OLEO INTERNATIONAL

LEADING THE WORLD IN ENERGY ABSORPTION

ELEVATOR

Safety Buffers

GBR

Oleo International

Oleo is a leading expert in energy absorption technology supplying solutions to the elevator, industrial 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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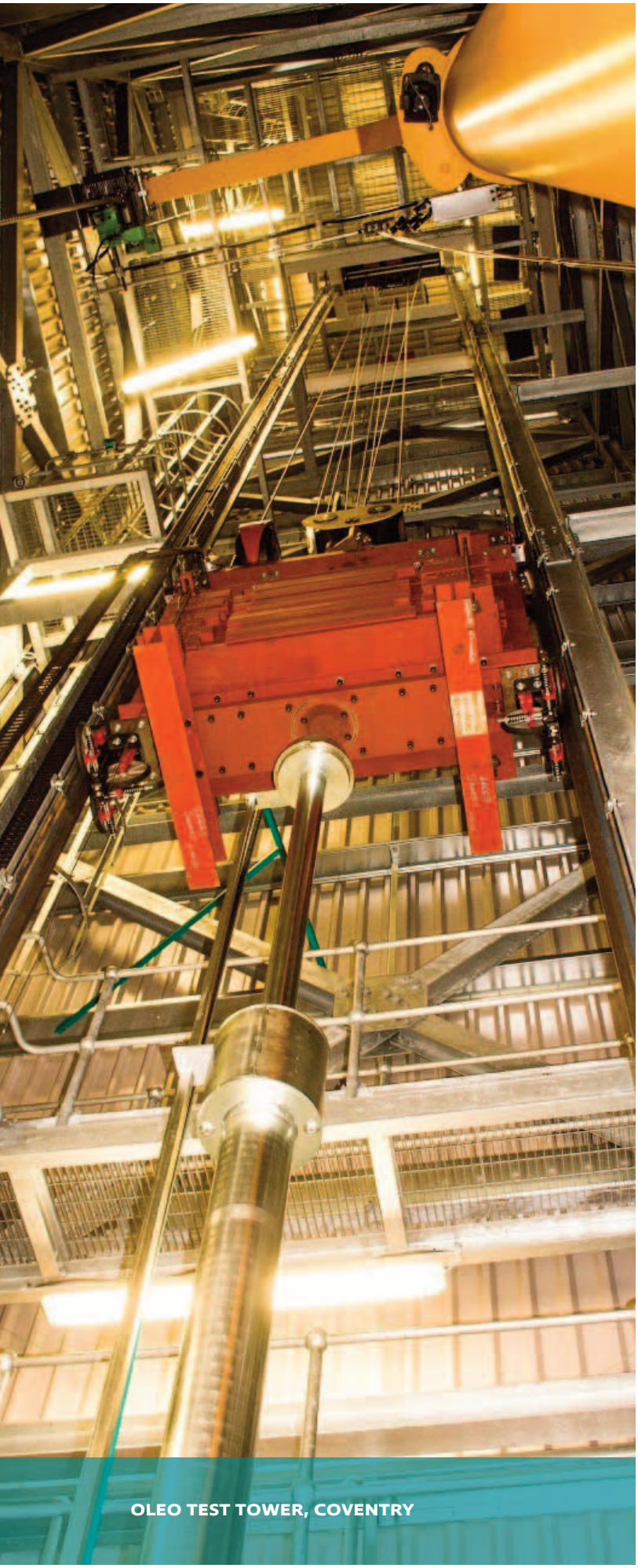


OLEO TEST TOWER, COVENTRY

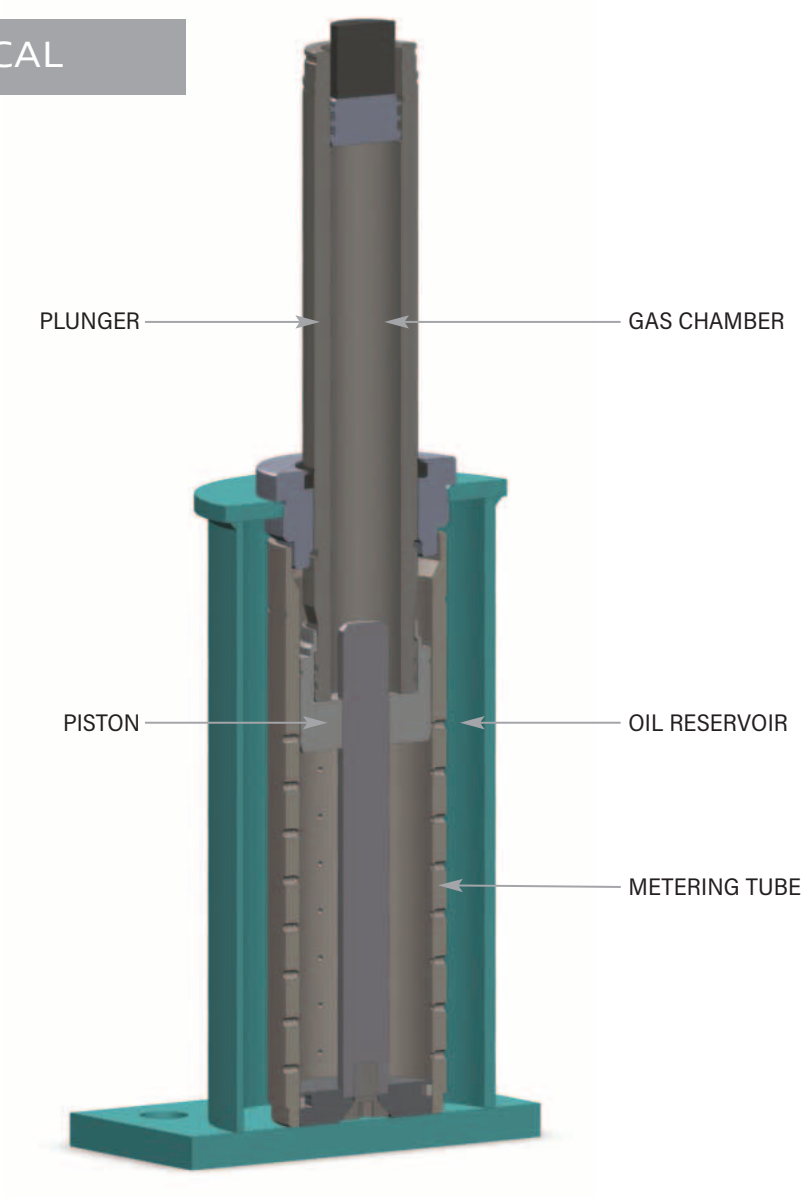
Oleo elevator buffers are designed to protect people and equipment from forces generated from an impact resulting from equipment failure or operator error.

Oleo has achieved this using hydraulic energy absorption systems combined with a gas return spring to give unsurpassed energy dissipation and recovery.

Oleo has a complete range of elevator buffers for every application offering a lighter, stronger, high quality product with minimum life-cycle costs.

Our elevator buffers are sold worldwide offering exceptional performance across a wide mass and speed range. Oleo buffers have worldwide certification and approvals which include EN81-20/50, ASME A17.1, CSA B44, GB7588, EK1002 and GOSTS R53780.

Oleo buffers are primarily available as standard designs but we would welcome the opportunity to look at a specific requirement.



Hydraulic Operating Principle

The illustration shows the robust construction of the Oleo elevator hydraulic buffer unit.

