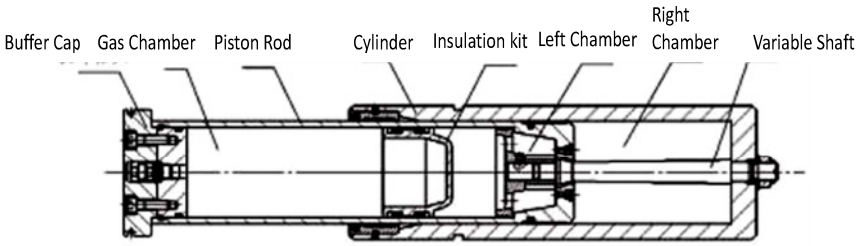
Gas-liquid Hybrid Buffers Series HD

Working Principal



Sketch Drawing for Gas-liquid Hybrid Buffer

During the initiated stage, there will be a certain volume of nitrogen in the gas chamber, and a certain volume of hydraulic oil in the oil chamber. And the piston rod reaches its max. out-reach, all components inside the buffer are in stable position. In case the buffer cap hit by an accident impact, the oil and gas pressure increased magnificently which was pushed by the piston. Hydraulic oil flows towards to left oil chamber through throttle holes which formed by variable shaft and piston rod. Meanwhile, the oil inside the left oil chamber pushes the insulation kit to left side, the nitrogen gas inside the gas chamber absorbing the impact energy and form the “gas” spring. In case the collision object left, the “gas” spring will push the buffer elements to their initiated position. While the oil flows through the throttle holes, the mechanical energy will transform into thermal energy, the total efficiency will be no less than 80%. The throttle area variation will be controlled by the diameter of variable shaft. The parameters of the variable shaft are selected through massive test practices and theoretical calculations.

Application

Gas-liquid hybrid buffers are widely used for all kinds of production and material handling machineries for mechanization and automation industry.
Horizontal Installation: ship-to-shore contain cranes, railway automotive and transportation vehicles for metallurgical workshop
Vertical Installation: elevators, mine pit and so on
Rotation Installation: conveyers, car dumpers and so on

Advantage of gas-liquid hybrid buffers

As the “gas” spring was to rest the hybrid buffer, in case of high-speed traveling facilities impact on buffers, most parts of impact energy (over 90%) transformed into thermal energy, only very few parts of energy transformed into hydraulic energy in the oil. Thus the absorbing efficiency (attenuation coefficient) is pretty good. This will minimize rebounding speed significantly. Due to the small modulus of volume elasticity of the “gas” spring, the hybrid buffer can run smoothly with minimal impact force. Unlike the traditional rubber buffers and spring buffers with poor damping effect, which can only eliminate very few impact energy, and cause very serious rebounding

Symbol

m	*Mass of Object*	t	v	*Motion speed*	m/s
m_d	*Nominal Mass of Object*	t	v_k	*Limited Motion speed*	m/s
H	*The Falling Height of Object*	m	ω	*Object angular velocity*	m/s
H_d	*The Nominal Falling Height of Object*	m	I	*Moment of inertia*	Tm^3
S	*Stroke*	m	F	*Driving Force*	kN
R	*Slewing Radial of rotating object mass center*	m	N	*Supporting Force*	kN
R	*Radial from buffer center line to rotating object pivot*	m	*Acceleration of gravity* g=9.81 m/s^2		
E	*Energy obtained by impact object*	kJ	Co	*Rotating Object Mass Center*	
E_D	*Energy generated by driving system*	kJ	η =0.8	*Effective Percentage of Buffer*	
E_1	*Energy generated by inertia motion*	kJ	n	*Number of Buffers*	
P_E	*Potential Energy*	kJ			

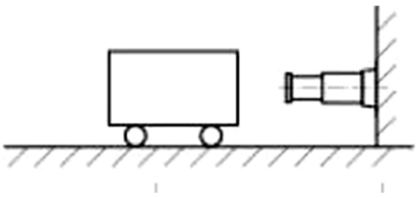
Selection of buffers

1. Determine the impact type (Vertical impact, horizontal impact or rotating impact);
2. Determine the mass of impact object: in case of simple horizontal motion impact, it can be calculated in accordance with the following table, for other situations, the nominal mass can be calculated from related formulas;
3. Determine the impact speed: in case of simple horizontal motion impact, it can be calculated in accordance with the following table, for other situations, the nominal impact speed can be calculated from related formulas;
4. Use formulas to determine the force for the pivot and kinetic energy, then determine the buffer type;
5. After determine the buffer type, double check the max. force bounded by the fixed end of buffer and max. energy absorbed;
6. Select the variable shaft code in accordance with the nominal impact object mass m_d.

