONAL

Oleo are leading experts in energy absorption technology supplying solutions to the industrial, elevator and rail sectors.

Our ongoing investment in research and development ensures that we are continually updating our designs and introducing new products and services to our portfolio.

We are able to supply an energy absorption solution to suit any requirement – we provide solutions not just products.

We sell worldwide through our offices in the United Kingdom, China, India, Germany and the USA and through a wide range of distributors.

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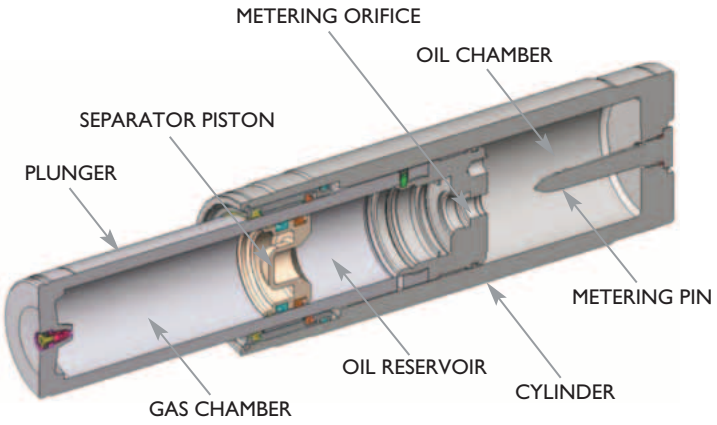
Oleo industrial buffers provide effective energy absorption solutions for a wide range of applications including dockside cranes, steelworks and rail infrastructure. Oleo has a presence in all major ports worldwide and with its network of distributors, can offer a complete consultancy service including after sales support.

What sets the Oleo gas hydraulic buffer above all other energy absorbers is their ability to dissipate over 95% of the impact energy, leading to controlled deceleration of moving equipment, whatever the speed of impact, keeping forces to a minimum and absorbing and dissipating virtually all the energy.

Recoil forces are kept to a minimum and are naturally damped in the reverse direction to protect ancillary systems such as transmissions and gearboxes.

HYDRAULIC OPERATING PRINCIPLE



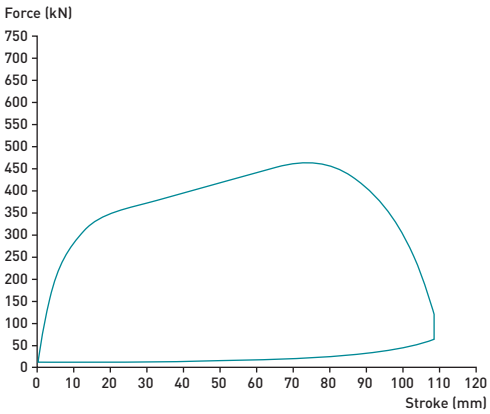
The illustration shows the robust construction of the Oleo hydraulic unit. Under impact the plunger is forced into the cylinder displacing oil through the orifice, moving the separator piston and compressing the gas. The compressed gas acts on the oil through the separator piston to give recoil force to re-extend the unit after impact. The energy absorbed and dissipated is dependent on the closure velocity.

When the plunger is forced into the cylinder rapidly, the oil displaced by the plunger has to pass through the orifice at very high velocity. This raises the pressure in the oil chamber to a level which optimises the closure force of the unit.

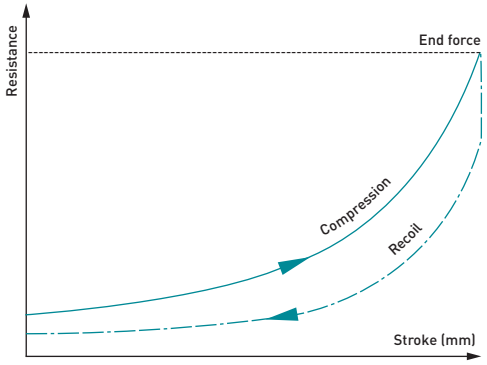
This optimisation process ensures that the impact energy is absorbed evenly throughout the plunger travel and thus maintaining a level impact force. This very useful feature is accomplished by Oleo's innovative metering designs which progressively alter the flow area as the unit closes. The actual metering designs are precisely calculated to provide the best possible protection.

The Oleo hydraulic unit therefore possesses the unique feature that its characteristics change according to operational needs. The majority of the impact energy is absorbed within the unit and the already low recoil force is damped by the reverse flow of oil, leaving very little energy and recoil force to be returned to the impacting vehicle.

DYNAMIC DIAGRAM

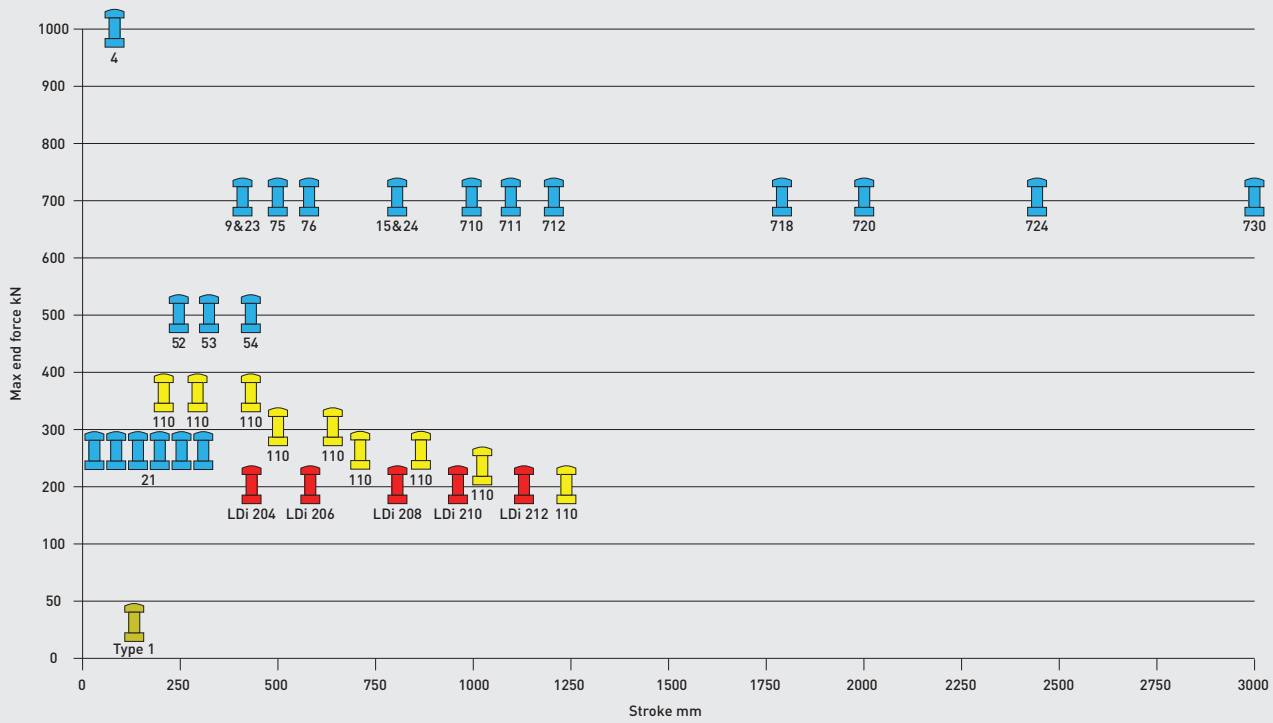


STATIC DIAGRAM



BUFFER SELECTION

Buffer range



The LDI range is suitable for light duty applications such as lower mass crane trolleys and stackers as well as automated warehouse equipment and order picking systems.

The Oleo heavy duty range, offers force and stroke characteristics to suit arduous applications such as required in steelworks, on dockside cranes and for use in end stops solutions, allowing safe operation of high mass moving equipment while protecting it from impact shocks.

The Type 1 is Oleo's solution for the low energy absorption market, positioned within Oleo's product range and suitable for applications such as small gantry cranes, warehouses and steel mills.

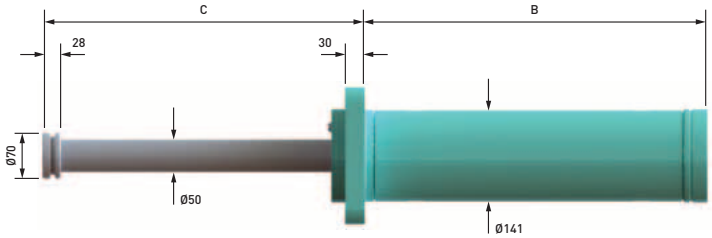
The 110 range is a modular design offering cost effective impact protection for a wide range of applications.

LDi RANGE 200 SERIES

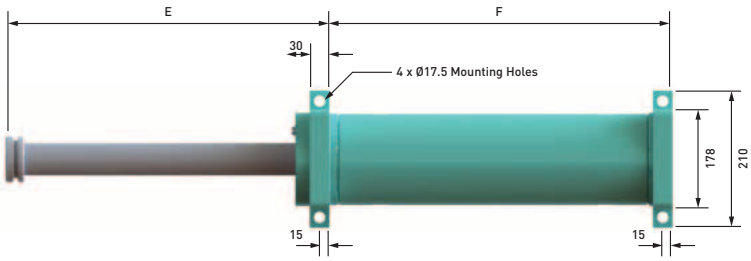
The LDi range are lighter duty buffers employing the same hydraulic principle as the heavier duty buffer range, but used for lighter applications in a wide variety of industrial solutions.

The LDi Range was originally developed for warehouse use as the units can fully stroke under low load, which enables the buffer to completely close when the trolley or stacker is driven to the end of the aisle. These buffers can also be found on trolleys, on smaller STS cranes (STS = ship to shore) and have a range of 400mm – 1200mm.

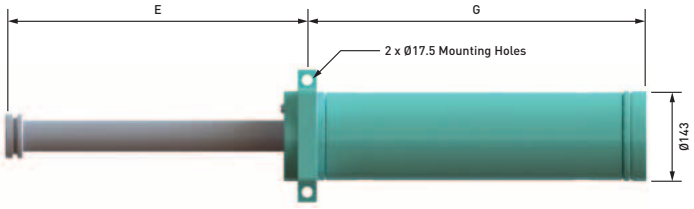
FRONT FLANGE MOUNTING



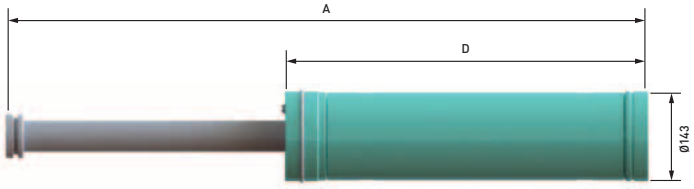
FOOT MOUNTING



FRONT FOOT AND BACK SUPPORT MOUNTING



CAPSULE/BACK MOUNTING



Dimensions

Model	204	206	208	210	212
A	1022	1447	1872	2297	2722
B	527	752	977	1202	1427
C	495	695	895	1095	1295
D	578	803	1028	1253	1478
E	481	681	881	1081	1281
F	526	751	976	1201	1426
G	541	766	991	1216	1441

All dimensions are in mm

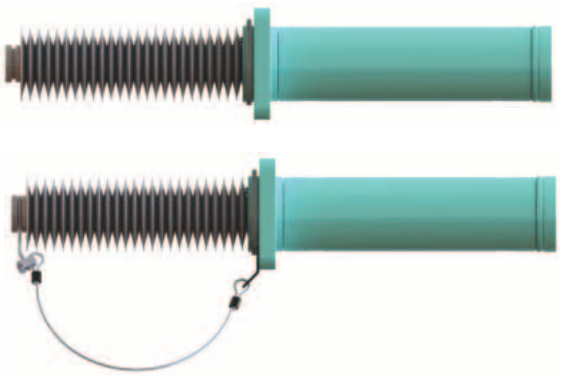
Note: The buffer cylinder requires a clearance hole of Ø146mm

Note: Foot mounted units should have a backstop as buffer loads should not be exerted through foot mounting bolts alone.