On impact the plunger is forced down around the gas rod and through the metering tube displacing oil through holes, thereby decelerating the impact mass. Following impact the gas hydraulic buffer returns to its full height using a unique method of moving the gas within the chamber.

The buffers performance on impact relies solely on oil displacement, the gas spring serves only to re-extend the plunger. When the plunger is forced into the cylinder rapidly the oil displaced by the plunger has to pass through the metering holes at very high velocity. This raises the pressure in the oil chamber to a level which optimises the closure force of the unit.

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.

Elevator Safety

Elevator buffers are safety devices which are required to be mounted at the base of an elevator shaft. As with any safety device, elevator buffers have to meet with a variety of specifications.

One of the most important of these specifications is the manner in which the buffers must bring an impacting elevator car to rest. There are different technical specifications for elevator buffers in different regions worldwide however all employ the same basic performance criteria.

Since the very early days of elevators, a variety of safety systems have been employed to ensure that the elevator will not free fall. The purpose of elevator buffers is to provide protection against the malfunction of an elevator control system resulting in the elevator continuing to travel past the lowest stop to the base of the elevator shaft. The buffers are specified in accordance with the operating velocity and mass of the elevator.

THE BURJ KHALIFA TOWERS OVER DOWNTOWN DUBAI

Although freefall is not a realistic event for an elevator, the specification and code requirements are based on the assumption of freefall.

The requirement for elevator buffers fall into two categories depending on the type of buffer.

1. **Energy accumulation buffers:** These can take the form of simple mechanical springs or polymer buffers which store the absorbed energy of the impact in the form of strain energy. In some accumulation buffers this stored energy can be dissipated on the return movement of the buffer leading to two separate requirements:
   a) Buffers with linear and non linear characteristics – these can be used if the elevator does not exceed 1.0m/s.
   b) Buffers with buffered return movement – these can be used for elevators that do not exceed 1.6m/s.
2. **Energy dissipation buffers:** These are usually hydraulic buffers which dissipate the energy of the impact in the form of heat during the travel of the buffer. This type of buffer can be used for all rated speeds, but must be used for speeds of 1.6m/s or over.

BUFFER PERFORMANCE CRITERIA – ENERGY DISSIPATION BUFFERS

Performance criteria in all specifications is governed by 2 underlying rules which state that the buffer must arrest a freefalling mass travelling at 115% of the rated speed of the elevator:

(i) With an average deceleration not exceeding 1g.

(ii) Without exceeding a deceleration of 2.5g for a time period greater than 0.04 seconds.

In addition a further, but separate, requirement states that the buffer stroke must be at least as great as free fall distance required to reach 115% of the rated elevator velocity. It is this requirement that dictates the stroke and consequently the installation height of elevator buffers. Due to customer demands, most elevator buffers do not deviate far from the minimum stroke requirement.

Elevator Safety – continued

The design engineer must consider the stroke requirements in the overall height of the buffer. If telescopic solutions are not to be used then the overall height must be at least double the minimum stroke with a further height requirement to restrict lateral movement when the buffer is fully extended.

Lateral movement should be restricted to +/-5mm per metre of stroke from the centre.

EMERGENCY TERMINAL SPEED LIMITING DEVICE

The function of an emergency terminal speed limiting device is to automatically reduce the speed of a car or counterweight by removing power from the driving machine. The device effectively slows the car or counterweight to the rated speed of the buffer before impact. This device would normally be independent of the normal terminal slowdown devices.

This is important when selecting a buffer for a particular application. If the emergency terminal speed limiting device is part of the installation then the 'reduced stroke' rules can apply. This effectively reduces the size of the buffer required for a particular application.

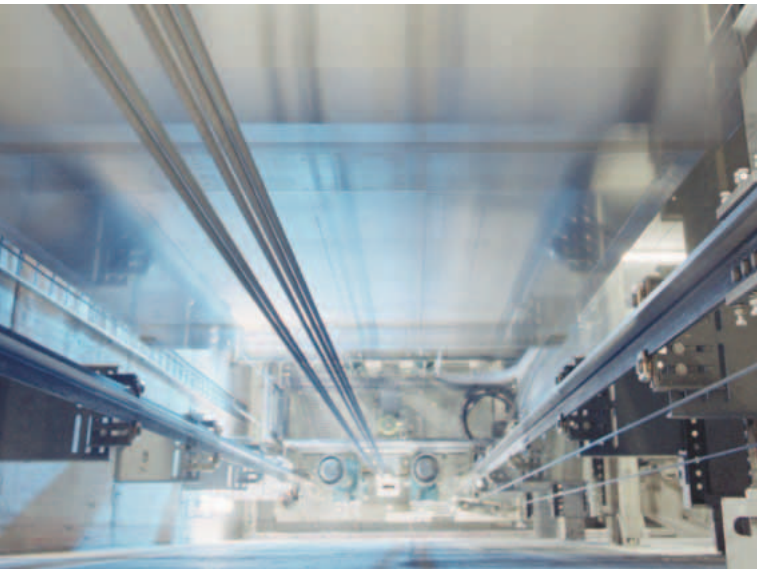
REDUCED STROKE

The calculation for reduced stroke is based on the stroke of the buffer and not the speed of the elevator. The reduced stroke calculation differs in some countries but the basic rules are as follows:

The stroke must not be less than:

a) One half (50%) of the stroke for elevators that do not exceed 4.00m/s.

b) One third (33.3%) or 0.45m, whichever is greater, of the stroke for elevators where the speed exceeds 4.00m/s.



Minimum strokes also apply under some code requirements including EN81-20. Under EN81-20 the minimum stroke should not be less than 0.42m for rated elevator speeds above 2.50m/s.. This does not apply under all code requirements.

Using the reduced stroke calculation a buffer rated at 5.09m/s could be used on an installation of 8.8m/s if used with a terminal speed limiting device.

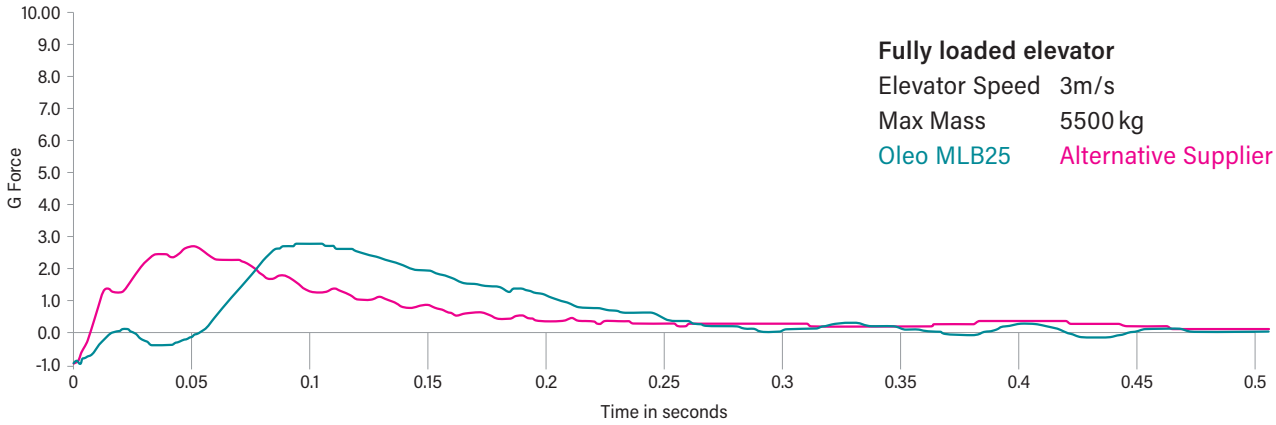
BUFFER PERFORMANCE

The minimum stroke for an elevator buffer is specified (within EN81-20 and ASME A17.1), as the necessary distance to bring an impacting mass, travelling at 115% of the buffer's rated speed, to rest with a uniform deceleration of 1g. However, this is only true if the buffer exerts a constant retardation force over its entire stroke.

