DELLNER DAMPERS

Hydraulic Energy Absorbers
HE and GHE series.

Dellner Dampers

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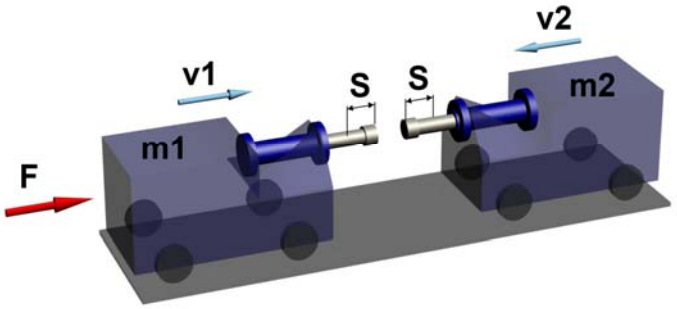
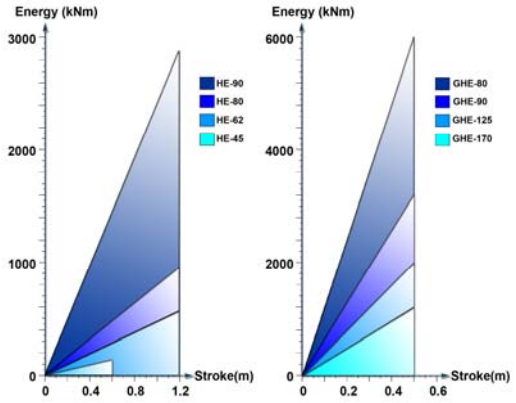
Easy to Calculate		**Page 3-5**	
Damper Selection Guide		**Page 6**	
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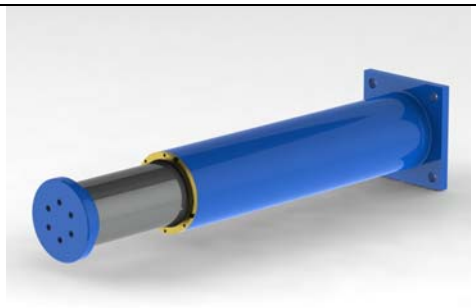
Gas Hydraulic Energy Absorbers	**GHE Series**	**Page 12-15**	

Hydraulic Energy Absorbers (HE) and Gas Hydraulic Energy Absorbers (GHE)

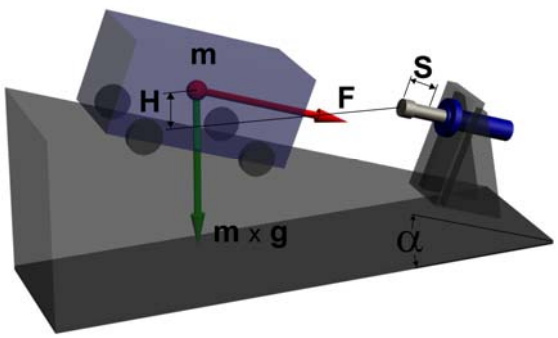
Dellner Damper energy absorbers provide linear deceleration and are therefore superior to other kinds of damping element. It is easy to calculate most of applications knowing only the following 4 parameters:

1. **Mass to be decelerated [weight]** **m [kg]**
2. **Impact velocity at energy absorber** **V_e [m/s]**
3. **Propelling force** **F [N]**
4. **Number of strokes per hour** **X [1/h]**

Key to Symbols used:		
W_k	[Nm]	Kinetic energy
W_A	[Nm]	Propelling force energy
W_{kg}	[Nm]	Total energy / $W_k + W_A$
$W_{kg/h}$	[Nm/h]	Total energy per hour
m	[kg]	Mass
me	[kg]	Effective mass
v	[m/s]	Impact speed
v_e	[m/s]	Effective speed
X	[1/h]	Number of strokes per hour
S	[m]	Stroke
F	[N]	Propelling force
H	[m]	Height
g	[m/s^2]	Acceleration due to gravity [9,81 m/s^2]
α	[°]	Angle
a	[m/s^2]	Acceleration/deceleration
t	[s]	Deceleration time
F_G	[N]	Counter force

1.

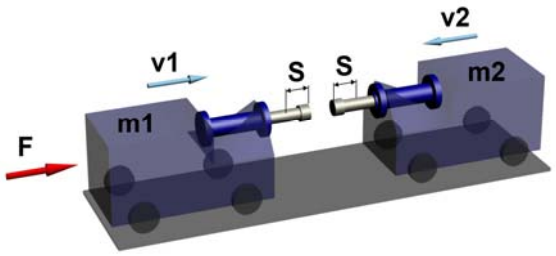
LOAD ON SLOPE



Example	Calculation				Damper type:	**HE45-600**
m = 21.000 kg	W_k	=	m x g x H	=	103,0 Nm	
H = 0,5 m	W_A	=	m x g x sinα x S	=	46,3 Nm	
α = 22°	W_{kg}	=	$W_k + W_A$	=	149,3 Nm	
S = 0,6	$W_{kg/h}$	=	W_{kg} x X	=	149,3 Nm/h	
X = 1/h	v	=	$v_e = \sqrt{[2xgxH]}$			

2.