Buffers should not be incorporated in applications with side loading without consulting your Oleo representative. For buffer applications and arrangements outside of the scope listed above please contact your Oleo representative.

Performance

Model	204	206	208	210	212
Stroke (mm)	400	600	800	1000	1200
Maximum Capacity (kJ)	68	102	136	170	204
Maximum End Force (kN)	200	200	200	200	200
Closure Force (kN)	2	2	2	2	2



RANGE OVERVIEW HEAVY DUTY SERIES

	Buffer Range	21	21	21	21	21	21	52	53	54	9	23	15	24	75	76	710	711	712	718	720	724	730	4
Energy to be absorbed/ buffer (kJ)	Maximum Permissible End Force kN	250	250	250	250	250	250	500	500	500	700	700	700	700	700	700	700	700	700	700	700	700	700	1000
	Stroke mm	50	100	150	200	250	300	250	300	400	400	400	800	800	500	600	1000	1100	1200	1800	2000	2400	3000	114
1	Forces Generated Per Buffer kN	27	13																			12		
2.5		67	33	22	17	13	11	13	11															29
5		133	67	44	33	27	22	27	22	17	17	17			13	11								58
10			133	89	67	53	44	53	44	33	33	33	17	17	27	22	13	12	11					117
20				178	133	107	89	107	89	67	67	67	33	33	53	44	27	24	22	15	13	11		234
30					200	160	133	160	133	100	100	100	50	50	80	67	40	36	33	22	20	17	13	351
40						213	178	213	178	133	133	133	67	67	107	89	53	48	44	30	27	22	18	468
50							222	267	222	167	167	167	83	83	133	111	67	61	56	37	33	28	22	585
60								320	267	200	200	200	100	100	160	133	80	73	67	44	40	33	27	702
80								427	356	267	267	267	133	133	213	178	107	97	89	59	53	44	36	936
100									444	333	333	333	167	167	267	222	133	121	111	74	67	56	44	
150										500	500	500	250	250	400	333	200	182	167	111	100	83	67	
200											667	667	333	333	533	444	267	242	222	148	133	111	89	
300													500	500		667	400	364	333	222	200	167	133	
350													583	583			467	424	389	259	233	194	156	
400													667	667			533	485	444	296	267	222	178	
450																	600	545	500	333	300	250	200	
Outline Dimensions	L1	260	420	582	700	867	1003	872	1006.5	1277	1205	1257	2385	2487	1620	1720	3218	3318	3418	5265	5980	6952	8625	546
	L1 (Bellows)	260	420	582	700	867	1003						*2464	2566			*3297	*3397	*3497					
	L2	133	183	233	360	409	459	528	577	677	678	728	905	950	832	932	1160	1260	1360	2183	2270	2805	3358	235
	L2 (Bellows)	153	213	273	380	429	479						*984	1029			*1239	*1339	*1439					
	L3	127	237	349	340			345	429.5	600	527	529	1480	1537	788	788	2058	2058	2058					311
	L3 (Bellows)	107	207	309	320								1480	1537			2058	2058	2058	3082	3710	4147	5267	
	D1	100/125						140/180			140/200		200		140/200		200			200/250				140/330
	D2	95						123			140		180		144		180			275				146
	A	120						210					215/209.6		210		215/209.6			280				210
	B	150						270					300		270		300			364				270
	D3	18						26					32		26		32			32				26

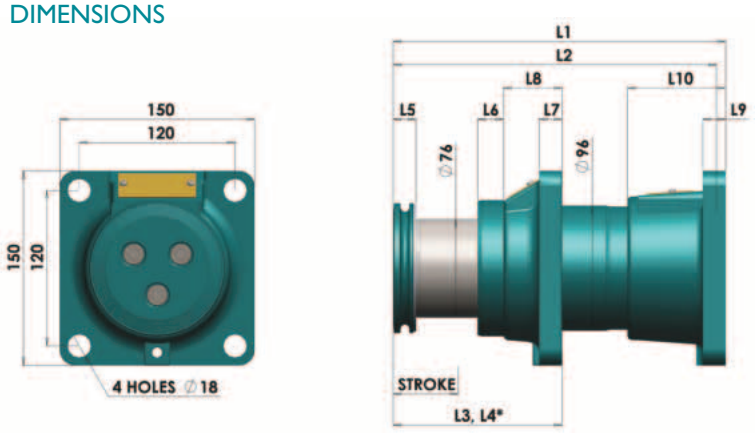
Recommended minimum space for installation is D2 + 5mm
Additional space for chamfer 20mm x 45°
The given endforce includes efficiency factor ξ = 0.75
All measurements in mm

* = Non standard units

TYPE 21

There are six different buffer units available for the Type 21 ranging from 50mm to 300mm. The Type 21 is a small unit with a lower capacity than other Oleo buffers so would generally be found on smaller cranes. These buffers are also used in steel mills as a stopper for hot slab works using multiple units.

DIMENSIONS



Static data

Type 21 Max force 250 kN

Type	21/50	21/100	21/150	21/200	21/250	21/300
Stroke (S) (mm)	50	100	150	200	250	300
Dynamic Capacity kJ	10	20	30	40	50	60
Max permissible End Force kN	250	250	250	250	250	250
Static Start Force kN	3	3	3	3	3	3
Static End Force kN	16	15	14	24	22	22

TYPE 21

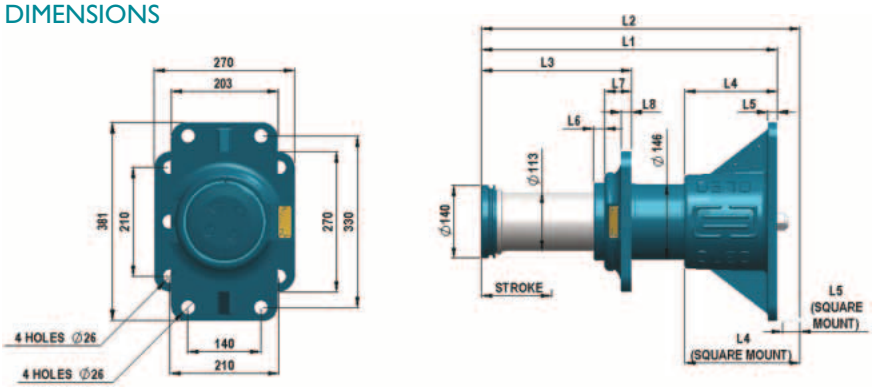
Type	21/50	21/100	21/150	21/200	21/250	21/300
Dynamic Capacity kJ	10	20	30	40	50	60
Maximum Permissible Impact Force kN	250	250	250	250	250	250
Capsule Unit (MCS) Weight (kg)	8	11	14	16	20	22
Back Mounted Unit (MBS) Weight (kg)	11	14	20	22	25	28
Front Mounted Unit (MFS) Weight (kg)	11	14	17	20	23	26
Stroke (S) (mm)	50	100	150	200	250	300
L1(mm)	260	420	582	700	867	1003
L3 (mm)	133	183	233	360	409	459
L4 (mm) *Only with protective bellows	153	213	273	380	429	479
L5 (mm)	18	18	18	64	64	64
L6 (mm)	20	20	20	20	20	20
L6 (mm) *with protective bellows	40	50	60	40	40	40
L7 (mm)	17.5	17.5	17.5	17.5	17.5	17.5
L8 (mm)	45	45	45	75	75	75
L9 (mm)	17.5	17.5	17.5	17.5	22	22
L10 (mm)	75	75	118	118	118	118
Impact weight (we)	**Metering Pin Code (xxx)**					
Up to 1.7 tonnes	051	101	151	201	251	301
Up to 3.5 tonnes	052	102	152	202	252	302
Up to 7 tonnes	053	103	153	203	253	303
Up to 13 tonnes	054	104	154	204	254	304
Up to 25 tonnes	055	105	155	205	255	305
Up to 50 tonnes	**056**	**106**	**156**	**206**	**256**	**306**
Up to 100 tonnes	**057**	**107**	**157**	**207**	**257**	**307**
Up to 200 tonnes	**058**	**108**	**158**	**208**	**258**	**308**
Up to 400 tonnes	**059**	**109**	**159**	**209**	**259**	**309**
Up to 800 tonnes	**–**	**110**	**–**	**210**	**–**	**310**

Bold denotes high mass pin range

TYPE 4

The Type 4 is a high capacity, short stroke unit. This was one of the first industrial buffers to be developed by Oleo which evolved from a Type 4 rail buffer. It has a very long life and it is not uncommon to find Type 4 units still in use which are over 25 years old. The Type 4 buffers can be used in various business sectors but traditionally are used in steel works. These buffers are also used on drawbridge applications, car dumpers where coal is being transported and in stacker re-claimers where high masses are moving very slowly.