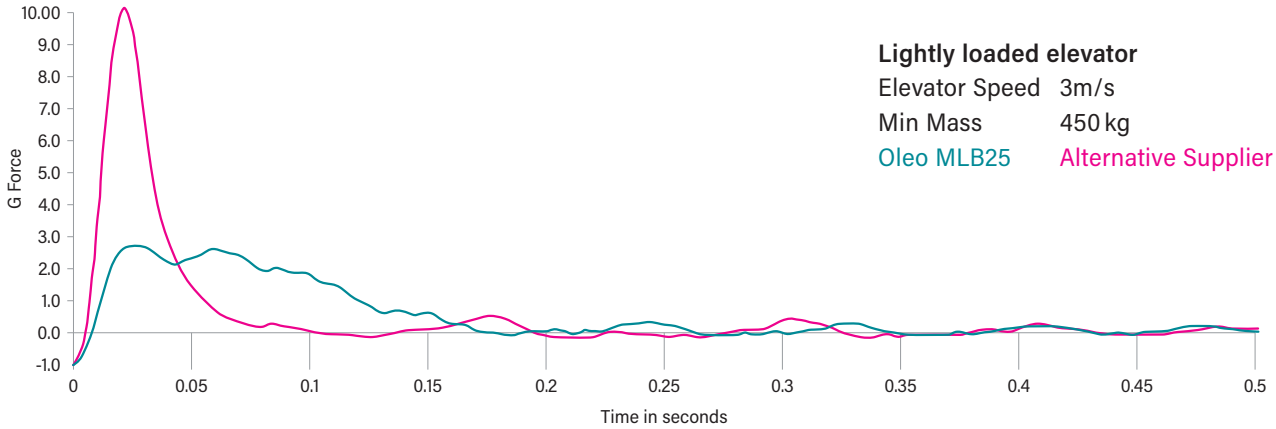
A hydraulic buffer can be designed to closely match this idealised performance. This is achieved by precise control of hydraulic oil flow across an orifice throughout the buffer stroke. However, this can only be achieved for one specific impact mass. The same performance is not achievable for the range of elevator masses that are encountered in the real world where the elevator car mass varies with passenger load.

In the elevator application, where there is a need to protect passenger safety, it is important to try to minimise the deceleration experienced during stopping. This can be easily resolved when the elevator is fully loaded but at low loads the same retardation force will slow the elevator more quickly and therefore initially result in higher deceleration for the passenger.

The graphs below compare test data from two hydraulic buffers that both meet the elevator code specification requirement being used to stop an elevator car travelling at 3m/s. This shows the g force that will be experienced by passengers travelling in fully and lightly loaded conditions.



The performance of the Oleo and the alternative supplier's elevator buffer is similar.



The performance of the Oleo buffer design shows its benefits with a much lower peak deceleration force of 2.6g in comparison to 10g for the alternative supplier's elevator buffer.

In both load conditions both buffers keep the average deceleration below 1g and do not allow 2.5g for more than 40 milliseconds and therefore are both fully compliant with elevator code specification requirements.

The limiting of peak deceleration force is not required by any elevator code or industry specification. Alternative buffers achieve the average 1g criterion by an initial period of high deceleration followed by extending the final stages as the elevator is coming to rest. The other key elevator buffer specification requires that passengers do not experience more than 2.5g for more than 40 milliseconds but within this period g forces are not limited. However, as illustrated above, in certain conditions very high instantaneous g forces occur and this may cause passenger discomfort.

Oleo has an overall passenger safety aware approach and seeks to avoid the passenger discomfort that may arise from instantaneous deceleration that may even exceed 10g in some circumstances. Many years of in-house testing and the development of mathematical algorithms that accurately simulate the performance of hydraulic buffers enable Oleo unsurpassed force control. The design philosophy is to minimise g force for all passenger load conditions the benefits are highlighted in the test data shown above.

SHANGHAI

Elevator Safety – continued

ELEVATOR SWITCHES

Oleo elevator buffers are designed to withstand many more maximum load impacts than elevators are likely to experience in their service life. Despite this, elevator buffers remain an emergency only device. It is never a desirable outcome in the real world to have to rely on buffers to bring your elevator to a stop – that said, it is absolutely essential that you can rely on the buffers in the event that they are required.

It is for this reason that many elevator buffers are fitted with a switch. The switch is positioned to detect that the buffer is fully extended and therefore ready for impact in the case of an emergency. If for any reason the switch does not detect full buffer extension, the entire elevator system is shut down.

MODELLING AND ANALYSIS

Oleo employs computer modelling and analysis to refine elevator buffers performance. Simulations are compared directly with test results obtained on Oleo's own in-house dynamic test facility. The ability to both simulate and test, has allowed increased optimisation of elevator buffer performance, providing benefits in terms of cost, safety and reliability.

BUFFER TYPE TESTING

Elevator buffers are subjected to a type test before they can be sold to the market. Type test requirements vary depending on country but most follow the guidelines of the European specification EN81-20 or ASME A17.1.

To comply with the requirements of EN81-20 the buffer must perform to the criteria detailed earlier. To establish this, the buffers are subject to drop tests. This is where a mass is dropped in freefall. The drop tests must take place at a temperature between 15°C and 25°C. Tests are conducted with masses at either extreme of the stated mass range of the buffer. Subsequent to the maximum mass drop, the mass must remain on the buffer for a minimum of 5 minutes, after which the buffer must fully re-extend within a time period of 90 seconds. Measurements must be made of the displacement, velocity and acceleration of the freefalling masses at a sample rate of at least 100Hz.

In order to eliminate erroneous noise and high frequency vibration from accelerometer traces, low pass filtering is usually applied to a signal sampled at a higher than required sampling frequency.