Basic selection formula

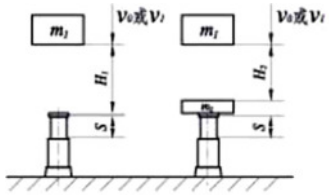
Horizontal Motion Impact

Kinetic energy caused by inertia force	$E_1 = \frac{mv^2}{2}$	kJ			
Total Kinetic energy	$E_r = E_1 + E_o$	kJ	Kinetic energy caused by driving force	$E_D = FS$	kJ
Support Force Caused by driving force	$N_{D\max} = F$	kN	Support Force Caused by inertia force	$N_{\mathrm{Im}\,ax} = \frac{E_1}{S\eta}$	kN
Nominal impact mass	$m_4 = \frac{2E_r}{v^2}$	t	Total Support Force	$N_{\max} = \frac{E_1}{S\eta}$	kN



Vertical Motion Impact

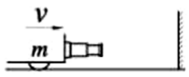
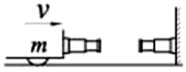
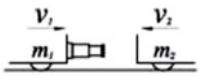
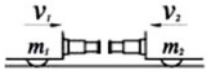
Total Potential Energy	$P_E = m_1 g(H_1 + S)$	kJ	Max. Support Force By each buffer	$N_{\max} = \frac{P_E}{S\eta}$	kN
Nominal impact mass for each buffer	$m_d = \frac{P_E}{ngH}$	t	In case object impacts on the buffer with V_k	$H = \frac{v_1^2}{2g}$	m
In case there is an object (m_2) mounted on buffer, then another object m_1 falls on m_2, then both objects are damping together. In such case, $H_1$was replaced by H_d				$H_1 = \frac{H_2 m_1}{m_1 + m_2}$	m



Rotating Motion Impact

Kinetic energy caused by inertia force	$E_1 = \frac{I\omega^2}{2} = \frac{mR^2\omega^2}{2}$	kJ			
Total Kinetic energy	$E_r = E_1 + E_D$	kJ	Kinetic energy caused by driving force	$E_D = \frac{T_S}{2}$	kJ
Nominal impact mass per buffer	$m_d = \frac{2E_r}{(r\omega)^2 n}$	t	Max. Support Force By each buffer	$N_{\max} = \frac{E_r}{S\eta}$	kN

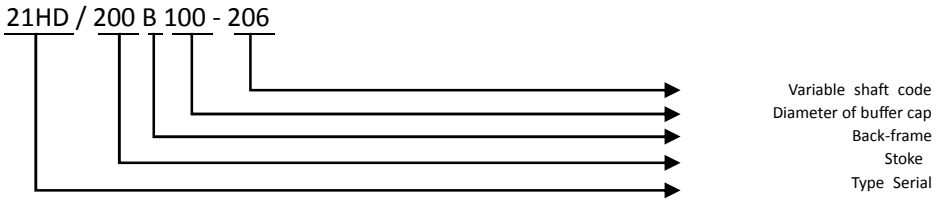
Remarks: Due to the Hybrid buffer could not bear large unbalance loading, the loading force direction shall keep aliment along with the buffer center line in most possibility, the mis-aliment angle shall be no more than 5° . If there are specified requirements, please contact with us.

Same type of buffers applied in horizontal position				
Index	1	2	3	4
Impact situation				
Nominal Speed m/s	v	$\frac{v}{2}$	$v_1 + v_2$	$\frac{v_1 + v_2}{2}$
Nominal Mass (t)	m	$2m$	$\frac{m_1 m_2}{m_1 + m_2}$	$\frac{2m_1 m_2}{m_1 + m_2}$
m: max. impact mass on the rail ***v***: max. impact speed on the rail				

21 Serial Gas-liquid Hybrid Buffer

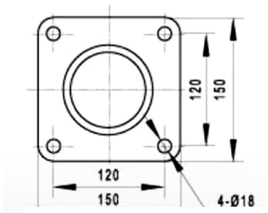
Sample for the complete code description:

21Serial, stroke 200mm, back-frame, diameter of buffer cap Φ100, impact object weight 50t
The complete code is:



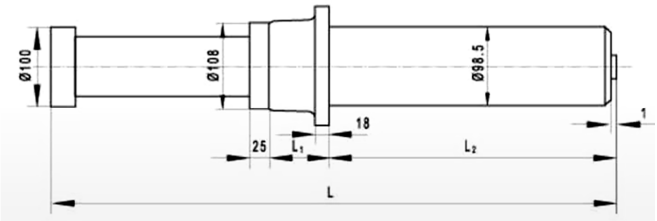
Basic Parameter Table

Model	21 HD/050	21HD/100	21HD/150	21HD/200
Stoke mm	50	100	150	200
Damping Capacity kJ	10	20	30	40
Max. Impact force kN	250			



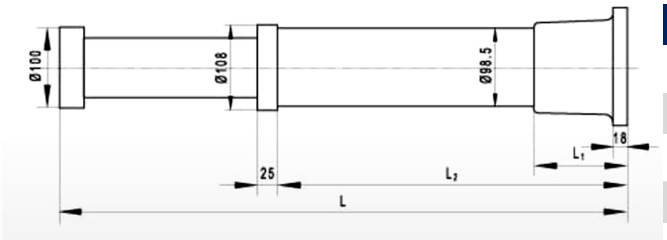
Installation Flange Dimension

21HD Front-frame (F)



Model	21 HD/050	21HD/100	21HD/150	21HD/200
L mm	276	430	594	710
L_1 mm	55	55	55	55
L_2 mm	120	224	333	359
Weight (kg)	13	17	20	24

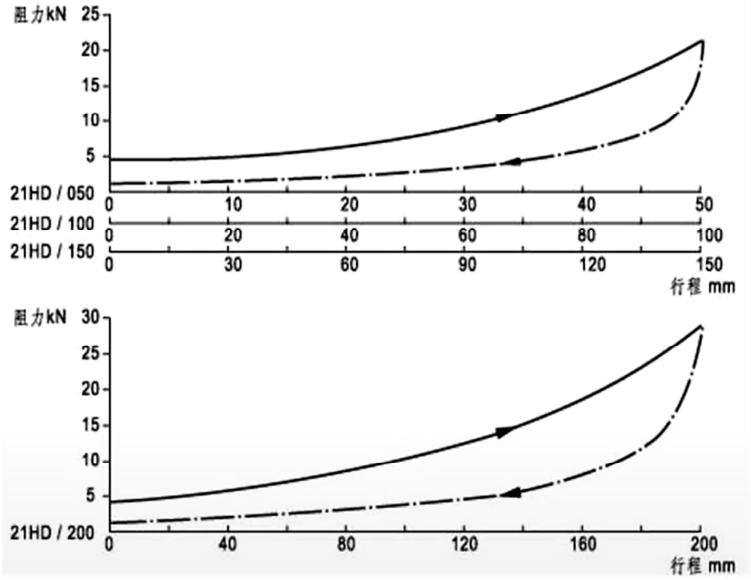
21HD Back-frame (B)



Model	21 HD/050	21HD/100	21HD/150	21HD/200
L mm	286	440	604	720
L_1 mm	75	75	118	118
L_2 mm	175	279	388	444
Weight (kg)	14	18	22	26

Static Pressure Figure

Initiated pressure(gas) 0.5Mpa



Variable shaft selection

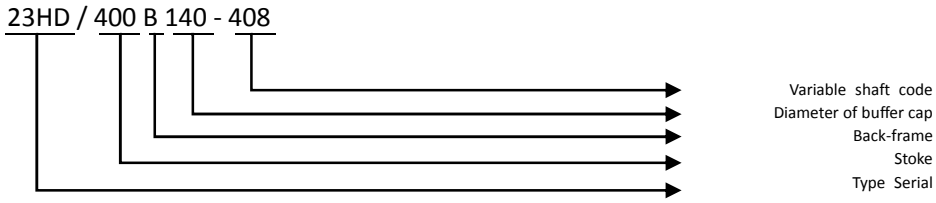
Model	21 HD/050	21HD/100	21HD/150	21HD/200
Impact Mass (t)		Variable shaft code XXX		
<1.7	051	101	151	201
>1.7~3.5	052	102	152	202
>3.5~7.0	053	103	153	203
>7.0~13.0	054	104	154	204
>13.0~25.0	055	105	155	205
>25.0~50.0	056	106	156	206
>50.0~100.0	057	107	157	207
>100.0~200.0	058	108	158	208
>200.0~400.0	059	109	159	209