DIMENSIONS



Static data

Type 4 Max force 1000 kN	
Type	**4**
Stroke (S) (mm)	114
Dynamic Capacity kJ	91
Max permissible End Force kN	1000
Static Start Force kN	12
Static End Force kN	120

Design Range Tonnes	Metering Pin Code (xx)
1 - 4	02
4 - 10	04
10 - 20	05
20 - 40	07
40 - 80	08
80 - 125	10
125 - 300	**12**
300 - 750	**16**
750 - 1500	**18**

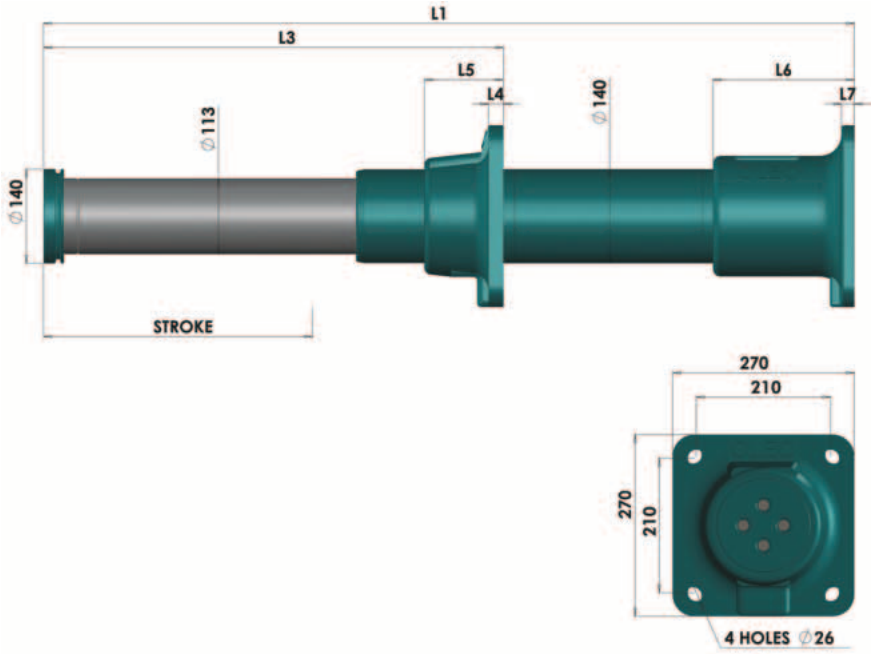
Bold denotes high mass pin range

Type	4
Dynamic Capacity kJ	91
Maximum Permissible Impact Force kN	1000
Capsule Unit (MCZ) Weight (kg)	38.3
Back Mounted Unit (MBZ) Weight (kg)	64.3
Back Mounted Unit (MBZ) Weight (kg)	61.3
Front Mounted Unit MFZ) Weight (kg)	50.3
Stroke (S) (mm)	114
L1 (mm) *rear mounting rectangular	515
L2 (mm) *rear mounting square	546
L3 (mm)	235
L4 (mm) *rear mounting rectangular	178
L4 (mm) *rear mounting square	209
L5 (mm) *rear mounting rectangular	19
L5 (mm) *rear mounting square	22
L6 (mm)	21
L7 (mm)	61
L8 (mm)	20

TYPE 9

The Type 9 was initially developed for overhead cranes in steel mills it is a high capacity, long life unit. The Type 9 is now typically used on dockside cranes and for end stops. Type 9's have been used on specialised applications on the water such as wave power converters using special water tight seals and stainless steel parts for anti corrosion.

DIMENSIONS



Design Range Tonnes	Metering Pin Code (xx)
1 - 4	02
4 - 10	04
10 - 20	05
20 - 40	07
40 - 80	08
80 - 125	10
125 - 300	**12**
300 - 600	**15**
600 - 1000	**19**
1000 - 2000	**22**

Bold denotes high mass pin range

Static data

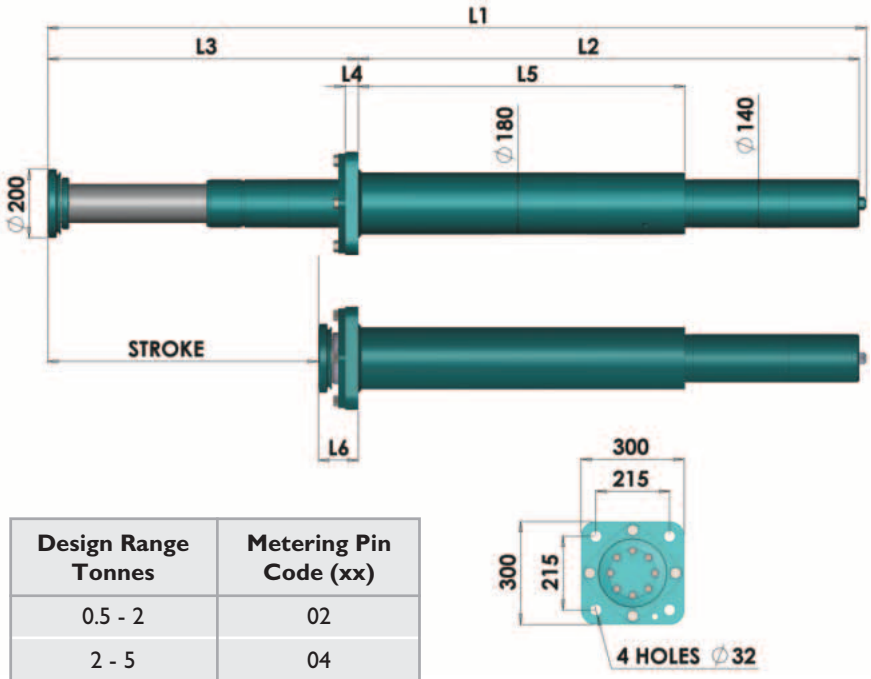
Type 9 Max force 700 kN	
Type	**9**
Stroke (S) (mm)	400
Dynamic Capacity kJ	224
Max permissible End Force kN	700
Static Start Force kN	12
Static End Force kN	155

Type	**9**
Dynamic Capacity kJ	224
Maximum Permissible Impact Force kN	700
Capsule Unit (MCZ) Weight (kg)	62
Back Mounted Unit (MBS) Weight (kg)	87
Front Mounted Unit (MFS) Weight (kg)	78
Stroke (S) (mm)	400
L1(mm)	1205
L3 (mm)	678
L4 (mm)	19
L5 (mm)	114
L6 (mm)	210
L7 (mm)	19

TYPE 15

Type 15's combines two type 9 units in series – typically used as end stops for either rail or crane applications on both dockside and offshore applications.

DIMENSIONS



Design Range Tonnes	Metering Pin Code (xx)
0.5 - 2	02
2 - 5	04
5 - 10	05
10 - 20	07
20 - 40	08
40 - 60	10
60 - 150	**12**
150 - 300	**15**
300 - 500	**19**
500 - 1000	**22**

Bold denotes high mass pin range

Type	15
Dynamic Capacity kJ	448
Maximum Permissible Impact Force kN	700
Front Mounted Unit (MMO) Weight (kg)	195
Stroke (S) (mm)	800
L1 (mm)	2385
L2 (mm)	1459
L3 (mm)	905
L4 (mm)	38
L5 (mm)	944
L6 (mm)	105

Static data

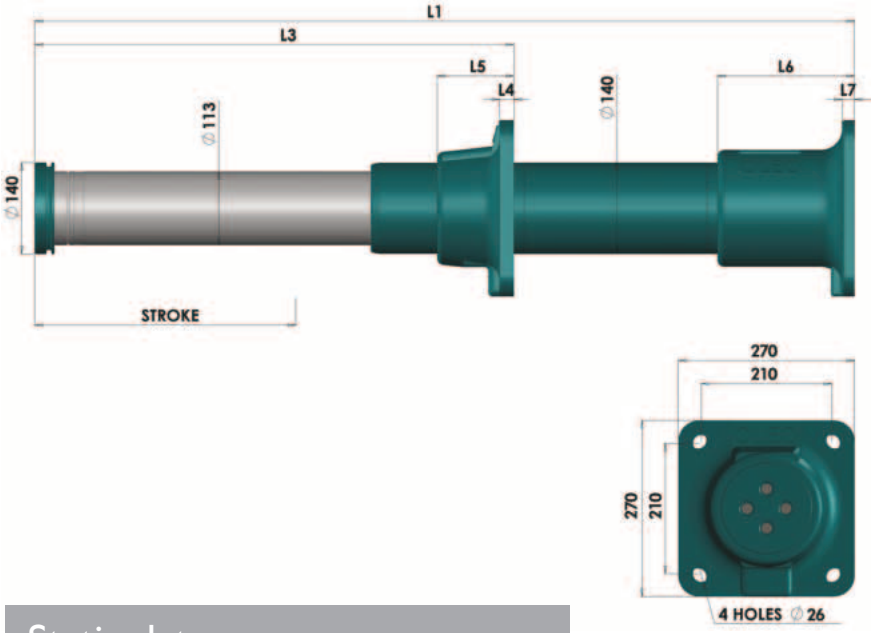
Type 15 Max force 700 kN	
Type	**15**
Stroke (S) (mm)	800
Dynamic Capacity kJ	448
Max permissible End Force kN	700
Static Start Force kN	12
Static End Force kN	155

TYPE 23

The Type 23 is a slightly longer version of the type 9, which allows the static end force to be reduced for applications where the buffer needs to be fully compressed at low speeds.

Type 23 was initially developed for overhead cranes in steel mills it is a high capacity, long life unit. The Type 23 is now typically used on dockside cranes.

DIMENSIONS



Static data

Type 23 Max force 700 kN	
Type	**23**
Stroke (S) (mm)	400
Dynamic Capacity kJ	224
Max permissible End Force kN	700
Static Start Force kN	12
Static End Force kN	85

Design Range Tonnes	Metering Pin Code (xx)
1 - 4	02
4 - 10	04
10 - 20	05
20 - 40	07
40 - 80	08
80 - 125	10
125 - 300	**12**
300 - 600	**15**
600 - 1000	**19**
1000 - 2000	**22**

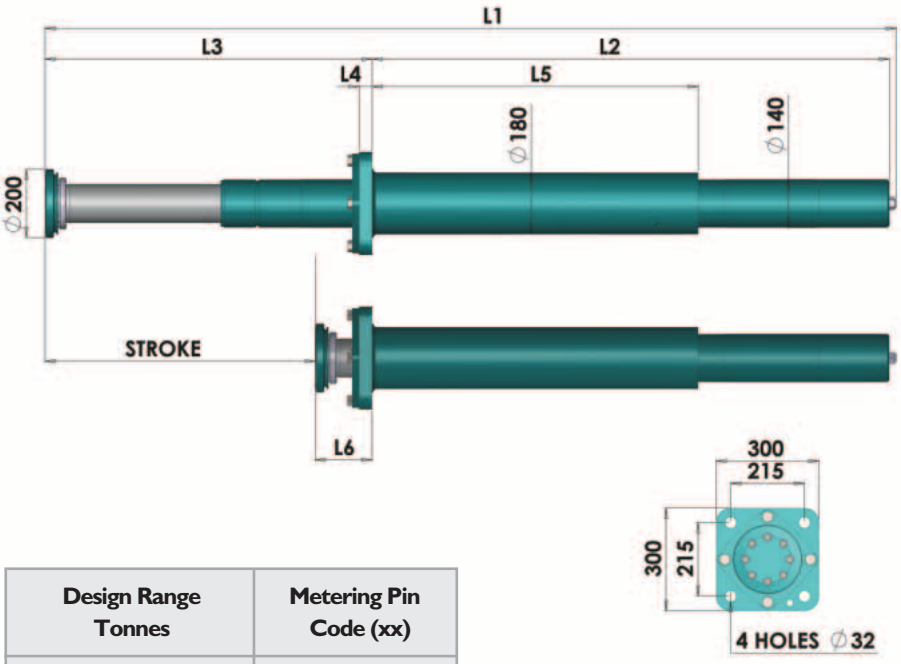
Bold denotes high mass pin range

Type	23
Dynamic Capacity kJ	224
Maximum Permissible Impact Force kN	700
Capsule Unit (MCZ) Weight (kg)	63
Back Mounted Unit (MBS) Weight (kg)	88
Front Mounted Unit (MFS) Weight (kg)	79
Stroke (S) (mm)	400
L1(mm)	1257
L3 (mm)	728
L4 (mm)	19
L5 (mm)	114
L6 (mm)	210
L7 (mm)	19

TYPE 24

Type 24's combine two Type 23 units in series – typically used as end stops for either rail or crane applications on both dock side and offshore applications.