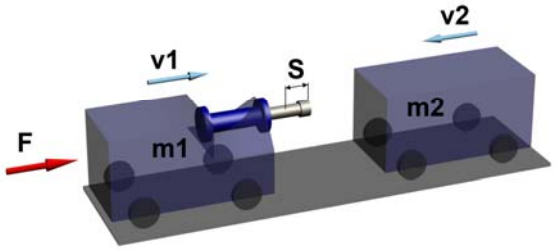
LOAD AGAINST LOAD WITH SHOCK ABSORBERS



Example	Calculation				Damper type:	
m1 = 15.000 kg	W_k	=	$\frac{[m1 \times m2] \times [v1 \times v2]^2}{2[m1 + m2]}$	=	26,5 Nm	
v1 = 1,9 m/s	With propelling force					
m2 = 16.000 kg	W_A	=	F x S			
v2 = 1,8 m/s	W_{kg}	=	$W_k + W_A$			
X = 12/h	$W_{kg/h}$	=	$W_{kg} \times X$	=	317,9 Nm/h	
S = 0,6	v_e	=	[v1 + v2]/2	=	1,85 m/s	

3.

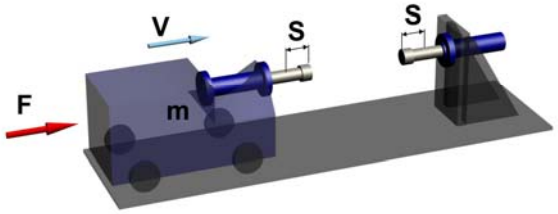
LOAD AGAINST LOAD WITH ONE SHOCK ABSORBER



Example	Calculation				Damper type:	
m1 = 5.000 kg	W_k	=	$\frac{[m1 \times m2] \times [v1 \times v2]^2}{2[m1 + m2]}$	=	17,7 Nm	
v1 = 1,6 m/s	With propelling force					
m2 = 6.000 kg	W_A	=	F x S			
v2 = 2,0 m/s	W_{kg}	=	$W_k + W_A$			
X = 6/h	$W_{kg/h}$	=	$W_{kg} \times X$	=	106,0 Nm/h	
S = 0,5	v_e	=	v1 + v2	=	3,6 m/s	

4.

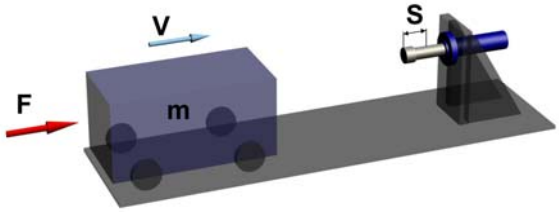
LOAD AGAINST SOLID STOP WITH SHOCK ABSORBERS



Example	Calculation				Damper type:	§
m = 5.000 kg	W_k	=	$\frac{m \times v^2}{2}$:2	=	16,9 Nm	
v = 1,6 m/s	With propelling force					
F = 6.000 kg	W_A	=	F x S	=	1,6 Nm	
X = 6/h	W_{kg}	=	$W_k + W_A$	=	18,5 Nm	
S = 0,5	$W_{kg/h}$	=	$W_{kg} \times X$	=	185,0 Nm/h	
	v_e	=	v1 + v2	=	1,3 m/s	

5.

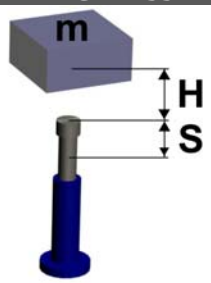
LOAD AGAINST SOLID STOP



Example	Calculation				Damper type:	
m = 40.000 kg	W_k	=	$\frac{m \times v^2}{2}$	=	125,0 Nm	
v = 2,5 m/s	With propelling force					
F = 6.000 kg	W_A	=	F x S	=	1,2 Nm	
X = 5/h	W_{kg}	=	$W_k + W_A$	=	63,1 Nm	
S = 0,2	$W_{kg/h}$	=	$W_{kg} \times X$	=	315,5 Nm/h	
n = 2	v_e	=	v	=	1,3 m/s	

6.

FALLING MASS



Example	Calculation				Damper type: **HE45-600**
m = 1000 kg	W_k	=	m x g x H	=	14,7 Nm
H = 1,5 m	W_A	=	m x g x S	=	3,9 Nm
S = 0,6	W_{kg}	=	$W_k + W_A$	=	18,6 Nm
X = 1/h	$W_{kg/h}$	=	W_{kg} x X	=	18,6 Nm/h
n = 1					

FORMULAS

Counterforce	Deceleration time	Deceleration Rate	Stroke
$F_G = \frac{W_{kg} \times 1{,}2^*}{S}$	$t = \frac{2 \times S}{v_e} \times 1{,}2^*$	$a = \frac{v^2}{2 \times S} \times 1{,}2^*$	$S = \frac{v^2}{2 \times a} \times 1{,}2^*$

*** Calculation for optimum setting. Allow a safety margin!**

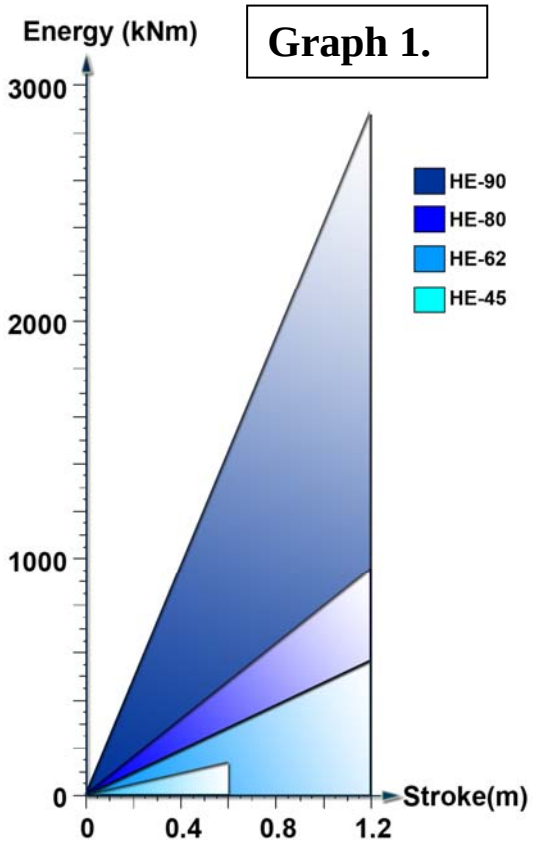
Damper Selection Guide

Use the easy calculation examples, on pages 3-5 to verify the damper needed.
You need these results:

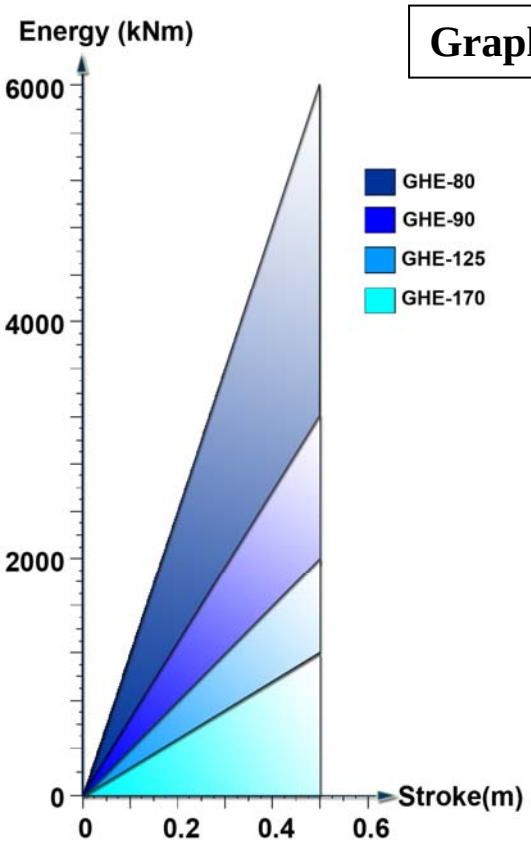
1. Stroke Required **S [m]**
2. Energy Required **W [kNm]**
3. Number of strokes per hour **X [1/h]**

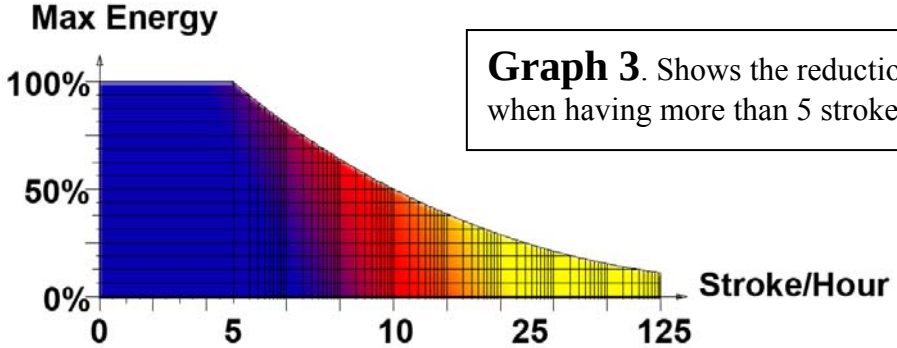
1. Use the Energy and Stroke values in graph 1 and 2 to select a damper type. [If possible select a damper from Graph 1. first]
2. If the damper need to work more frequently then 5 strokes/h, then check graph 3. to see how much you need to reduce the energy capacity of the damper.

Graph 1.



Graph 2.