SIBRE Siegerland-Bremsen GmbH – Auf der Stücke 1-5 – D-35708 Haiger, Germany
Tel.: +49 2773 94000 – Fax: +49 2773 9400-10 – e-mail: info@sibre.de – www.sibre.de

23 Serial Gas-liquid Hybrid Buffer

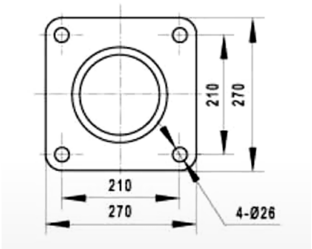
Sample for the complete code description:

23Serial, stroke 400mm, back-frame, diameter of buffer cap Φ140, impact object weight 80t



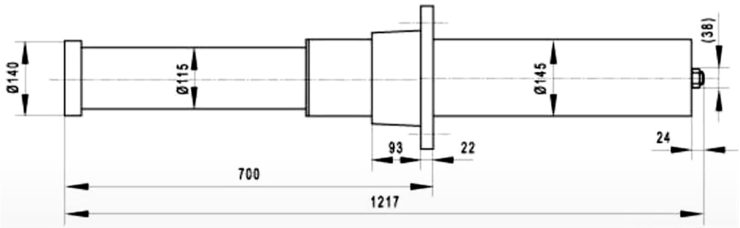
Basic Parameter Table

Model	23 HD/400
Stoke (mm)	400
Damping Capacity kJ	224
Max. Impact force kN	700



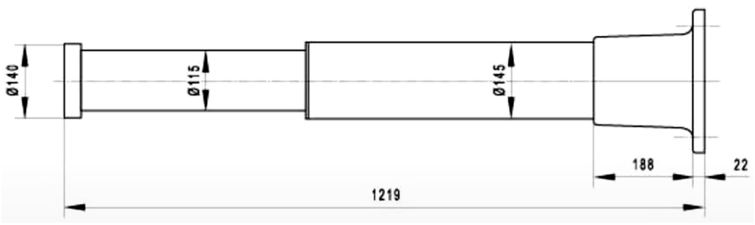
Installation Flange Dimension

23HD/400F140-XXX Front-frame (F)



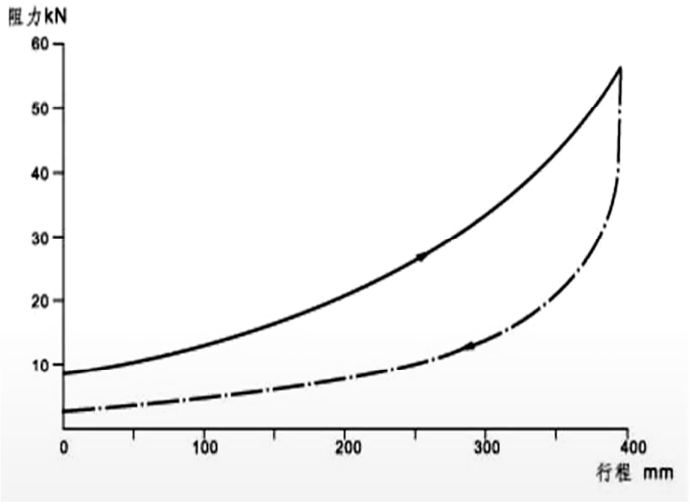
Weight (kg)	80

23HD/400B140-XXX Back-frame (B)