DIMENSIONS



Design Range Tonnes	Metering Pin Code (xx)
0.5 - 2	02
2 - 5	04
5 - 10	05
10 - 20	07
20 - 40	08
40 - 60	10
60 - 150	**12**
150 - 300	**15**
300 - 500	**19**
500 - 1000	**22**

Bold denotes high mass pin range

Type	24
Dynamic Capacity kJ	448
Maximum Permissible Impact Force kN	700
Front Mounted Unit (MMO) Weight (kg)	197
Stroke (S) (mm)	800
L1 (mm)	2487
L2 (mm)	1516
L3 (mm)	950
L4 (mm)	38
L5 (mm)	962
L6 (mm)	150

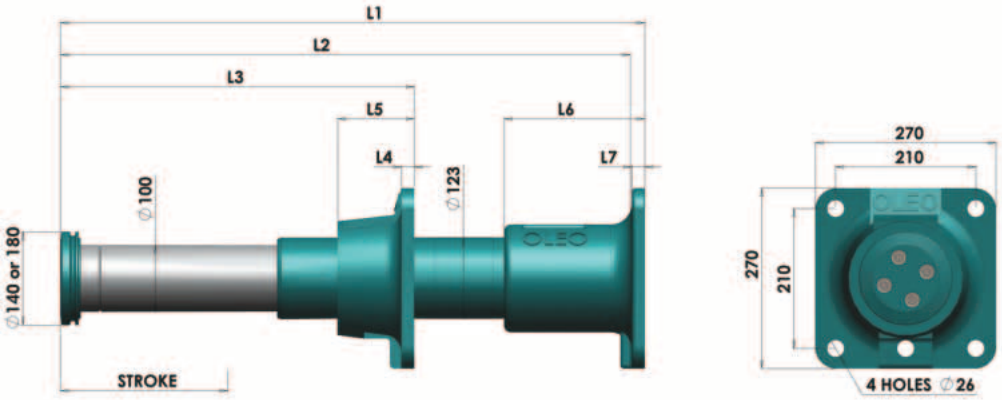
Static data

Type 24 Max force 700 kN	
Type	**24**
Stroke (S) (mm)	800
Dynamic Capacity kJ	448
Max permissible End Force kN	700
Static Start Force kN	12
Static End Force kN	85

TYPE 50

Like the Type 9 the Type 50 can be used in applications such as overhead cranes in steel mills or on dockside cranes. The type 50 is rated to a lower max. force and, has a lower end force with strokes of 250mm, 300mm and 400mm. These are typically used on the main boom and main trolley on large STS cranes.

DIMENSIONS



Static data

Type 50 Max force 500 kN			
Type	**52**	**53**	**54**
Stroke (S) (mm)	250	300	400
Dynamic Capacity kJ	100	120	160
Max permissible End Force kN	500	500	500
Static Start Force kN	5	5	5
Static End Force kN	60	60	60

Type	52	53	54
Dynamic Capacity kJ	100	120	160
Maximum Permissible Impact Force kN	500	500	500
Capsule Unit (MCS) Weight (kg)	39	44	53
Back Mounted Unit (MBS) Weight (kg)	63	67	76
Front Mounted Unit (MFS) Weight (kg)	59	63	72
Stroke (S) (mm)	250	300	400
L1(mm)	872	1006.5	1277
L2 (mm)	850.5	985	1255.5
L3 (mm)	527.5	577	677
L4 (mm)	19	19	19
L5 (mm)	114	114	114
L6 (mm)	210	210	210
L7 (mm)	19	19	19

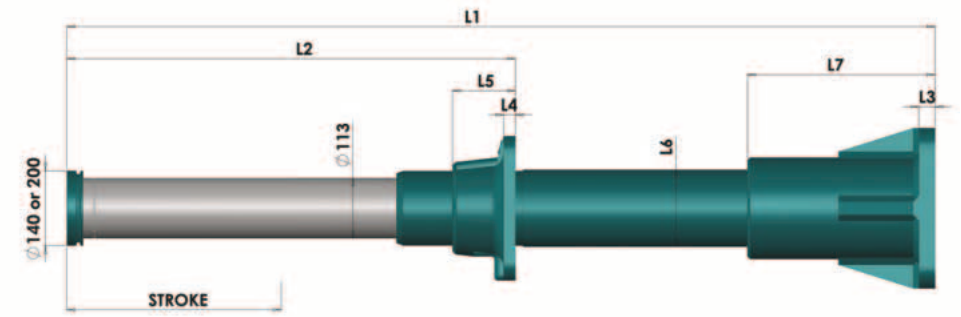
Design Range Tonnes	Metering Pin Code (xxx)		
1 - 2.5	202	302	402
2.5 - 5	203	303	403
5 - 10	204	304	404
10 - 20	205	305	405
20 - 40	207	307	407
40 - 80	208	308	408
80 - 150	210	310	410
150 - 300	**212**	**312**	**412**
300 - 600	**215**	**315**	**415**
600 - 1000	**219**	**319**	**419**
1000 - 2000	**222**	**322**	**422**

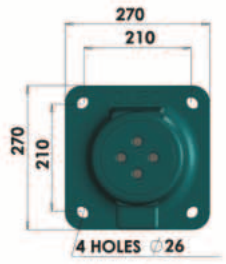
Bold denotes high mass pin range

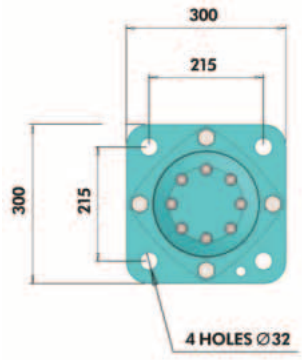
TYPE 70

The Type 70 buffer is a long stroke 700kN buffer available with 500mm and 600mm stroke. These are typically used on dockside cranes and in steel mills. The Type 70 buffers are also used on mining applications as they can be used vertically. They have also been used as end stops for funicular railways as they have the ability to be set at an angle.

DIMENSIONS







Static data

Type 70 series Max force 700 kN		
Type	**75**	**76**
Stroke (S) (mm)	500	600
Dynamic Capacity kJ	280	336
Max permissible End Force kN	700	700
Static Start Force kN	12	12
Static End Force kN	55	150

Type	75	76
Dynamic Capacity kJ	280	336
Maximum Permissible Impact Force kN	700	700
Capsule Unit (MCZ) Weight (kg)	87	88
Back Mounted Unit (MBZ) Weight (kg)	144	145
Front Mounted Unit (MFZ) Weight (kg)	102	103
Stroke (S) (mm)	500	600
L1 (mm)	1599	1699
L1 (mm) - Back mounted	1620	1720
L2 (mm)	832	932
L3 (mm)	30	30
L4 (mm)	19	19
L5 (mm)	114	114
L6 (mm)	144	144
L7 (mm)	350	350

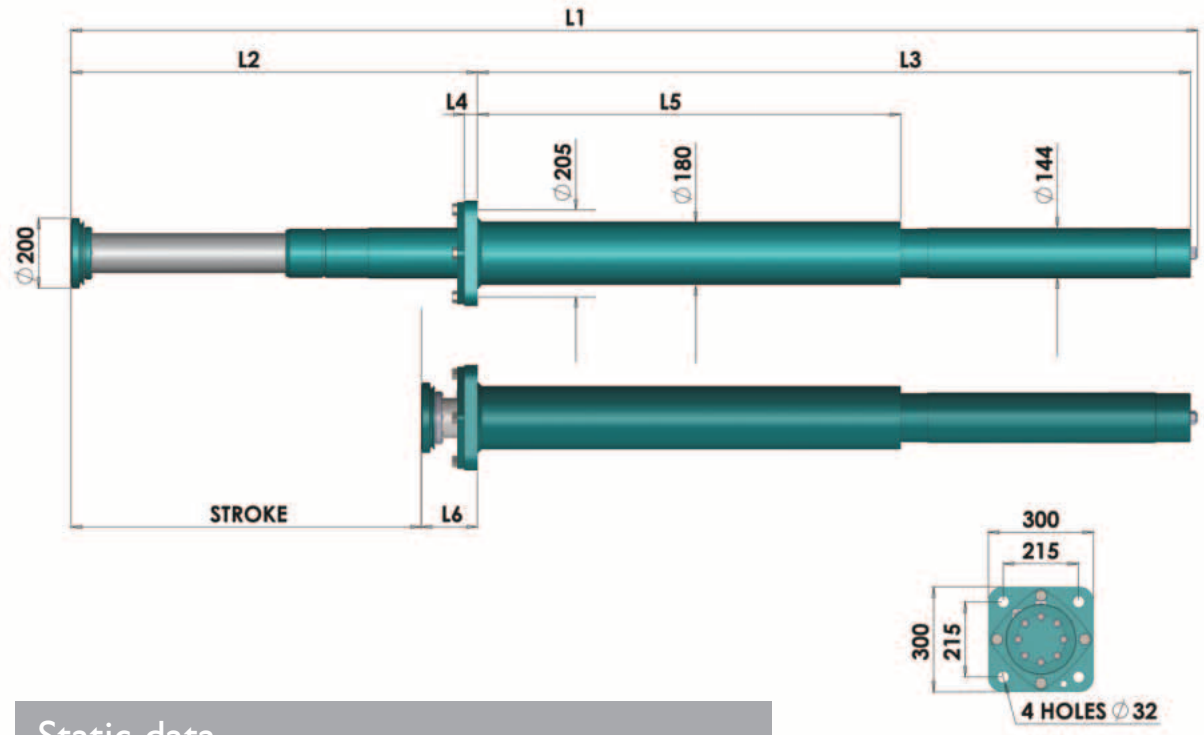
Design Range Tonnes	Metering Pin Code (xxx)	
2.5 - 5	503	603
5 - 10	504	604
10 - 20	505	605
20 - 40	507	607
40 - 80	508	608
80 - 150	510	610
150 - 300	**512**	**612**
300 - 600	**515**	**615**
600 - 1000	**519**	**619**
1000 - 2000	**522**	**622**

Bold denotes high mass pin range

TYPE 700

These Type 700 buffers are multiple units of Type 70 buffers used in series – typically used as end stops for either rail or crane applications on both dockside and offshore applications. The Type 700 is now a popular choice for dockside cranes as these are becoming faster and larger and need a more robust buffer for energy absorption.