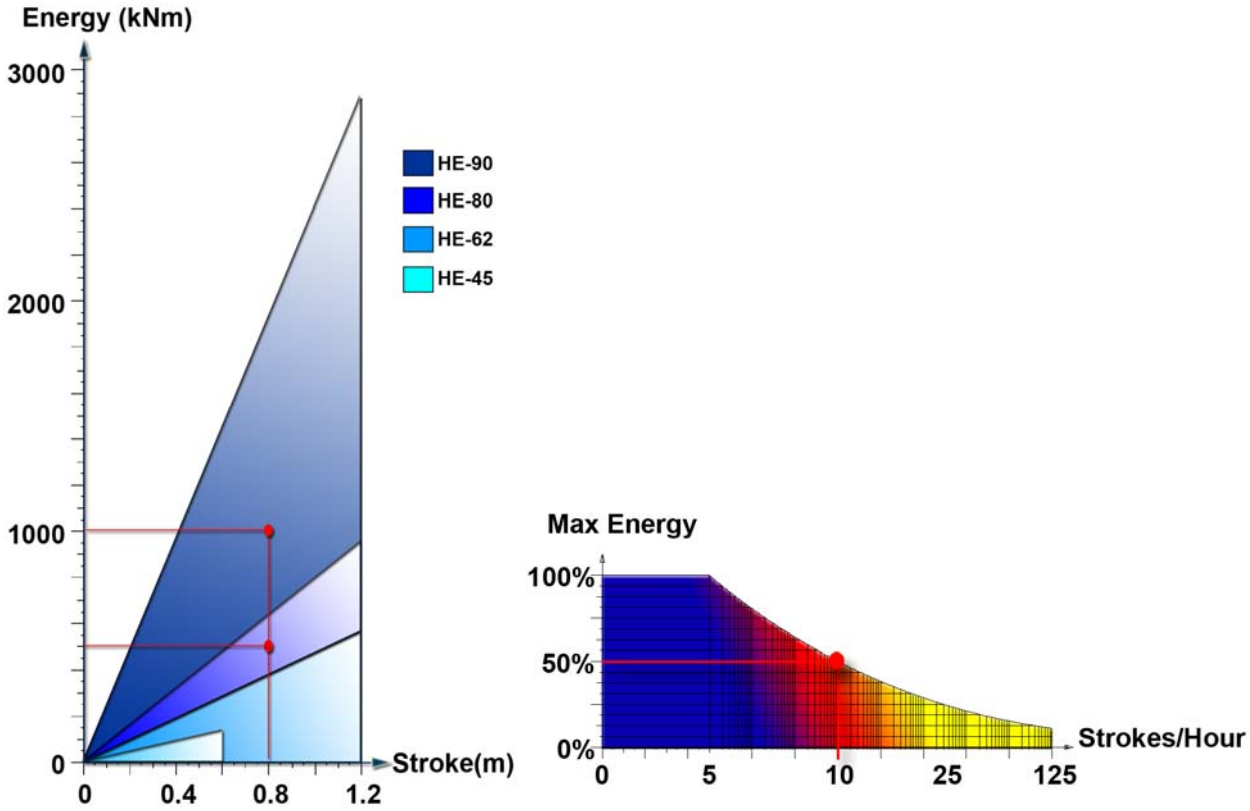




Graph 3. Shows the reduction of energy absorption when having more than 5 strokes/h

Damper Selection Guide

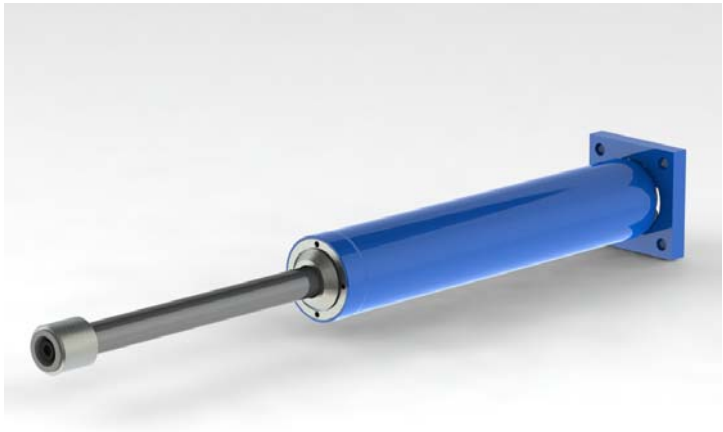
Example:



Hydraulic Energy Absorbers

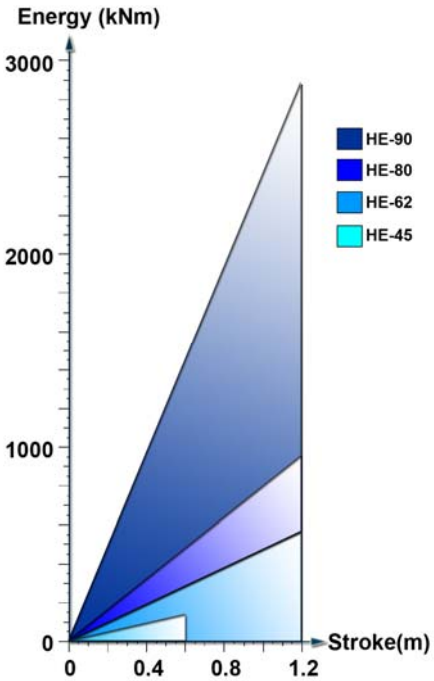
HE Series

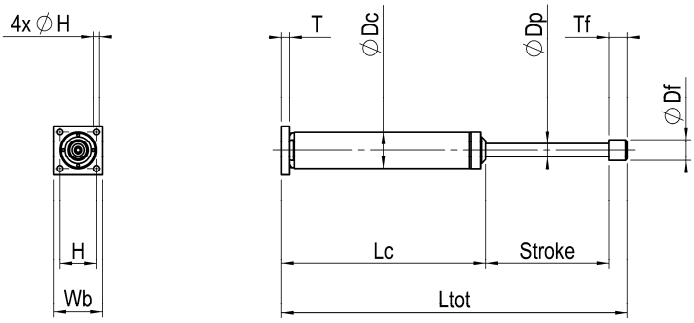
Dellner Damper Technical Data

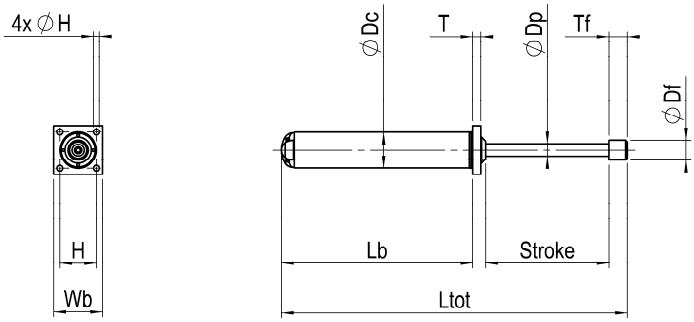


The HE Series is developed for applications where an energy stop device is needed. It has a novel twin tube design, where the inner tube is the working cylinder and the external acts as housing and accumulator for displaced oil. The maximum damping force is 45 kN.

A metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The flow area is determined by the number of drilled holes along the length of the metering pin. The width and distribution of the holes are optimised by computer simulation to gain constant force during retardation.