PANORAMA OF THE NEW YORK CITY SKYLINE IN MANHATTAN

Range Overview

Buffer unit	Rated Speed	Max Speed (115%)	Reduced Stroke		Stroke (min)	Impact mass range		Height (extended)	Height (compressed)	Height to reservoir top	Weight no oil (dry)	Oil volume
			ASME A17.1	EN81-20		Kg		m Dim H	m Dim C	m Dim F		
	m/s	m/s	m/s	m/s	m	Min.	Max.	Max.	Min.	Nom.	Kg	Litres
LSB 10	1.000	1.150	1.470	n/a	0.0734	380	3250	0.2222	0.1459	0.0994	3.529	0.45
LSB 16	1.600	1.840	2.270	n/a	0.1735	450	3250	0.4855	0.3069	0.2366	6.565	0.88
LSB 18	1.800	2.070	2.550	n/a	0.2195	450	3250	0.5775	0.3529	0.2826	7.820	1.03
LT 20	2.030	2.335	2.870	n/a	0.2798	600	3250	0.7795	0.4902	0.4560	9.000	0.62
LT 25	2.540	2.921	3.590	3.590	0.4365	600	3250	1.1632	0.7172	0.6830	11.30	0.96
SEB 16	1.600	1.840	2.260	n/a	0.1730	450	4545	0.5400	0.3508	0.3080	11.78	1.45
SEB 18	1.800	2.070	2.540	n/a	0.2190	450	4545	0.6430	0.4078	0.3650	13.26	1.77
SEB 20	2.032	2.337	2.870	n/a	0.2790	450	4545	0.7770	0.4818	0.4390	15.28	2.20
SEB 25	2.540	2.920	3.590	3.590	0.4350	450	4545	1.1260	0.6748	0.6320	20.45	3.30
MLB 13	1.300	1.495	1.880	n/a	0.1213	450	5500	0.4103	0.2754	0.2387	9.810	1.02
MLB 16	1.600	1.840	2.260	n/a	0.1743	450	5500	0.5323	0.3444	0.3077	11.15	1.41
MLB 18	1.800	2.070	2.540	n/a	0.2203	450	5500	0.6343	0.4004	0.3637	12.67	1.74
MLB 20	2.030	2.335	2.870	n/a	0.2803	450	5500	0.7823	0.4884	0.4517	15.02	2.18
MLB 25	2.540	2.921	3.590	3.590	0.4363	450	5500	1.1643	0.7144	0.6777	21.05	3.32
MLB 32	3.150	3.623	5.490	5.490	0.6803	450	5500	1.7305	1.0340	0.9817	29.72	5.19
MLB 35	3.560	4.094	6.260	6.260	0.8809	600	5500	2.1079	1.2093	1.1680	61.45	19.50
MLB 40	4.060	4.669	7.120	7.120	1.1409	600	5500	2.6929	1.5343	1.4930	75.66	25.00
LB 16	1.600	1.840	2.450	n/a	0.2032	500	8330	0.6166	0.3973	0.3560	25.54	4.62
LB 18	1.800	2.070	2.710	n/a	0.2489	500	8330	0.7229	0.4563	0.4150	28.12	5.58
LB 20	2.032	2.337	2.980	n/a	0.2999	500	8330	0.8389	0.5213	0.4800	30.96	6.64
LB 25	2.540	2.920	4.530	3.700	0.4619	500	8330	1.2109	0.7313	0.6900	40.14	10.00
LB 32	3.150	3.623	5.570	5.570	0.6989	700	8330	1.7059	0.9893	0.9470	54.93	20.00
LB 35	3.560	4.094	6.260	6.260	0.8809	1000	8330	2.1079	1.2093	1.1670	65.46	24.50
LB 40	4.064	4.674	7.120	7.120	1.1409	1000	8330	2.6929	1.5343	1.4920	80.69	31.50
LB 50	5.080	5.842	8.850	8.850	1.7410	1500	7500	4.2144	2.4395	2.3430	202.6	27.80
LB 55	5.588	6.426	9.730	9.730	2.1100	1250	7500	5.0374	2.8935	2.7970	235.2	33.30
LB 60	6.096	7.010	10.590	10.590	2.5050	1500	10000	6.1796	3.5975	3.4550	458.1	73.00
HSL 58	5.850	6.728	10.220	10.220	2.3420	4000	10000	4.9655	2.5225	1.9425	779.0	98.00
HSL 72	7.250	8.338	12.740	12.740	3.6448	4000	10000	7.4147	3.6752	3.0175	1249.0	144.00
HSL 87	8.700	10.005	15.210	15.210	5.1920	4000	10000	10.2950	5.1835	4.4925	1450.0	207.00
HSL 101	10.100	11.615	17.650	17.650	6.9730	5000	8000	12.5700	4.1830	3.6330	3000.0	275.00
HSL 115	11.550	13.283	20.230	20.230	9.1264	5500	8000	14.9190	5.7011	5.1570	3497.0	490.00

A COMPLETE RANGE OF ELEVATOR BUFFERS FOR EVERY APPLICATION

While we have made every effort to ensure that the information in this brochure is up to date and accurate, we do not accept responsibility for your reliance on the information contained herein. All products are subject to availability and may be withdrawn without prior notice. All products are subject to change without prior notice.

Approved emergency terminal slow down devices in accordance with the local code requirements must be correctly installed before reduced stroke can only be applied. Reduced stroke values provided in this brochure are for reference only. Oleo International are not responsible for the incorrect application of reduced stroke. Local rules must be checked before applying. Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 5.8.2.2.2 and ASME A17.1 rule 2.22.4.1.2.

LSB Series

The LSB oil buffer series is a self contained, maintenance free* unit designed for low and medium speed applications.

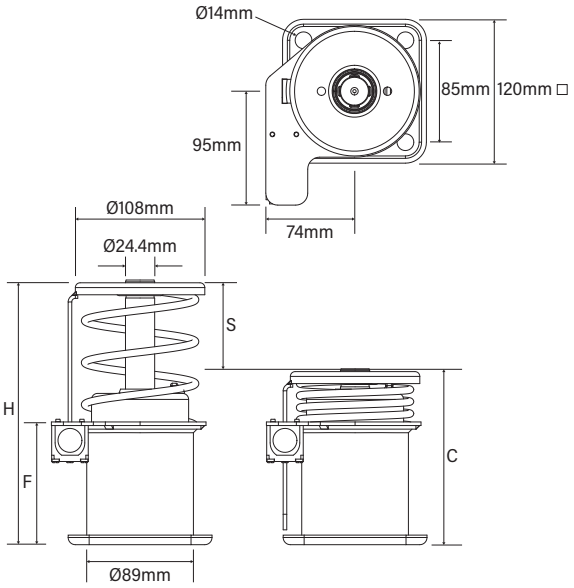
The LSB series is designed to be low cost while maintaining Oleo's recognised performance standards.

Oleo's LSB buffers weigh approx half of a conventional buffer and have a small space envelope, this means that shipping costs are significantly reduced. In addition there is the option to supply the buffers oil filled rather than with a separate container of oil saving valuable time during elevator installation and reducing the risk of errors and spillage.

The LSB series is designed and built according to strict engineering standards and is universally approved and globally certified.

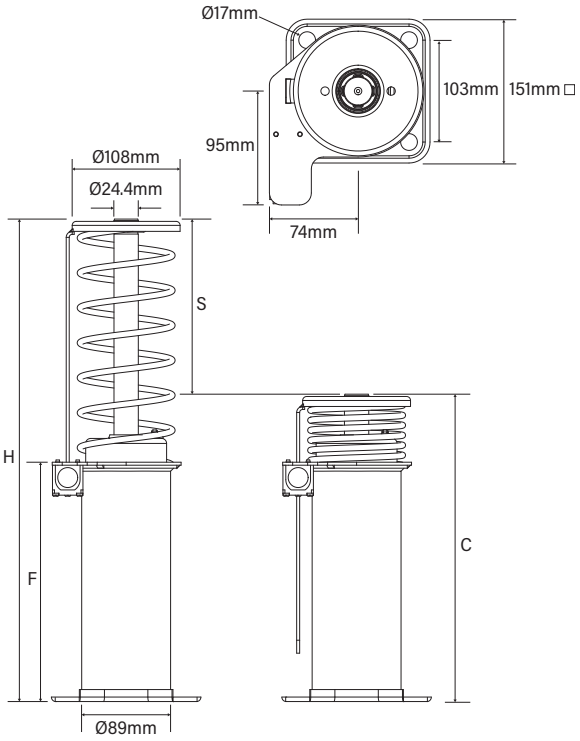
*other than statutory inspections.