DIMENSIONS



Static data

Type 700 Max force 700 kN

Type	710	711	712
Stroke (S) (mm)	1000	1100	1200
Dynamic Capacity kJ	560	616	672
Max permissible End Force kN	700	700	700
Static Start Force kN	12	12	12
Static End Force kN	55	145	145

Type	710	711	712
Dynamic Capacity kJ	560	616	672
Maximum Permissible Impact Force kN	700	700	700
Front Mounted Unit (MMO) Weight (kg)	244	245	246
Stroke (S) (mm)	1000	1100	1200
L1(mm)	3218	3318	3418
L2 (mm)	1160	1260	1360
L3 (mm)	2037	2037	2037
L4 (mm)	37.5	37.5	37.5
L5 (mm)	1208	1208	1208
L6 (mm)	160	160	160

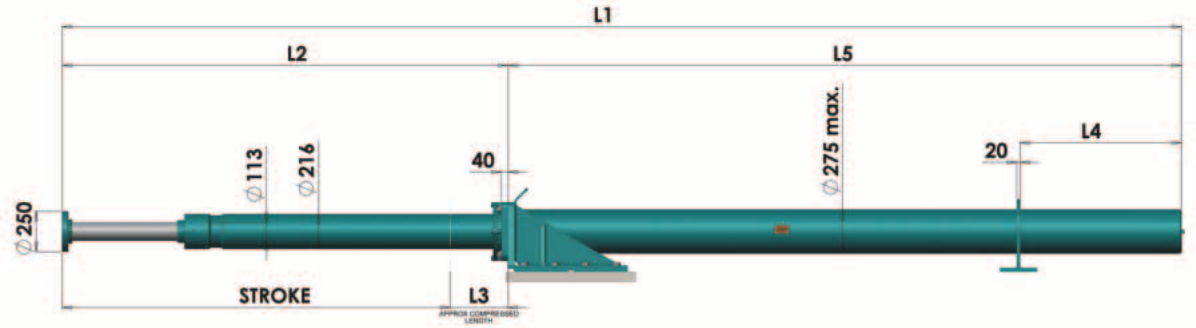
Design Range Tonnes	Metering Pin Code (xxxx)		
2.5 - 5	1004	1104	1204
5 - 10	1005	1105	1205
10 - 20	1007	1107	1207
20 - 40	1008	1108	1208
40 - 75	1010	1110	1210
75 - 150	**1012**	**1112**	**1212**
150 - 300	**1015**	**1115**	**1215**
300 - 500	**1019**	**1119**	**1219**
500 - 1000	**1022**	**1122**	**1222**
1000 - 2000	**1024**	**1124**	**1224**

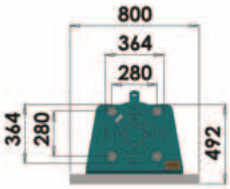
Bold denotes high mass pin range

TYPE 700

These buffers are traditionally used as end stops and made up of multiple Type 70 units which are housed in a casing. They can be either mounted on a fabrication or on a reinforced concrete block. These long stroke buffers are usually used in conjunction with a buffing trolley to protect them from damaging offset loads.

DIMENSIONS





Static data

Type 700 series Max force 700 kN				
Type	**718**	**720**	**724**	**730**
Stroke (S) (mm)	1800	2000	2400	3000
Dynamic Capacity kJ	1008	1120	1344	1680
Max permissible End Force kN	700	700	700	700
Static Start Force kN	12	12	12	12
Static End Force kN	150	55	150	150

Type	718	720	724	730
Dynamic Capacity kJ	1008	1120	1344	1680
Maximum Permissible Impact Force kN	700	700	700	700
Foot Mounted Unit (MMO) Weight (kg)	–	1500	2288	2345
Front Mounted Unit (MMO) Weight (kg)	1090	–	1692	1749
Stroke (S) (mm)	1800	2000	2400	3000
L1(mm)	5265	5980	6952	8625
L2 (mm)	2199	2270	2770	3358
L3 (mm)	402	269	356	358
L4 (mm)	550	1000	1000	1000
L5 (mm)	3066	3710	4187	5267

TYPE 1

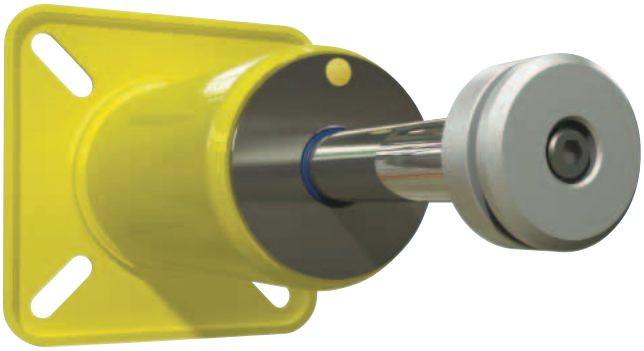
Oleo's solution for the low energy absorption market, this is our lowest priced and lowest energy capacity buffer. A stock buffer with a low lead time and competitive price.

The new cost effective design is competitive for <4kJ applications and has a 100mm stroke

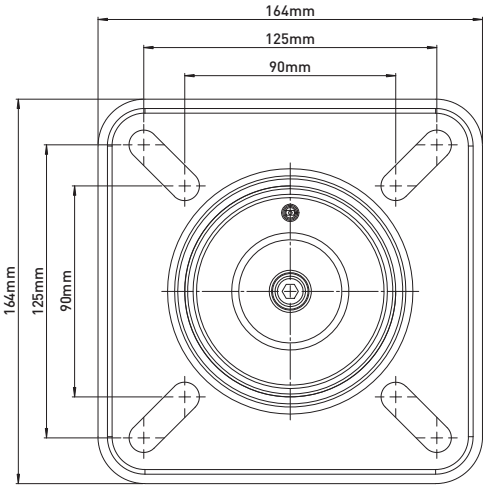
The Type 1 is positioned within Oleo's product range and is suitable for lower energy applications, such as small gantry cranes, warehouses and steel mills.

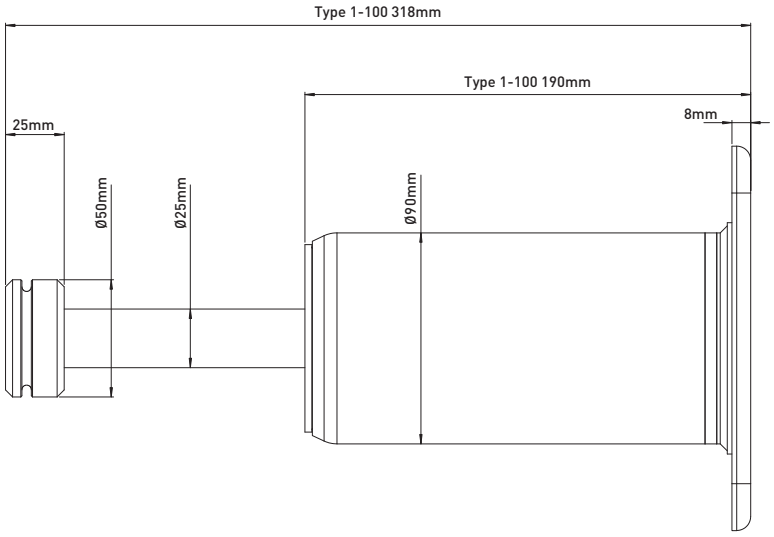
Technology Innovation

- New design allows same reliability and efficiency advantages of gas-hydraulics but on a smaller scale
- Bellows option is cheaper than for other Oleo ranges but offers the same protection
- Compatible with a variety of existing mounting holes



Model	Type 1
Dimensions	318 x 164 x 164 mm
Max. End Force	50 kN
Energy Capacity	3.5 kJ
Stroke	100 mm
Max Side Angle	3.5°
Cycling Durability	≥Type 21

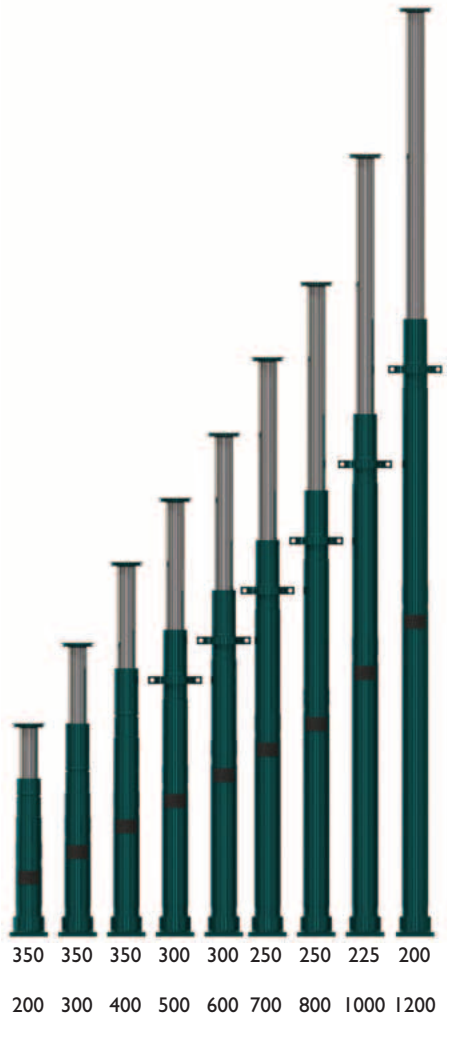




RANGE OVERVIEW 110 SERIES

110 series

Energy to be absorbed/ buffer (kJ)	Buffer Range	200	300	400	500	600	700	800	1000	1200
	Maximum Possible Force kN	350	350	350	300	300	250	250	225	200
	Stroke mm	200	300	400	500	600	700	800	1000	1200
1		7	4	3	3	2	2	2	1	1
2.5		17	11	8	7	6	5	4	3	3
5		33	22	17	13	11	10	8	7	6
10		67	44	33	27	22	19	17	13	11
20		133	89	67	53	44	38	33	27	22
30		200	133	100	80	67	57	50	40	33
40		267	178	133	107	89	76	67	53	44
50	Forces	333	222	167	133	111	95	83	67	56
60	Generates Per		267	200	160	133	114	100	80	67
80	Buffer kN			267	213	178	152	133	107	89
100				333	267	222	190	167	133	111
150								250	200	167



The type 110 buffer is a highly modular design allowing the same components to be used in a variety of applications.

The type 110 buffer comes with a standard chrome finish for non corrosive environments such as factory buildings and optional marine plating for more corrosive environments such as docksides and ports.

The type 110 is specified for the following usage:

- 3,500 cycles at 10% of rated load (corresponds with a daily impact of the unit at 10 years life)
- 500 cycles at 50% of rated load (corresponds with a weekly impact at 10 years life)
- 12 cycles at full load, which is the equivalent of:
  - One installation test
  - One test every year for 10 years
  - One emergency operation
- Operating temperature range of -30°C to +100°C.