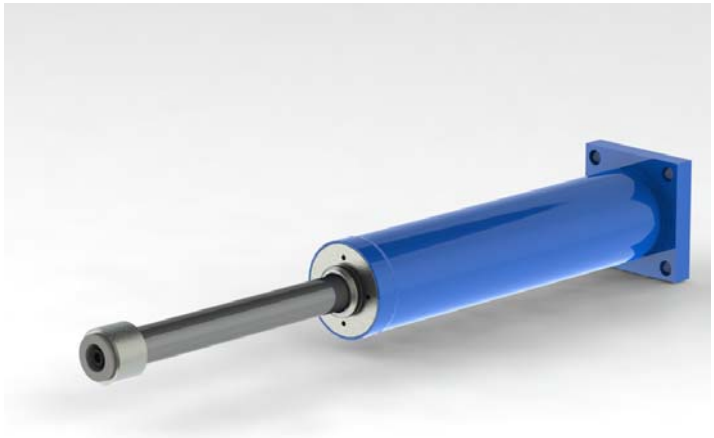
HE-45

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
HE-45-100	45	450	100	Ø45	Ø32	120	90	Ø14	Ø89	Ø50	20	290	45
HE-45-200	45	650	200	Ø45	Ø32	120	90	Ø14	Ø89	Ø50	20	390	45
HE-45-300	45	850	300	Ø45	Ø32	120	90	Ø14	Ø89	Ø50	20	490	45
HE-45-400	45	1050	400	Ø45	Ø32	120	90	Ø14	Ø89	Ø50	20	590	45
HE-45-500	45	1250	500	Ø45	Ø32	120	90	Ø14	Ø89	Ø50	20	690	45
HE-45-600	45	1450	600	Ø45	Ø32	120	90	Ø14	Ø89	Ø50	20	790	45

Hydraulic Energy Absorbers

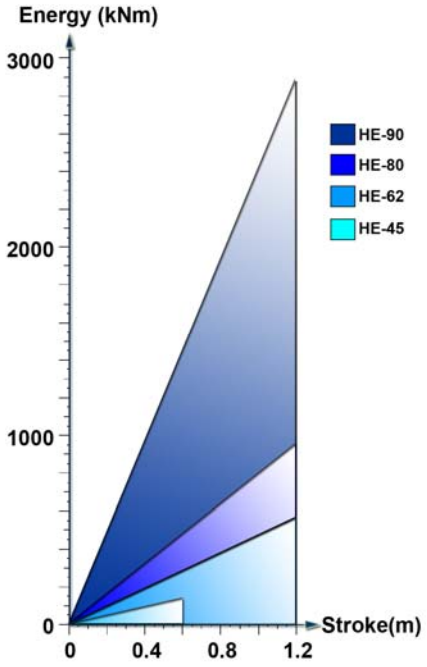
HE Series

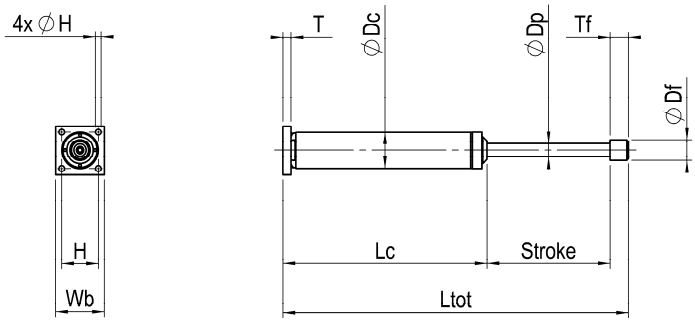
Dellner Damper Technical Data

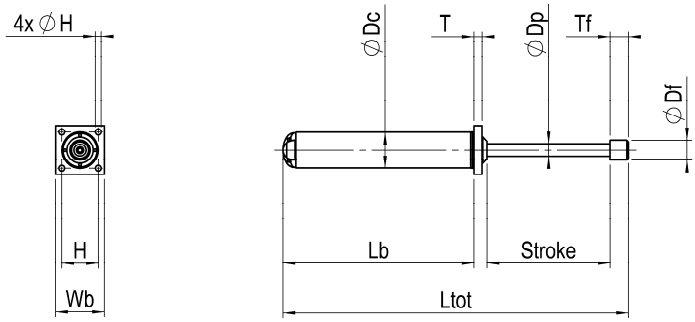


The HE Series is developed for applications where an energy stop device is needed. It has a novel twin tube design, where the inner tube is the working cylinder and the external acts as housing and accumulator for displaced oil. The maximum damping force is 80 kN.

A metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The flow area is determined by the number of drilled holes along the length of the metering pin. The width and distribution of the holes are optimised by computer simulation to gain constant force during retardation.







HE-62

Part Number	Max. Force	Ltot	Stroke	Piston.	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
HE-62-200	80	650	200	Ø62	Ø40	140	111	Ø22	Ø108	Ø60	20	390	45
HE-62-400	80	1050	400	Ø62	Ø40	140	111	Ø22	Ø108	Ø60	20	590	45
HE-62-600	80	1450	600	Ø62	Ø40	140	111	Ø22	Ø108	Ø60	20	790	45
HE-62-800	80	1950	800	Ø62	Ø40	140	111	Ø22	Ø108	Ø60	20	1090	45
HE-62-1000	80	2350	1000	Ø62	Ø40	140	111	Ø22	Ø108	Ø60	20	1290	45
HE-62-1200	80	2750	1200	Ø62	Ø40	140	111	Ø22	Ø108	Ø60	20	1490	45