Dimensions for LSB 10



Model		LSB 10	LSB 16	LSB 18
Rated speed	m/s	1.000	1.600	1.800
Max Speed (115%)	m/s	1.150	1.840	2.070
Stroke 'S' (min.)	m	0.0734	0.1735	0.2195
Impact mass range	Kg	380-3250	450-3250	450-3250
Height 'H' **max.** (extended)**	m	0.2222	0.4855	0.5775
Height 'C' **min.** (compressed)**	m	0.1459	0.3069	0.3529
Height 'F' to reservoir top	m	0.0994	0.2366	0.2826
Weight no oil (dry)	Kg	3.529	6.565	7.820
Oil volume	Litres	0.45	0.88	1.03
Reduced stroke: Rated speed with terminal speed limiting device, based on ASME A17.1 rule 2.22.4.1.2				
Reduced stroke ASME A17.1 North America	m/s	1.470	2.270	2.550
Reduced stroke EN81-20 Europe	m/s	n/a	n/a	n/a

Dimensions for LSB 16, 18



**The max and min figures provided take account of the extremes of the tolerance to provide absolute maximum and absolute minimum dimensions. For more details please request detailed installation drawing.

All information included is correct at the time of printing.

LT Series

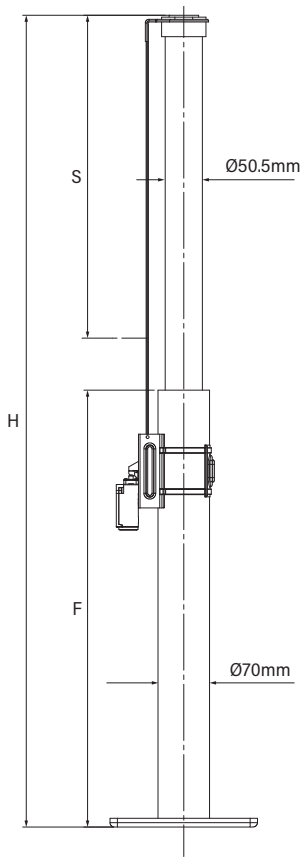
The LT oil buffer series is a self contained, maintenance free* unit designed for low and medium speed applications.

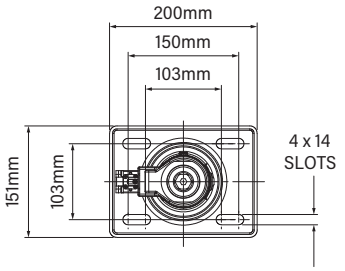
The LT series is designed to be low cost while maintaining Oleo's recognised performance standards.

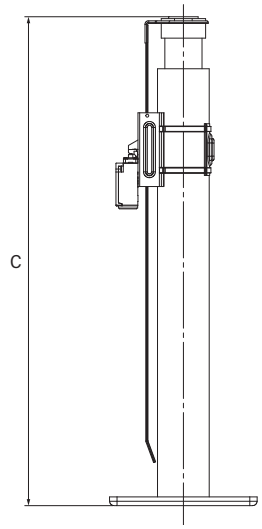
Oleo's LT buffers weigh approximately half of a conventional buffer and have a small space envelope, this gives more freedom for elevator pit design and also means that shipping costs are significantly reduced.

The LT series is designed and built according to strict engineering standards and is approved and certified for EN81 and GB standards.

*other than statutory inspections.







Model		LT 20	LT 25
Rated speed	m/s	2.030	2.540
Max Speed (115%)	m/s	2.335	2.921
Stroke 'S' (min.)	m	0.2798	0.4365
Impact mass range	Kg	600-3250	600-3250
Height 'H' **max.** (extended)**	m	0.7795	1.1632
Height 'C' **min.** (compressed)**	m	0.4902	0.7172
Height 'F' to reservoir top	m	0.4560	0.6830
Weight no oil (dry)	Kg	9.000	11.30
Oil volume	Litres	0.62	0.96
Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 10.4.3.2			
Reduced stroke ASME A17.1 North America	m/s	2.870	3.590
Reduced stroke EN81-20 Europe	m/s	n/a	3.590

**The max and min figures provided take account of the extremes of the tolerance to provide absolute maximum and absolute minimum dimensions. For more details please request detailed installation drawing.

All information included is correct at the time of printing.

SEB Series

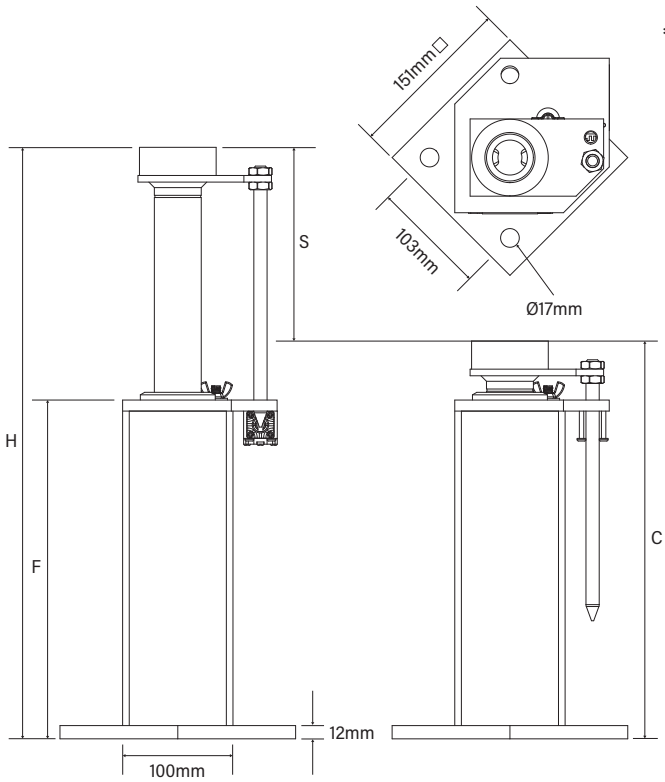
The SEB buffer range has been available for over twenty years with thousands successfully installed around the world.

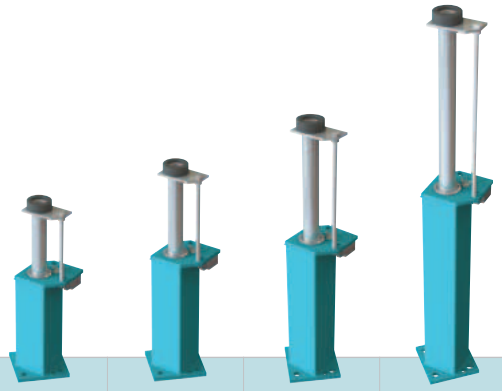
The SEB gas hydraulic buffer series provides a premium robust solution for medium speed applications.

A self contained, maintenance free* unit designed to weigh approximately half of a conventional buffer and have a small space envelope. This means that shipping costs are significantly reduced and allows for quick and easy installation.

The SEB series is designed and built according to strict engineering standards and is universally approved and globally certified.

*other than statutory inspections.





Model		SEB 16	SEB 18	SEB 20	SEB 25
Rated speed	m/s	1.600	1.800	2.032	2.540
Max Speed (115%)	m/s	1.840	2.070	2.337	2.920
Stroke 'S' (min.)	m	0.1730	0.2190	0.2790	0.4350
Impact mass range	Kg	450-4545	450-4545	450-4545	450-4545
Height 'H' **max.** (extended)**	m	0.5400	0.6430	0.7770	1.1260
Height 'C' **min.** (compressed)**	m	0.3508	0.4078	0.4818	0.6748
Height 'F' to reservoir top	m	0.3080	0.3650	0.4390	0.6320
Weight no oil (dry)	Kg	11.78	13.26	15.28	20.45
Oil volume	Litres	1.45	1.77	2.20	3.30
Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 10.4.3.2 and ASME A17.1 rule 2.22.4.1.2					
Reduced stroke ASME A17.1 North America	m/s	2.260	2.540	2.870	3.590
Reduced stroke EN81-20 Europe	m/s	n/a	n/a	n/a	3.590

**The max and min figures provided take account of the extremes of the tolerance to provide absolute maximum and absolute minimum dimensions. For more details please request detailed installation drawings.