Performance chart

Stroke mm	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**1000**	**1200**
Maximum End Force kN	350	350	350	300	300	250	250	225	200
Angle of Impact (Code F, D, T)	2.5°	2.5°	2.5°	2.0°	2.0°	2.0°	2.0°	1.5°	1.5°
Angle of Impact (Code B)	1.5°	1.5°	1.5°	N/A	N/A	N/A	N/A	N/A	N/A
Head Diameter mm	130	130	130	130	130	130	130	130	130
Maximum Absorbed Energy kJ	53	78	105	112	135	131	150	170	180

TYPE 110

Stroke	Free Length				Bracket												Mass (kg)
S	Where bellows are fitted L11 and L12 apply, otherwise L1 and L2 apply				L3	L4	L5	L6	L7	L8	L9	L10	L13	L14	L15	L16	Capsule only
	L1	L11	L2	L12													
200	839	849	360	370	139	539	474	75	18	79	18	30	15	76	30	21	28.7
300	1155	1165	578	588	257	637	572	75	18	79	18	30	15	76	30	21	37.2
400	1469	1479	678	688	257	851	786	75	18	79	18	30	15	76	30	21	46.2
500	1720	1730	778	788	257	1002	938	75	18	79	18	30	15	76	30	21	52.3
600	1975	1985	878	888	257	1157	1092	75	18	79	18	30	15	76	30	21	59.6
700	2270	2280	978	988	257	1352	1288	75	18	79	18	30	15	76	30	21	66.7
800	2564	2574	1078	1088	257	1547	1482	75	18	79	18	30	15	76	30	21	76.4
1000	3064	3074	1278	1288	257	1846	1781	75	18	79	18	30	15	76	30	21	89.5
1200	3635	3645	1478	1488	257	2217	2152	75	18	79	18	30	15	76	30	21	105.4

Metering Availability									
Stroke (mm)	200	300	400	500	600	700	800	1000	1200
Mass (tonne)									
up to 5	02	-	-	-	-	-	-	-	-
5 to 12.5	04	04	04	04	-	-	-	-	-
10 to 25	05	05	05	05	05	05	05	05	05
20 to 50	07	07	07	07	07	07	07	07	07
40 to 100	08	08	08	08	08	08	08	08	08
80 to 200	10	10	10	10	10	10	10	10	10
150 to 350	12	12	12	12	12	12	12	12	12
300 to 700	15	15	15	15	15	15	15	15	15
600 to 1250	19	19	19	19	19	19	19	19	19
1000 to 2500	22	22	22	22	22	22	22	22	22

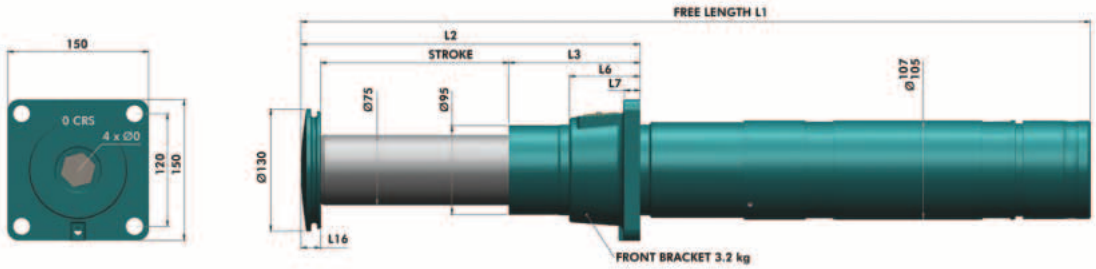
Type 110 Maximum Permissible End Forces				
Mounting Styles	Code F, D, T		Code B	
Buffer Stroke	Max Force kN	Max Impact Angle*	Max Force kN	Max Impact Angle*
200mm	350	2.5	225	1.5
300mm	350	2.5	200	1.5
400mm	350	2.5	200	1.5
500mm	300	2.0	N/A	N/A
600mm	300	2.0	N/A	N/A
700mm	250	2.0	N/A	N/A
800mm	250	2.0	N/A	N/A
1000mm	225	1.5	N/A	N/A
1200mm	200	1.5	N/A	N/A

USEAGE

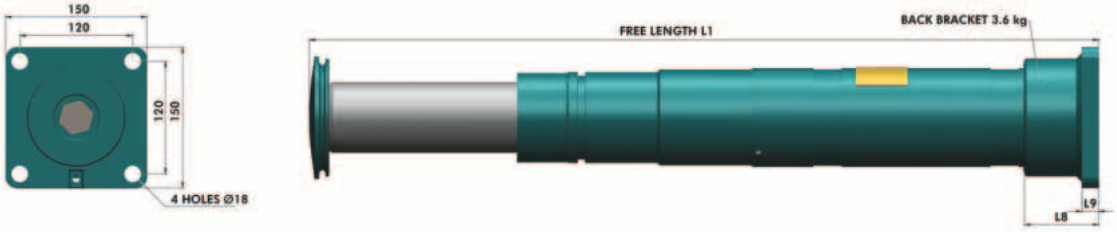
The Type 110 is available in a number of mounting configurations:

- Front mounting
- Back mounting (200mm, 300mm and 400mm stroke only)
- Back
- Foot mount front and back

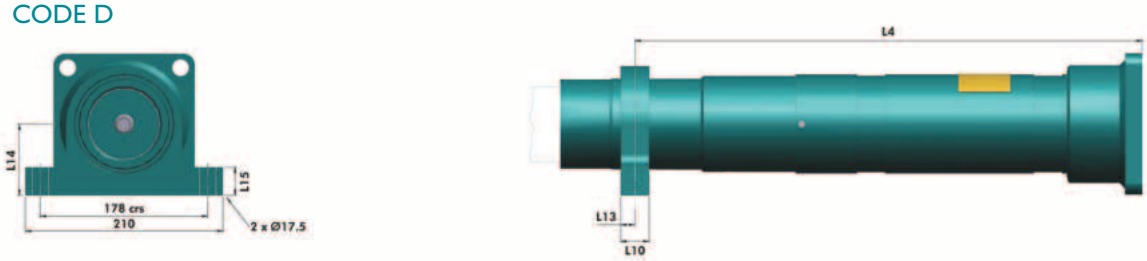
FRONT MOUNT
CODE F



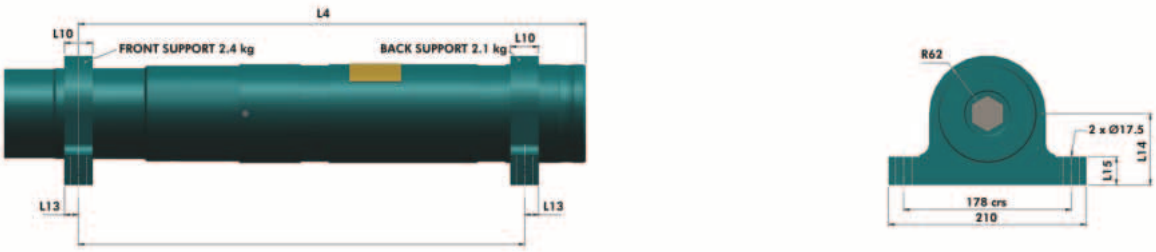
BACK MOUNT
CODE B



BACK MOUNT FRONT SUPPORT
CODE D



DOUBLE FOOT MOUNT
CODE T



NOTE

* Where bellows are fitted L1 and L2 are +10mm

Back Mount – 200mm, 300mm, 400mm STROKE ONLY

Double Foot Mount – Foot mounted units should employ a backstop as buffer loads should not be exerted through foot bolts alone

OPTIONAL EXTRAS

Optional extras are available for Oleo industrial buffers including:

Marine Plated Plungers: These are essential when exposed to salt laden or industrial fall out atmospheres.

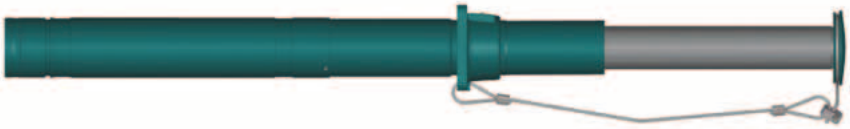
High Temperature Seals: These are necessary where a combination of high work rate and high ambient temperatures exist.

Safety Wires: These are used where there is a specification for overhead cranes e.g. AISE, OSHA etc. (Ø125mm heads only).

Bellows: These are used for corrosive and dusty environments to protect the plunger from debris, salt and chemicals etc.

BUFFER FRONT MOUNTED WITH BELLOWS

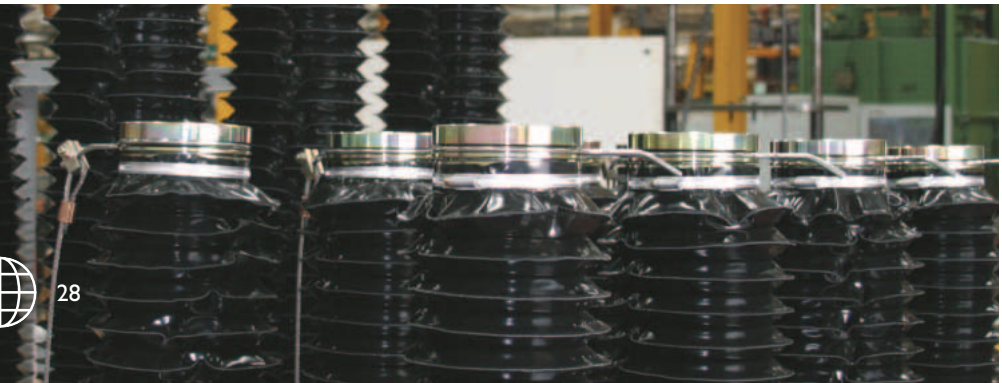
BUFFER FRONT MOUNTED WITH WIRE



BUFFER BACK MOUNTED WITH BELLOWS AND WIRE

BUFFER BACK MOUNTED WITH WIRE

In particularly harsh environments, chemically aggressive areas or where chemical attack of polymers is expected, customers are requested to contact Oleo or our agents to enable an engineering survey and recommendation to be made.



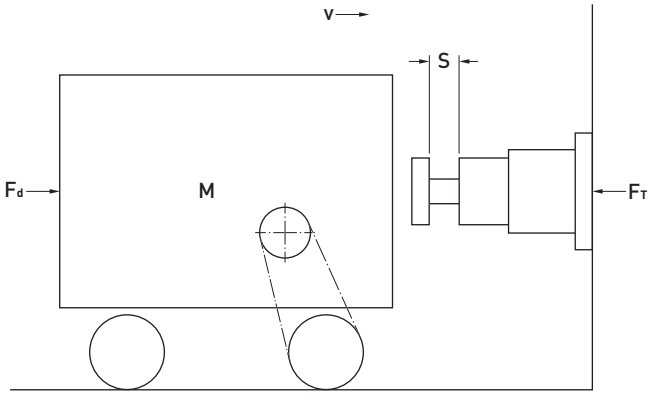
BESPOKE UNITS

Bespoke units have been made to suit customer requirements, adaptations have included:

- Specially tailored metering
- Brackets and adaption elements to suit customer interfaces
- Special paint requirement for harsh environments
- Special plating for harsh environments
- Extra sealing arrangements to allow use in marine environments

Oleo are happy to work with our clients to deliver an energy absorption solution to meet their specification. For more information or for a quote please contact us.

HORIZONTAL IMPACT



Kinetic energy to be absorbed	$E_k = \frac{Mv^2}{2}$
Energy due to drive force to be absorbed	$E_d = F_dS$
Total energy to be absorbed	$E_T = E_k + E_d$
Maximum impact force due to inertia	$F_i = \frac{E_k}{S\xi}$
Total maximum impact force	$F_T = F_i + F_d$
Design mass for buffer	$M_e = \frac{2.E_T}{nv^2}$

SUMMARY OF NOTATION

To avoid confusing conventions within calculations always use SI units in formulae then convert to more appropriate units if required.