Weight (kg)	85

Static Pressure Figure
Initiated pressure(gas) 0.5Mpa



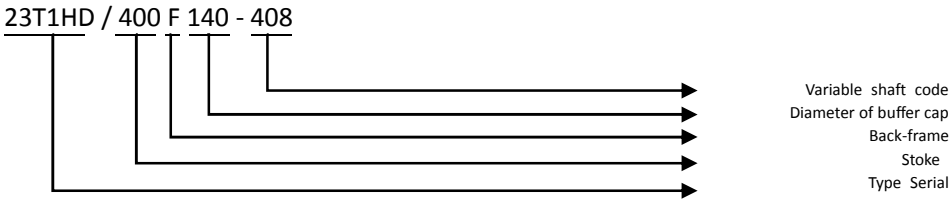
Variable shaft selection

Model	23 HD/400
Impact Mass (t)	Variable shaft code XXX
<4.0	402
>4.0~8.0	403
>8.0~10.0	404
>10.0~20.0	405
>20.0~40.0	407
>40.0~80.0	408
>80.0~150.0	410
>150.0~300.0	412
>300.0~600.0	415
>600.0~800.0	417
>800.0~1000.0	419
>1000.0~2000.0	422

23T1 Serial Gas-liquid Hybrid Buffer

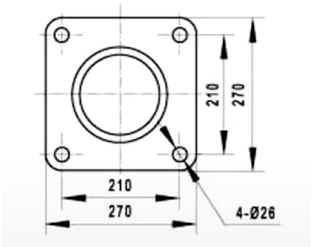
Sample for the complete code description:

23T1 Serial, stroke 400mm, front-frame, diameter of buffer cap Φ140, impact object weight 80t



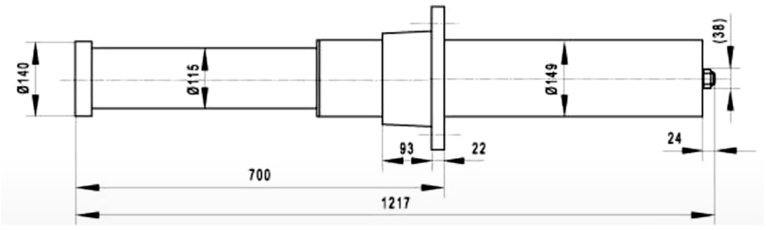
Basic Parameter Table

Model	23 T1HD/400
Stoke mm	400
Damping Capacity kJ	280
Max. Impact Force kN	875



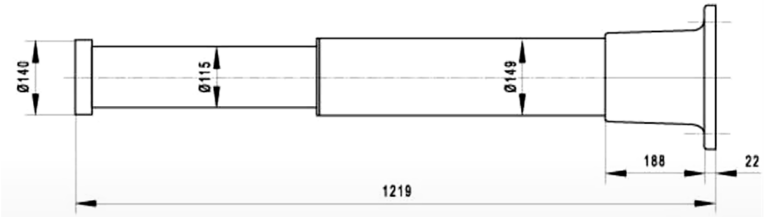
Installation Flange Dimension

23T1HD/400F140-XXX Front-frame (F)



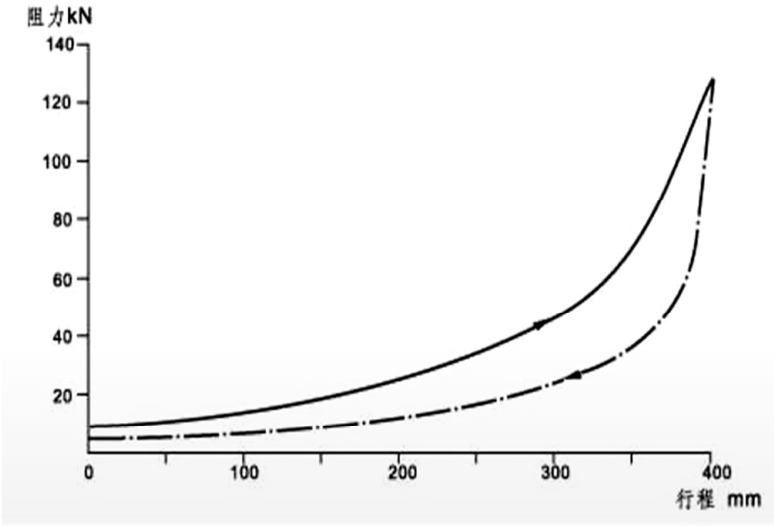
Weight (kg)	90

23T1HD/400B140-XXX Back-frame (B)