All information included is correct at the time of printing.

MLB Series

The MLB series has been designed to complement the successful LB series while retaining key operational characteristics.

The MLB gas hydraulic buffer series is a self contained, maintenance free* unit designed for quick and easy installation, primarily designed for medium speed elevator applications, typical applications include low to medium rise buildings.

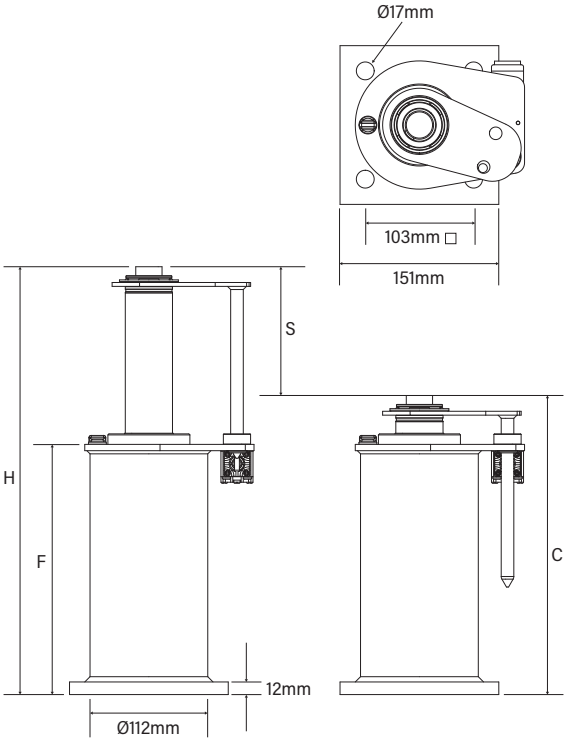
Oleo's MLB buffers weigh approx half of a conventional buffer and have a small space envelope, this means that shipping costs are significantly reduced. In addition there is the option to supply the MLB 13 – MLB 32 oil filled rather than with a separate container of oil saving valuable time during elevator installation and reducing the risk of errors and spillage. The MLB 35 and MLB 40 are delivered without oil.

The MLB series is designed and built according to strict engineering standards and is universally approved and globally certified.

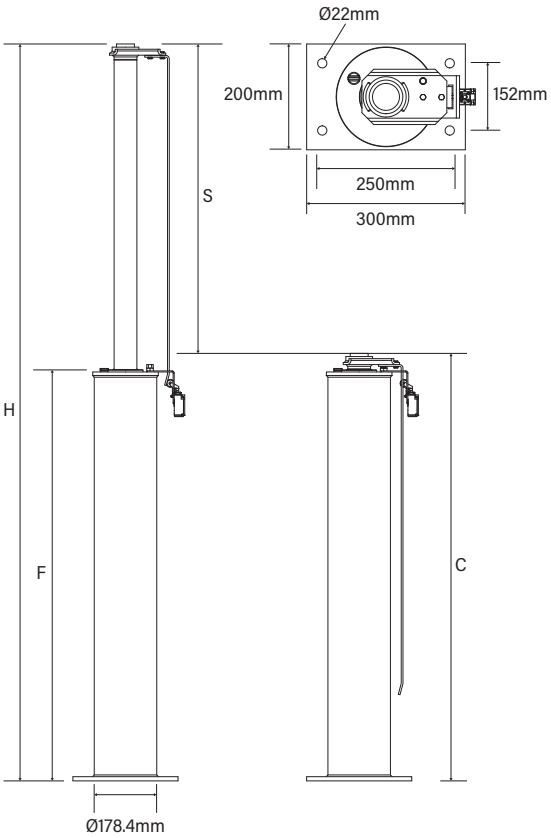
The MLB series provides a cost effective solution with excellent performance characteristics across an exceptionally wide mass range.

*other than statutory inspections.

Dimensions for MLB 13, 16, 18, 20, 25, 32



Dimensions for MLB 35, 40



Model		MLB 13	MLB 16	MLB 18	MLB 20	MLB 25	MLB 32	MLB 35	MLB 40
Rated speed	m/s	1.300	1.600	1.800	2.030	2.540	3.150	3.560	4.060
Max Speed (115%)	m/s	1.495	1.840	2.070	2.335	2.921	3.623	4.094	4.669
Stroke 'S' (min.)	m	0.1213	0.1743	0.2203	0.2803	0.4363	0.6803	0.8809	1.1409
Impact mass range	Kg	450-5500	450-5500	450-5500	450-5500	450-5500	450-5500	600-5500	600-5500
Height 'H' **max.** (extended)**	m	0.4103	0.5323	0.6343	0.7823	1.1643	1.7305	2.1079	2.6929
Height 'C' **min.** (compressed)**	m	0.2754	0.3444	0.4004	0.4884	0.7144	1.0340	1.2093	1.5343
Height 'F' to reservoir top	m	0.2387	0.3077	0.3637	0.4517	0.6777	0.9817	1.1680	1.4930
Weight no oil (dry)	Kg	9.81	11.15	12.67	15.02	21.05	29.72	61.45	75.66
Oil volume	Litres	1.02	1.41	1.70	2.20	3.30	5.20	19.50	25.00
Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 10.4.3.2 and ASME A17.1 rule 2.22.4.1.2									
Reduced stroke ASME A17.1 North America	m/s	1.880	2.260	2.540	2.870	3.590	5.490	6.260	7.120
Reduced stroke EN81-20 Europe	m/s	n/a	n/a	n/a	n/a	3.590	5.490	6.260	7.120

**The max and min figures provided take account of the extremes of the tolerance to provide absolute maximum and absolute minimum dimensions. For more details please request detailed installation drawing.

All information included is correct at the time of printing.

LB Series

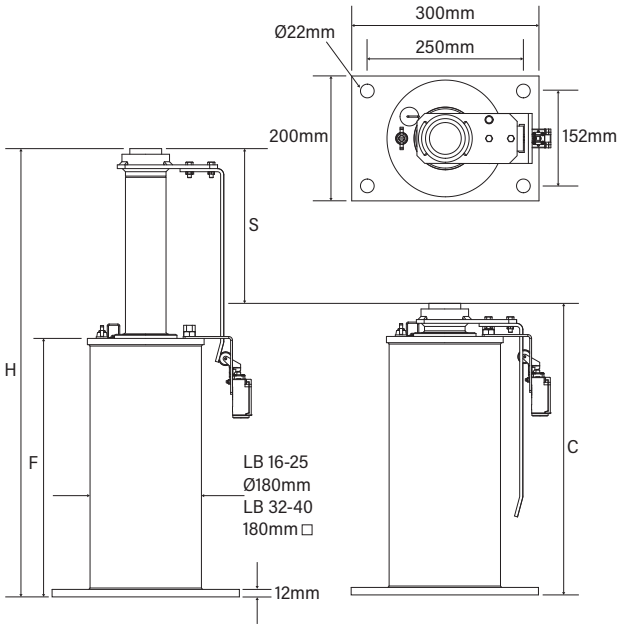
Oleo has been offering the LB series for over thirty years. The Oleo LB gas hydraulic buffer series is globally recognised for its excellent performance and reliability.