Notation	Quantity	SI Unit
M	Mass of body	kg
M_e	Buffer design mass	kg
S	Buffer stroke	m
E_k	Kinetic energy	J
E_d	Energy due to drive force	J
E_T	Total energy	J
v	Velocity	m/s
F_i	Inertial force	N
F_d	Drive force	N
F_T	Total force	N
n	Number of buffers in parallel	–
ξ	Efficiency	–

Worked example

Eg. Consider a body of mass M = 20000kg (20 tonnes), moving at a velocity (v) of 1.5m/s with a drive force (F_d) of 20kN (20000N).

To find energy absorbed:
$E_k = 1/_2\ Mv^2 = ((20000kg) \times (1.5m/s)^2)/2 = 22500J = 22.5kJ$

Let us therefore select a Type21-150
$E_d = F_d.S = 20000N \times 0.15m = 3000J = 3kJ$

Total energy to be absorbed
$E_T = E_k + E_d = 22500J + 3000J = 25500J = 25.5kJ$

To find the maximum impact force:
$F_{i\ max} = E_k / (S.\ \xi) = 22500J / (0.15m \times 0.8) = 187500N = 187.5kN$

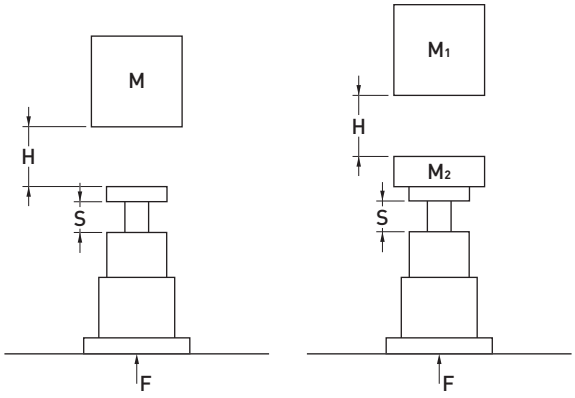
$F_{d\ max} = 20000N = 20kN$

$F_{T\ max} = F_{i\ max} + F_{d\ max} = 187500N + 20000N = 207500N = 207.5kN$

To find buffer design mass for metering pin selection:
$M_e = 2.E_T / (n.v^2) = 2 \times 25500J / (1 \times 1.5m/s)^2 = 22667kg = 22.667$ tonnes

Select a Type 21-150 buffer with a dynamic capacity of 30kJ and a maximum permissible load of 250kN, to meet these requirements. Therefore select metering pin code 155, for masses up to 25000kg (25tonnes).

VERTICAL IMPACT



SUMMARY OF NOTATION

To avoid confusing conventions within calculations always use SI units in formulae then convert to more appropriate units if required.

Notation	Quantity	SI Unit
M	Mass of body	kg
M_1	Mass of body 1	kg
M_2	Mass of body 2	kg
M_e	Buffer design mass	kg
H	Freefall height	m
S	Buffer stroke	m
E_p	Potential energy	J
v	Velocity	m/s
F	Maximum Impact force	N
g	Acceleration due to gravity	m/s^2
n	Number of buffers in parallel	–
ξ	Efficiency	–

Single Mass Case:

Potential energy to be absorbed $E_p = Mg(H+S)$

Maximum impact force $F = \frac{E_p}{S\xi}$

Design mass for buffer $M_e = \frac{2E_p}{nv^2}$

OR $M_e = \frac{M(H+S)}{nH}$

Initial Plunger Velocity $v = \sqrt{2gH}$

Multiple Mass Case:

Potential energy to be absorbed $E_p = M_1 g\,(H+S) + M_2 gS$

Maximum impact force $F = \frac{E_p}{S\xi}$

Initial Plunger Velocity $v = \left(\frac{M_1}{M_1+M_2}\right)\sqrt{2gH}$

Buffer design Mass $M_e = \frac{2E_p}{nv^2}$

Worked example

Eg. Consider a body of mass (M_1) = 22000kg (22 tonnes) / free falling onto another body of mass (M_2) 3000kg (3 tonnes) supported by a buffer. The free fall height (H) being 0.15m. A typical example of this being in catch gear buffers for mine cages where 4 Type 4-114mm stroke buffers are used; this is a multiple mass case.

To find the equivalent energy absorbed:

$E_p = M_1\,g\,(H+S) + M_2\,g\,S = (22000).(0.15+0.114) \times 9.81 + 3000 \times 9.81 \times 0.114 = 60331.5J = 60.3315kJ$

To find the maximum impact end force:

$$F = \frac{E_p}{S\xi} = \frac{60331.5}{0.114 \times 0.8}$$

$F = 661529.6N = 661.5296kN$

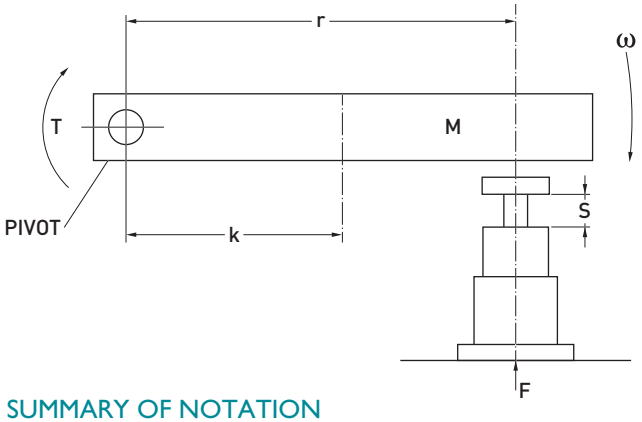
To find the equivalent mass for metering pin selection:

Initial plunger velocity $v = \frac{M_1\sqrt{2gH}}{M_1+M_2} = \frac{22000 \times \sqrt{2 \times 9.81 \times 0.15}}{22000 + 3000} = 1.5m/s$

Buffer design Mass $M_e = \frac{2E_p}{nv^2} = \frac{2 \times 60331.5}{4 \times 1.5^2} = 13407kg = 13.4$ tonnes

By selecting a Type 4 buffer with a dynamic capacity of 1000kN these requirements are met. Therefore select metering pin code 05 for masses up to 20000kg (20 tonnes).

ROTATIONAL IMPACT



SUMMARY OF NOTATION

To avoid confusing conventions within calculations always use SI units in formulae then convert to more appropriate units if required.

Notation	Quantity	SI Unit
M	Mass of body	kg
M_e	Buffer design mass	kg
S	Buffer stroke	m
k	Radius of gyration	m
E_k	Kinetic energy	J
E_d	Energy due to drive force	J
E_T	Total energy	J
ω	Angular velocity	rad/s
I	Moment of inertia	$kg.m^2$
T	Torque	Nm
F	Impact force	N
n	Number of buffers in parallel	–
ξ	Efficiency	–

Basic Formula

Kinetic energy to be absorbed $E_k = \frac{I\omega^2}{2} = \frac{Mk^2\omega^2}{2}$

Energy due to drive force $E_d = \frac{TS}{r}$

Total energy to be absorbed $E_T = E_k + E_d$

Maximum impact force $F = \frac{E_T}{S\xi}$

Design mass for buffer $M_e = \frac{2\,E_T}{n\,(\omega r)^2}$

Worked example

Eg. Consider a swing bridge, having a moment of inertia (I) of 7500000 kgm^2, buffer arm radius (r) 8 m, angular velocity (ω) of 0.174 rad/sec and a driving torque (T) of 1500000 Nm. Using 2 buffers.

To find the energy to be absorbed:

$E_k = \frac{I\omega^2}{2} = \frac{7500000 \times 0.174^2}{2} = 113535\,J = 113.54\,kJ$

Let us select a Type 4 with 114mm stroke:

$E_d = \frac{TS}{r} = \frac{1500000 \times 0.114}{8} = 21.375\,kJ$

Total energy to be absorbed:

Therefore $E_T = E_k + E_d = 113535 + 21375 = 134910\,J = 134.91\,kJ$

To find the maximum impact force:

$F = \frac{E_T}{S\xi} = \frac{134910}{0.114 \times 0.8} = 1479276\ N = 1479.3\,kN$

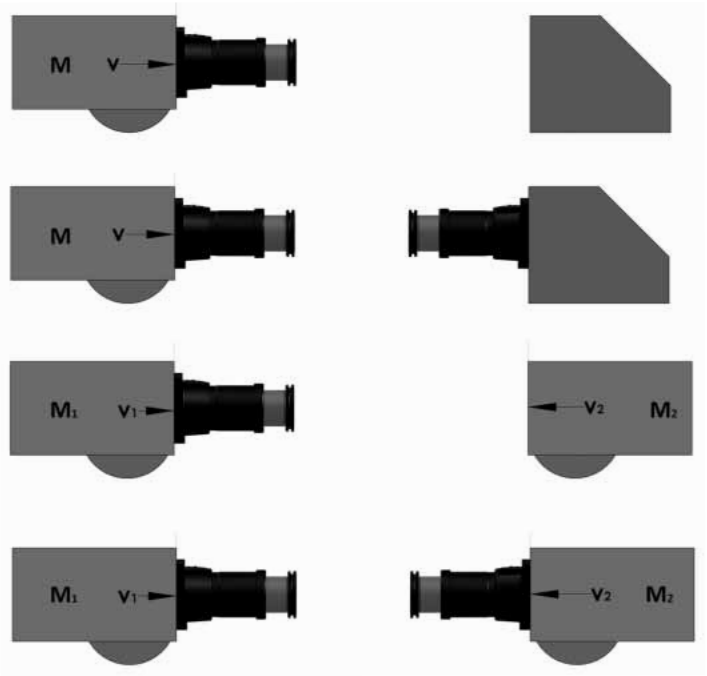
To find the equivalent mass for metering pin selection:

$M_e = \frac{2E_T}{n\,(\omega r)^2} = \frac{2 \times 134910}{2 \times (0.174 \times 8)^2} = 69.625$ tonnes

Therefore select metering pin code 08 for masses up to 80000 kg (80 tonnes).