Weight (kg)	94

Static Pressure Figure
Initiated pressure(gas) 1.0Mpa



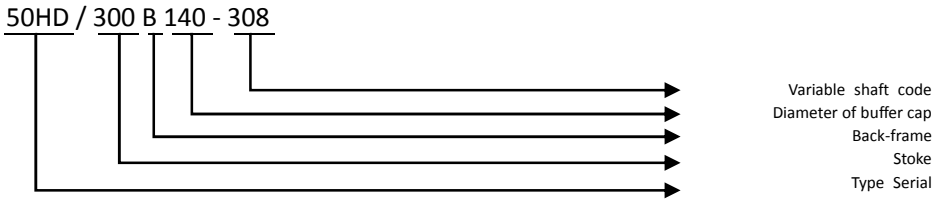
Variable shaft selection

Model	23 T1HD/400
Impact Mass (t)	Variable shaft code XXX
<4.0	402
>4.0~8.0	403
>8.0~10.0	404
>10.0~20.0	405
>20.0~40.0	407
>40.0~80.0	408
>80.0~150.0	410
>150.0~300.0	412
>300.0~600.0	415
>600.0~800.0	417
>800.0~1000.0	419
>1000.0~2000.0	422

50 Serial Gas-liquid Hybrid Buffer

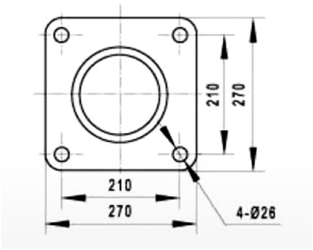
Sample for the complete code description:

50 Serial, stroke 300mm, back-frame, diameter of buffer cap Φ140, impact object weight 80t



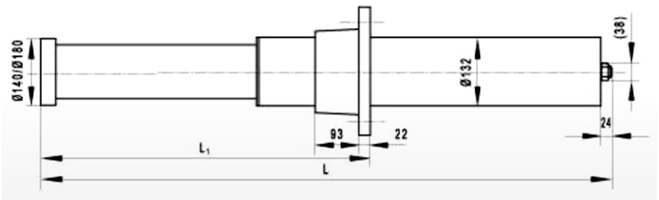
Basic Parameter Table

Model	50HD/250	50HD/300	50HD/400
Stoke mm	250	300	400
Damping Capacity kJ	100	120	160
Max. Impact Force kN		500	



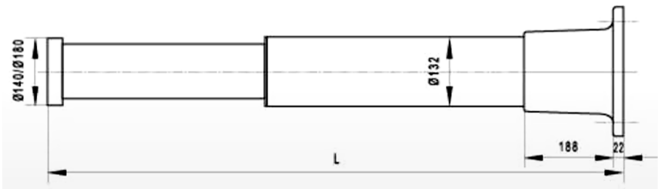
Installation Flange Dimension

50HD Front-frame (F)



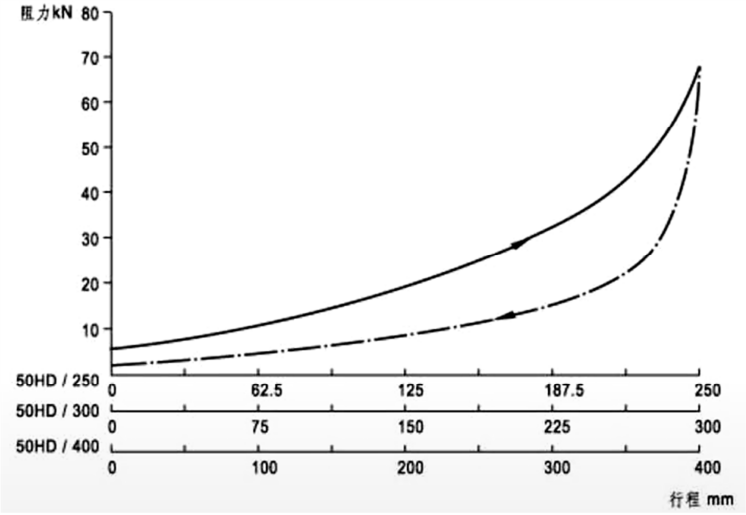
Model	50 HD/250	50HD/300	50HD/400
L mm	883	1018	1288
L_1 mm	530	580	680
Weight (kg)	60	70	76

50HD Back-frame (B)