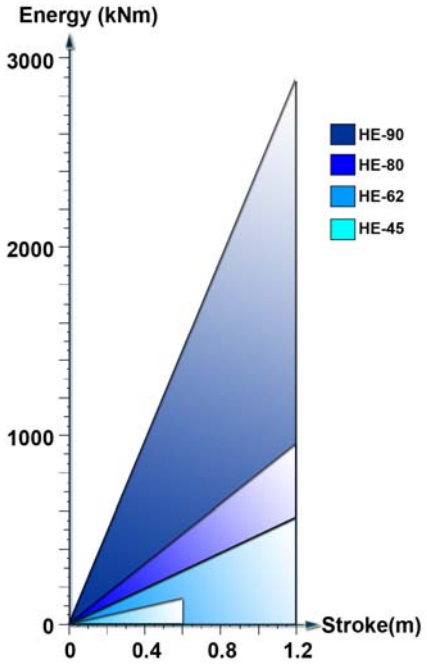
Hydraulic Energy Absorbers

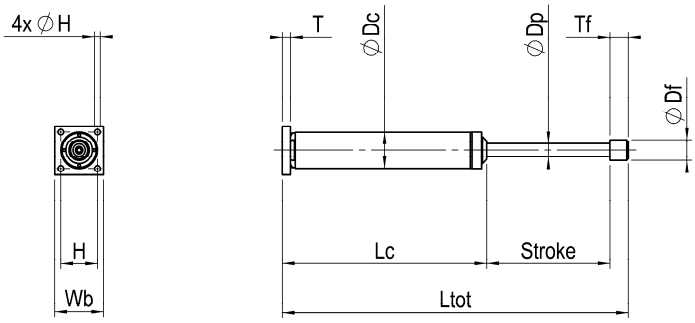
HE Series

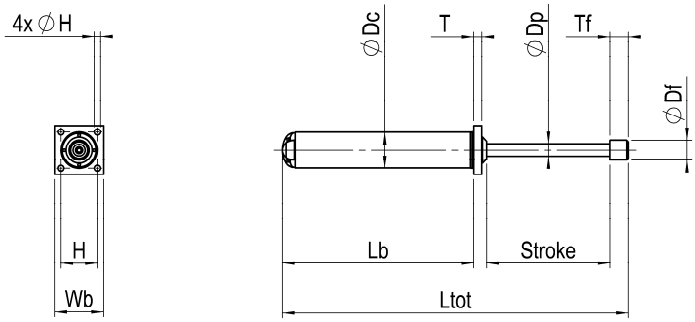
Dellner Damper Technical Data

The HE Series is developed for applications where an energy stop device is needed. It has a novel twin tube design, where the inner tube is the working cylinder and the external acts as housing and accumulator for displaced oil. The maximum damping force is 150 kN.

A metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The flow area is determined by the number of drilled holes along the length of the metering pin. The width and distribution of the holes are optimised by computer simulation to gain constant force during retardation.







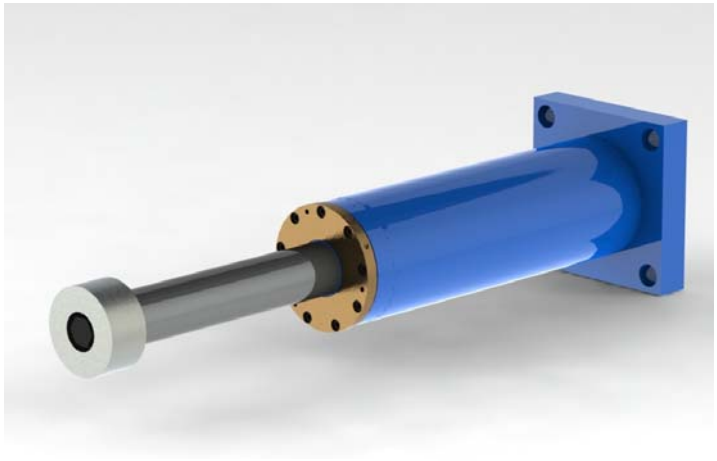
HE-80

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
HE-80-200	150	650	200	Ø80	Ø50	170	125	Ø22	Ø127	Ø70	20	390	45
HE-80-400	150	1050	400	Ø80	Ø50	170	125	Ø22	Ø127	Ø70	20	590	45
HE-80-600	150	1780	600	Ø80	Ø50	170	125	Ø22	Ø127	Ø70	20	790	45
HE-80-800	150	1950	800	Ø80	Ø50	170	125	Ø22	Ø127	Ø70	20	1090	45
HE-80-1000	150	2350	1000	Ø80	Ø50	170	125	Ø22	Ø127	Ø70	20	1290	45
HE-80-1200	150	2750	1200	Ø80	Ø50	170	125	Ø22	Ø127	Ø70	20	1490	45