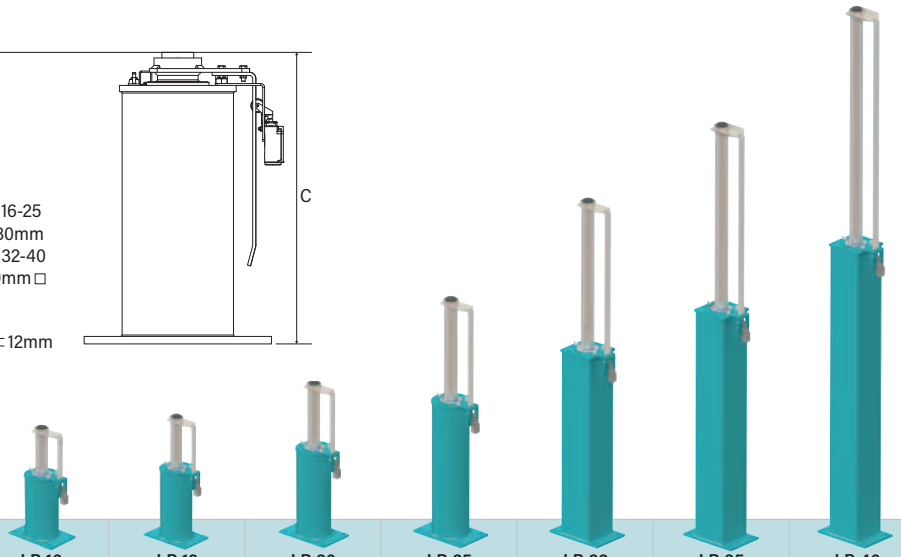
It is a self contained, maintenance free* unit designed for heavy and high speed installations offering our largest mass range.

Given the large mass range and rated speed of the LB series, this buffer can be found in a number of different installations including, low, medium and high rise buildings, vehicle and service elevators.

The LB series is designed and built according to strict engineering standards and is universally approved and globally certified.

*other than statutory inspections.





Model		LB 16	LB 18	LB 20	LB 25	LB 32	LB 35	LB 40
Rated speed	m/s	1.600	1.800	2.032	2.540	3.150	3.560	4.064
Max Speed (115%)	m/s	1.840	2.070	2.337	2.920	3.623	4.094	4.674
Stroke 'S' (min.)	m	0.2032	0.2489	0.2999	0.4619	0.6989	0.8809	1.1409
Impact mass range	Kg	500-8330	500-8330	500-8330	500-8330	700-8330	1000-8330	1000-8330
Height 'H' **max.** (extended)**	m	0.6166	0.7229	0.8389	1.2109	1.7059	2.1079	2.6929
Height 'C' **min.** (compressed)**	m	0.3973	0.4563	0.5213	0.7313	0.9893	1.2093	1.5343
Height 'F' to reservoir top	m	0.3560	0.4150	0.4800	0.6900	0.9470	1.1670	1.4920
Weight no oil (dry)	Kg	25.54	28.12	30.96	40.14	54.93	65.46	80.69
Oil volume	Litres	4.62	5.58	6.64	10.00	20.00	24.50	31.50
Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 10.4.3.2 and ASME A17.1 rule 2.22.4.1.2								
Reduced stroke ASME A17.1 North America	m/s	2.450	2.710	2.980	4.530	5.570	6.260	7.120
Reduced stroke EN81-20 Europe	m/s	n/a	n/a	n/a	3.700	5.570	6.260	7.120

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All information included is correct at the time of printing.

High Speed LB Series

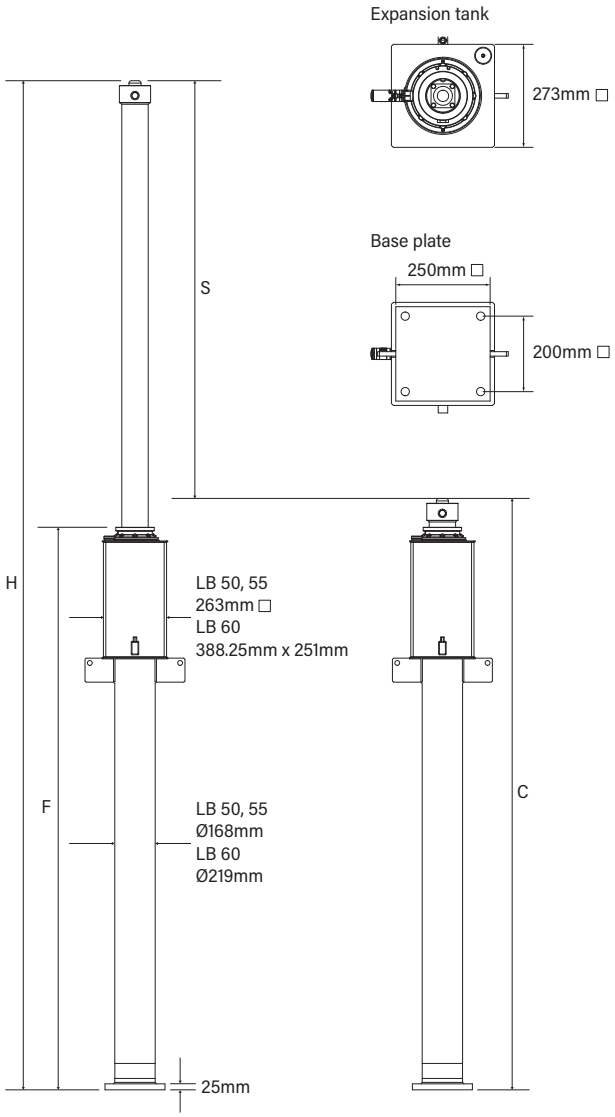
The Oleo LB 50-60 gas hydraulic buffer range is designed specifically for high speed elevator applications typically seen in high rise buildings where speeds over 5m/s are achieved.

If approved terminal speed limiting devices are employed by applying the reduced stroke calculation the LB 50-60 can deal with speeds up to 10.55m/s.

The Oleo principle of designing self contained, maintenance free* buffer units is applied to the LB 50-60 series of buffers and offers an easy installation process, this makes Oleo buffers the best solution for the life of the installation.

The LB series is designed and built according to strict engineering standards and is universally approved and globally certified.

*other than statutory inspections.



Model		LB 50	LB 55	LB 60
Rated speed	m/s	5.080	5.588	6.096
Max Speed (115%)	m/s	5.842	6.426	7.010
Stroke 'S' (min.)	m	1.7410	2.1100	2.5050
Impact mass range	Kg	1500-7500	1250-7500	1500-10000
Height 'H' **max.** (extended)**	m	4.2144	5.0374	6.1796
Height 'C' **min.** (compressed)**	m	2.4395	2.8935	3.5975
Height 'F' to reservoir top	m	2.3430	2.7970	3.4550
Weight no oil (dry)	Kg	202.6	235.2	458.1
Oil volume	Litres	27.80	33.30	73.00
Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 10.4.3.2 and ASME A17.1 rule 2.22.4.1.2				
Reduced stroke ASME A17.1 North America	m/s	8.850	9.730	10.590
Reduced stroke EN81-20 Europe	m/s	8.850	9.730	10.590

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High Speed Lift Series

The new Oleo HSL telescopic gas hydraulic buffer range is designed specifically for high speed elevator applications typically seen in high rise buildings where speeds over 4.82m/s are achieved.