Model	50 HD/250	50HD/300	50HD/400
L mm	885	1020	1290
Weight (kg)	68	76	84

Static Pressure Figure
Initiated pressure(gas) 0.5Mpa



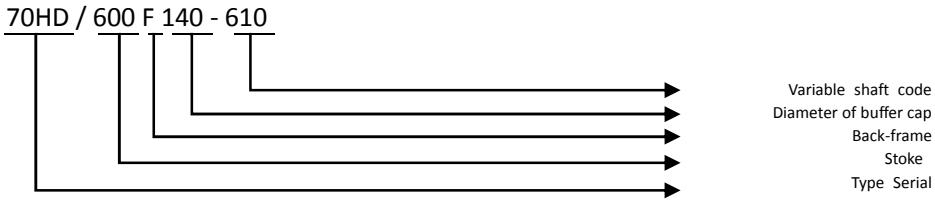
Variable shaft selection

Model	50HD/250	50HD/300	50HD/400
Impact Mass (t)	Variable shaft code XXX		
<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

70 Serial Gas-liquid Hybrid Buffer

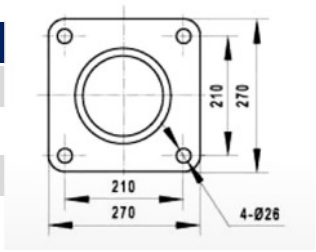
Sample for the complete code description:

70 Serial, stroke 600mm, front-frame, diameter of buffer cap Φ140, impact object weight 150t



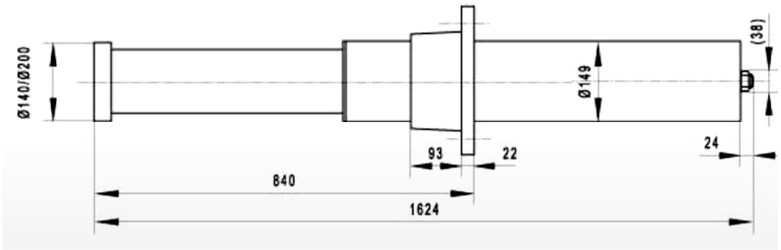
Basic Parameter Table

Model	70HD/500	70HD/600
Stoke mm	500	600
Damping Capacity kJ	280	336
Max. Impact Force kN	700	



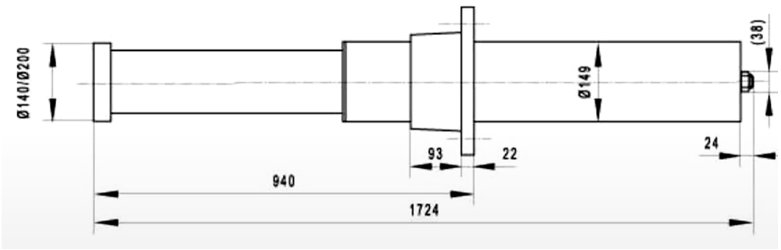
Installation Flange Dimension

70HD/500F140-XXX Front-frame (F)



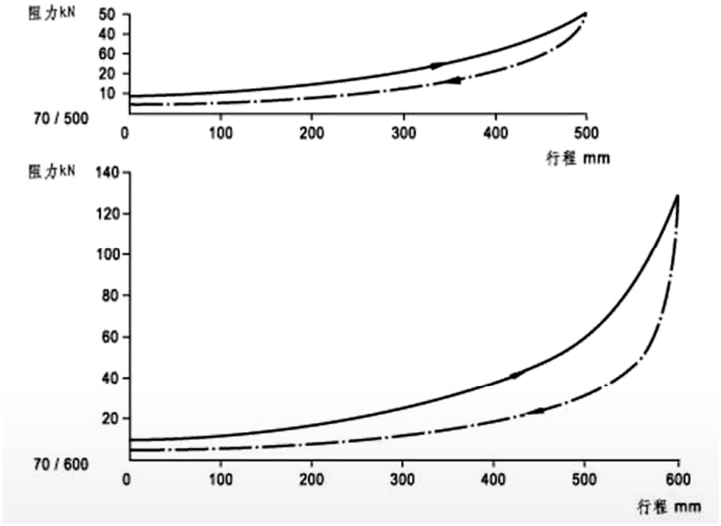
Weight (kg)	96

70HD/600F140-XXX Back-frame (F)



Weight (kg)	100

Static Pressure Figure
Initiated pressure (gas) 1.0Mpa



Variable shaft selection

Model	70HD/500	70HD/600
Impact Mass (t)	Variable shaft code XXX	
<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