Hydraulic Energy Absorbers

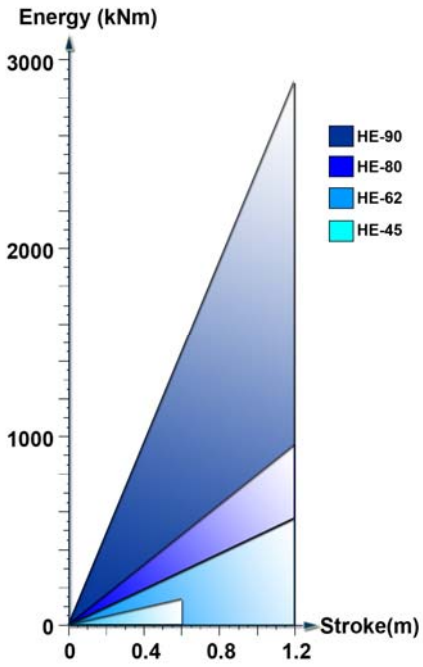
HE Series

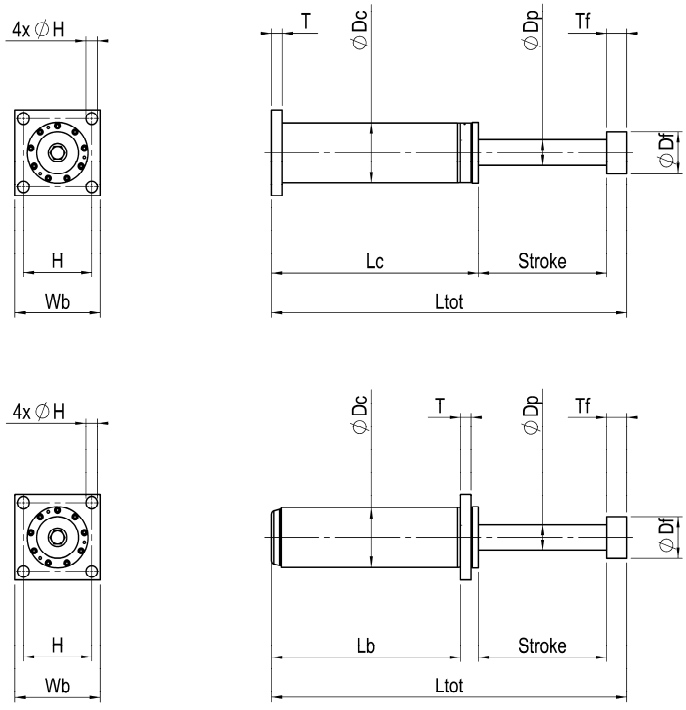
Dellner Damper Technical Data



The HE Series is developed for applications where an energy stop device is needed. It has a novel twin tube design, where the inner tube is the working cylinder and the external acts as housing and accumulator for displaced oil. The maximum damping force is 300 kN.

A metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The flow area is determined by the number of drilled holes along the length of the metering pin. The width and distribution of the holes are optimised by computer simulation to gain constant force during retardation.





HE-90

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
HE-90-200	300	610	200	Ø90	Ø60	200	160	Ø27	Ø140	Ø98	25	350	47
HE-90-400	300	1050	400	Ø90	Ø60	200	160	Ø27	Ø140	Ø98	25	600	47
HE-90-600	300	1450	600	Ø90	Ø60	200	160	Ø27	Ø140	Ø98	25	800	47
HE-90-800	300	1850	800	Ø90	Ø60	200	160	Ø27	Ø140	Ø98	25	1000	47
HE-90-1000	300	2300	1000	Ø90	Ø60	200	160	Ø27	Ø140	Ø98	25	1250	47
HE-90-1200	300	2700	1200	Ø90	Ø60	200	160	Ø27	Ø140	Ø98	25	1450	47

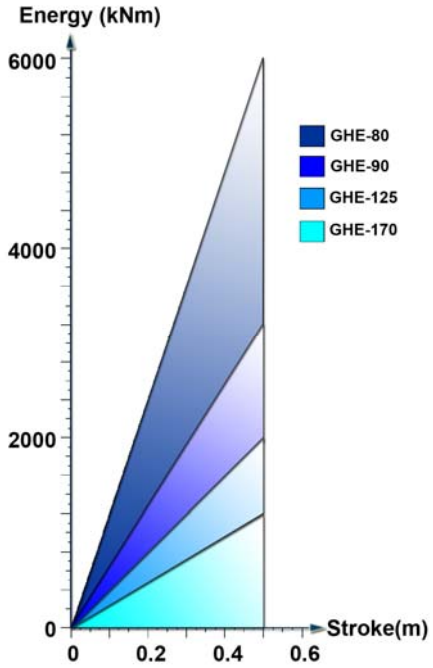
Gas Hydraulic Energy Absorbers

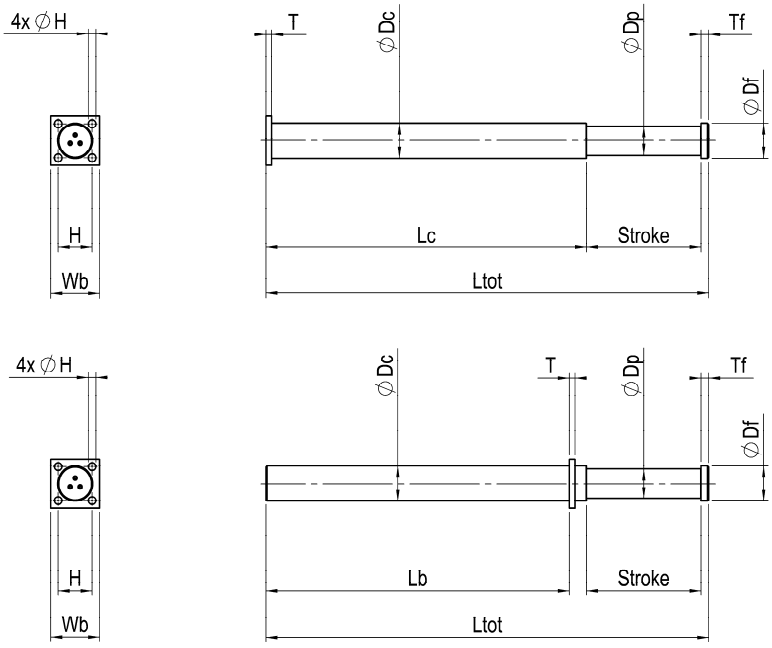
GHE Series

Dellner Damper Technical Data

The GHE Series is developed for applications where an energy stop device is needed. The robust design gives good stiffness suitable for higher forces. It has a cylinder with oil and hollow piston rod containing the reservoir. The hollow rod contains a floating piston, separating oil and gas.
The maximum damping force is 300 kN.