If approved terminal speed limiting devices are employed by applying the reduced stroke calculation the HSL115 can deal with speeds up to 20.23m/s.

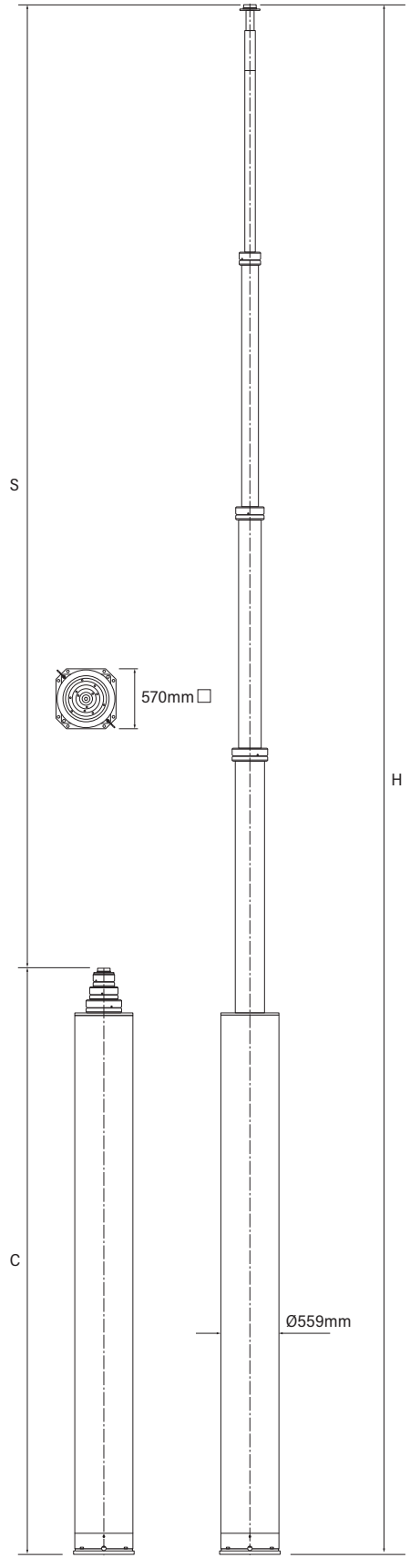
The HSL Series offers considerably more installation possibilities than conventional single stage buffers due to telescopic technology. This allows for lower compressed unit heights and smaller buffer envelopes at higher elevator speeds.

The Oleo principle of designing self contained, maintenance free* buffer units is applied to the HSL series of buffers and offers an easy installation process, this makes Oleo buffers the best solution for the life of the installation.

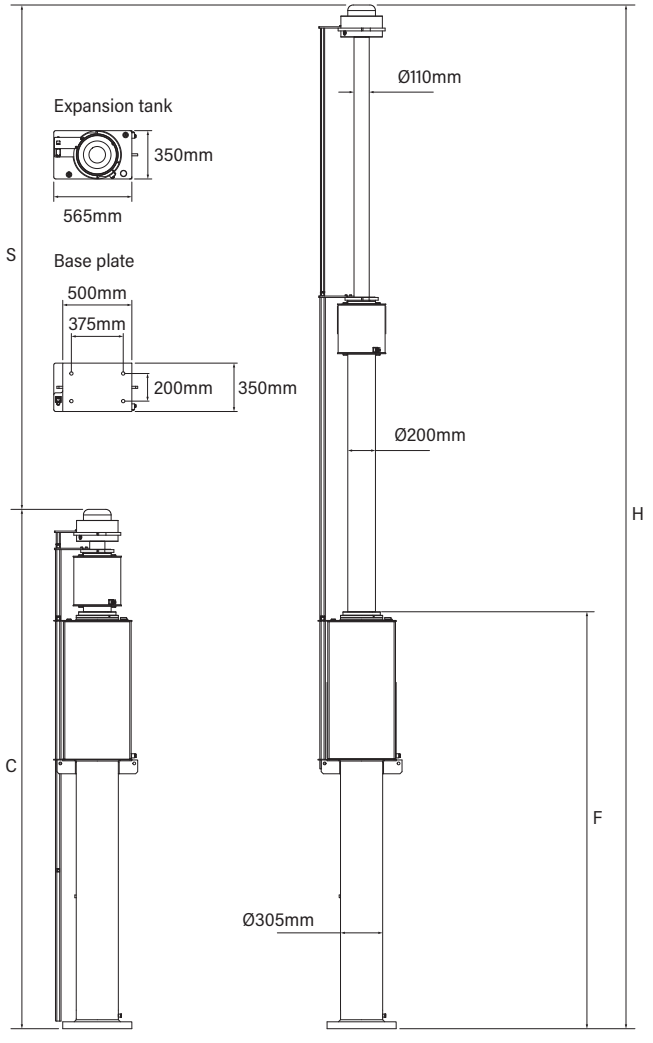
The HSL series is designed and built according to strict engineering standards and has achieved the EN81 and GB 7588 certification.

*other than statutory inspections.

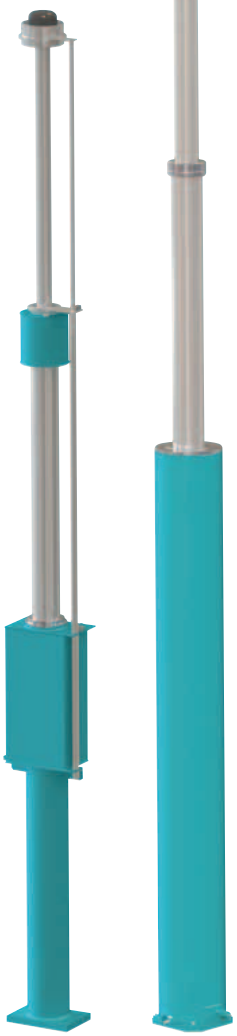
HSL 101, 115



HSL 58, 72, 87



Model		HSL 58	HSL 72	HSL 87	HSL 101	HSL 115
Rated speed	m/s	5.850	7.250	8.700	10.100	11.550
Max Speed (115%)	m/s	6.728	8.338	10.005	11.615	13.283
Stroke 'S' (min.)	m	2.3420	3.6448	5.1920	6.9730	9.1264
Impact mass range	Kg	4000-10000	4000-10000	4000-10000	5000-8000	5500-8000
Height 'H' **max.** (extended)**	m	4.9655	7.4147	10.2950	12.5700	14.9190
Height 'C' **min.** (compressed)**	m	2.5225	3.6725	5.1835	4.1830	5.7011
Height 'F' to reservoir top	m	1.9425	3.0175	4.4925	3.6330	5.1570
Weight no oil (dry)	Kg	779.0	1249.0	1450.0	3000.0	3497.0
Oil volume	Litres	98.00	144.00	207.00	275.00	490.00
Reduced stroke: Rated speed with terminal speed limiting device, based on EN81-20 rule 10.4.3.2 and ASME A17.1 rule 2.22.4.1.2						
Reduced stroke ASME A17.1 North America	m/s	10.220	12.740	15.210	17.650	20.230
Reduced stroke EN81-20 Europe	m/s	10.220	12.740	15.210	17.650	20.230



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LEADING THE WORLD IN ENERGY ABSORPTION

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Issue 5 – March 2017

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