LOAD CASES

FOR BUFFERS OF THE SAME TYPE USED TOGETHER



Case No.	Velocity V_e (m/s)	Mass per buffer M_e (kg)
1	V	M
2	$\frac{V}{2}$	2M
3	$V_1 + V_2$	$\frac{M_1 M_2}{M_1 + M_2}$
4	$\frac{V_1 + V_2}{2}$	$\frac{2M_1 M_2}{M_1 + M_2}$

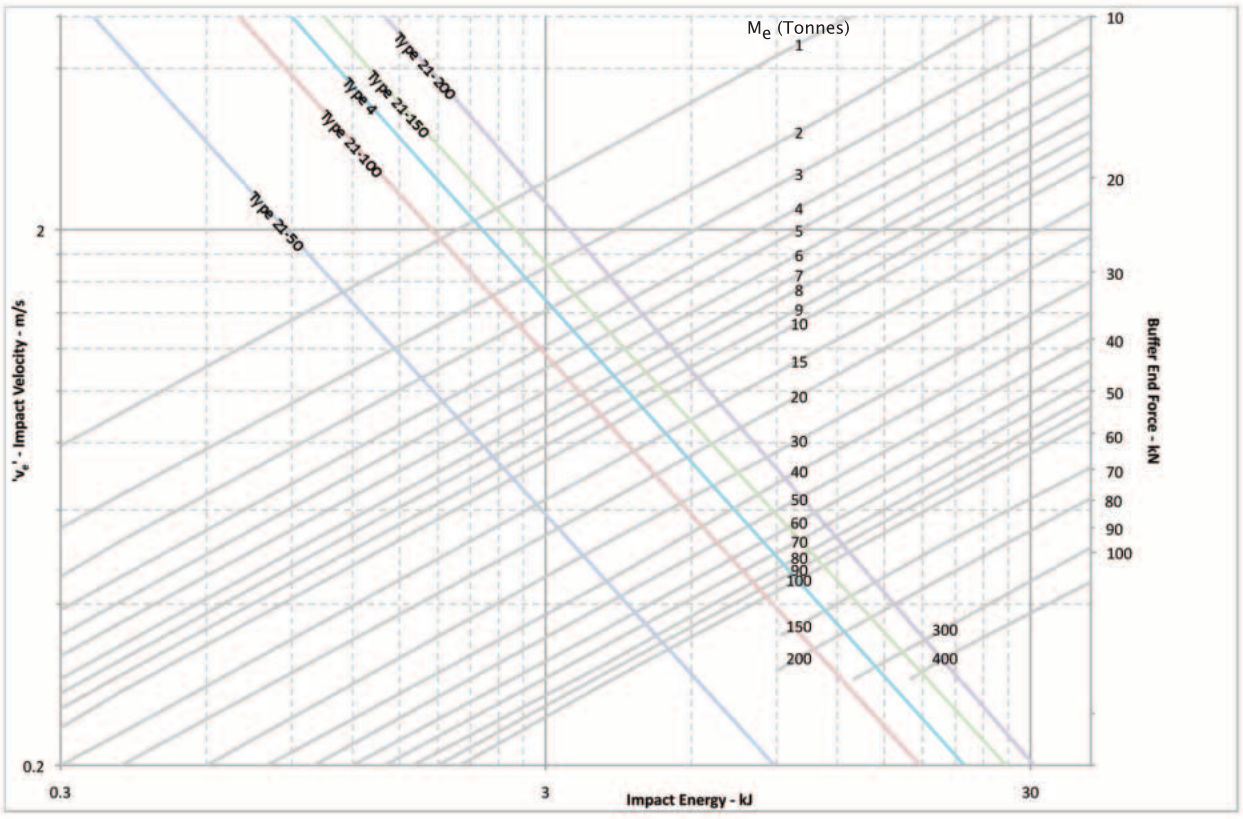
FOR BUFFERS OF DIFFERENT TYPES WITH IDENTICAL CYLINDER BORE USED TOGETHER (eg TYPE 9 WITH A TYPE 15)

Velocity v_e (m/s)	Mass per buffer M_e (kg)	Design mass for pin selection
$\frac{V}{1.5}$	1.5M	Type 15 1.5M Type 9 3.0M

Velocity v_e (m/s)	Mass per buffer M_e (kg)	Design mass for pin selection	
$\frac{V_1 + V_2}{1.5}$	$\frac{1.5M_1 M_2}{M_1 + M_2}$	Type 15	$\frac{1.5M_1 M_2}{M_1 + M_2}$
		Type 9	$\frac{3M_1 M_2}{M_1 + M_2}$

NOMOGRAPH

Performance chart



Before using the chart, it is necessary to know the impact Mass 'M_e' and the impact velocity 'v_e' of the moving machine. On very wide track machines such as travelling cranes, the mass on the rail can vary considerably due to asymmetric loading, or the position of the trolley. In these cases the maximum mass on the rail MUST BE used and each side of the bridge dealt with separately.

How to use the chart:

Impact into stops
(Impact case 1 or 2 see page 10)
Project a horizontal line from the 'v_e' scale across the chart, to intersect with the inclined impact mass line 'M_e'. Through this point make a vertical line to the bottom scale to obtain the impact energy to be absorbed per buffer. From the points at which this vertical line intersects the diagonal buffer lines, project horizontal lines to the right hand scale to obtain the force per buffer.

It may be found that an intersection between the velocity line and the impact mass line cannot be made on the chart. This indicates that the energy to be absorbed is above the capacity of a single buffer, and the above exercise should then be repeated for a case 2 impact. i.e. add an extra buffer, making sure that the impact Mass 'M_e' and impact velocity 'v_e' are correct. This formula is shown in Load Cases section.

Impacts between two moving structures
(Impact Case 3 or 4)
The procedure is the same as outlined above, but again first make the corrections for impact Mass 'M_e' and velocity 'v_e' from the formula in the Load Cases section, which takes into account the Mass and velocity of both machines.

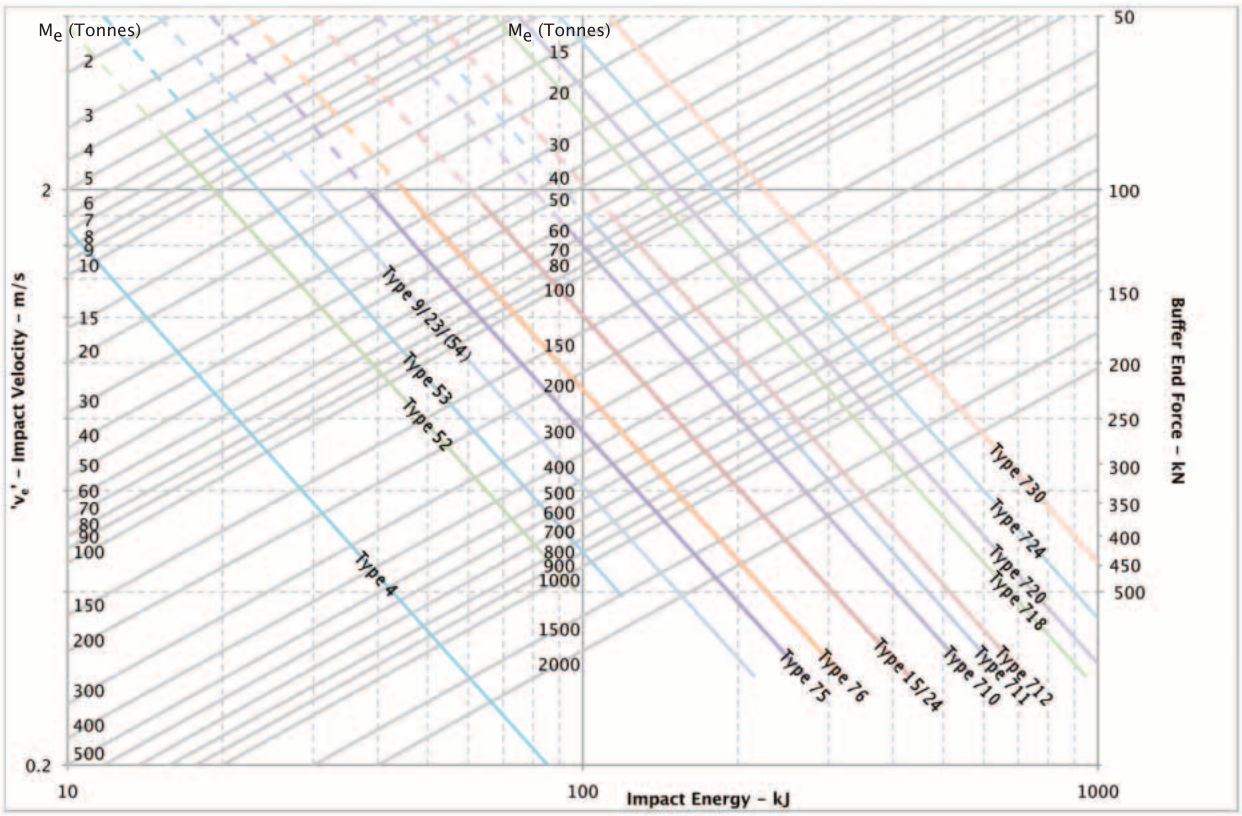
Commence with Case 3 and repeat for Case 4 if the buffer Energy capacity has been exceeded or if the Buffer resistance is too high, i.e. add an extra buffer.

Buffers in parallel
Impact conditions 1-4 cover a single buffer or two in series. To obtain additional energy absorption capacity these arrangements can be duplicated, so that forces are shared. When this is done the Impact Mass per buffer 'M_e' given in the table must be halved.

Such an arrangement is sometimes advantageous when length is limited and forces on the end stops are not vital, so that Case 1 in duplicate can be used instead of Case 2.

NOMOGRAPH

Performance chart



Example – Overhead Travelling Crane

Total crane weight	700 Tonnes
Trolley weight	200 Tonnes
Crane velocity	0.6m/s

Buffers for a crane into an end stop
Take case 1 Impact condition

Deal with the mass on the rail at each end of the bridge separately. Mass of the crane bridge ONLY at one end = 250000kg = 250 Tonnes

Additional mass from the trolley positioned at that end (0.75 of total span) = 150000kg = 150 Tonnes
M_e = 150000kg + 250000kg = 400 Tonnes

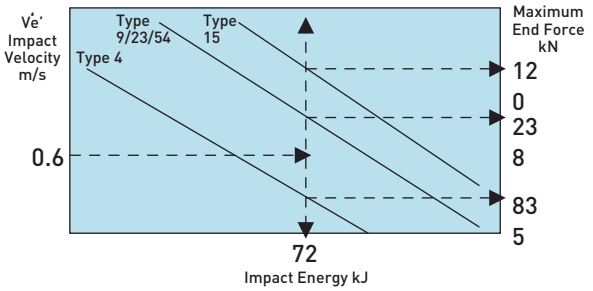
Maximum impact velocity, v_e = 0.6m/s

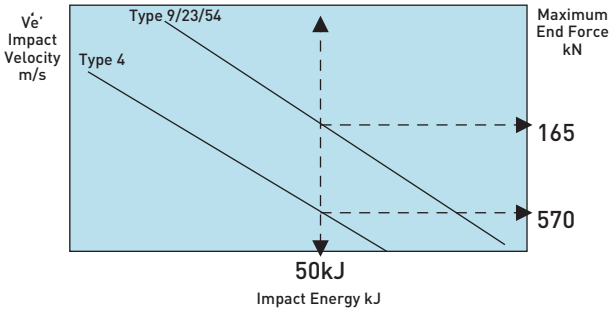
Read from chart: Energy to be absorbed per buffer = 72kJ
Type 4 buffer force = 835kN
Type 9 buffer force = 238kN*
Type 15 buffer force = 120kN

* An ideal choice would be for the Type 9 buffer

E.g. Buffer for body rolling into an end stop, with a requirement that the maximum impact energy does not exceed 50kJ. Use the nomogram to evaluate the end force.

Type 4 = 570kN
Type 9, 23, 54 =165kN





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HEAD OFFICE Grovelands Longford Road Exhall Coventry CV7 9NE UK
T +44 (0)24 7664 5555 F +44 (0)24 7664 5900 E info@oleo.co.uk OLEO.CO.UK

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