The damping force is achieved by a blow off valve in combination with a metering pin. The metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The blow off valve maximizes the force.





GHE-80

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
GHE-80-50	300	300	50	Ø80	Ø77	128	89	Ø20	Ø92	Ø92	15	220	20
GHE-80-100	300	480	100	Ø80	Ø77	128	89	Ø20	Ø92	Ø92	15	350	20
GHE-80-200	300	750	200	Ø80	Ø77	128	89	Ø20	Ø92	Ø92	15	520	20
GHE-80-300	300	970	300	Ø80	Ø77	128	89	Ø20	Ø92	Ø92	15	640	20
GHE-80-400	300	1225	500	Ø80	Ø77	128	89	Ø20	Ø92	Ø92	15	795	20
GHE-80-500	300	1615	500	Ø80	Ø77	128	89	Ø20	Ø92	Ø92	15	1085	20

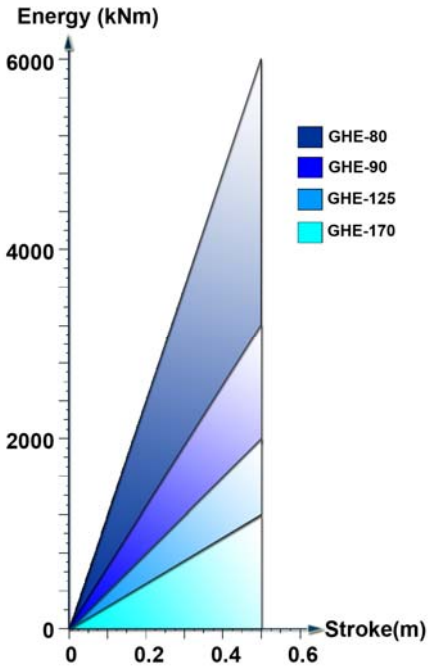
Gas Hydraulic Energy Absorbers

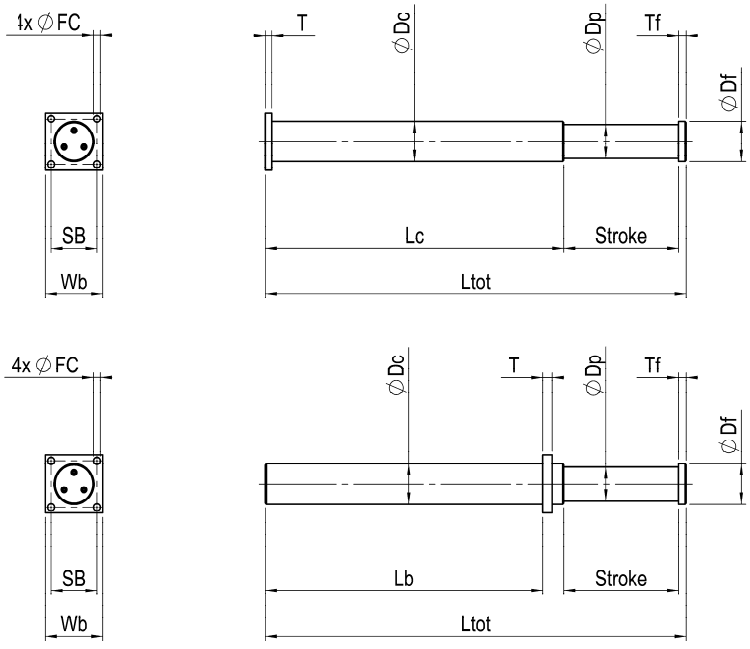
GHE Series

Dellner Damper Technical Data

The GHE Series is developed for applications where an energy stop device is needed. The robust design gives good stiffness suitable for higher forces. It has a cylinder with oil and hollow piston rod containing the reservoir. The hollow rod contains a floating piston, separating oil and gas.
The maximum damping force is 500 kN.

The damping force is achieved by a blow off valve in combination with a metering pin. The metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The blow off valve maximizes the force.





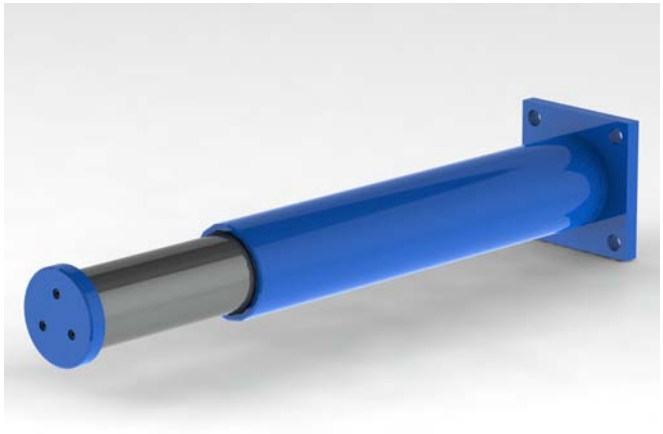
GHE-90

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
GHE-90-50	500	300	50	Ø90	Ø87	150	120	Ø18	Ø105	Ø105	20	220	20
GHE-90-100	500	480	100	Ø90	Ø87	150	120	Ø18	Ø105	Ø105	20	350	20
GHE-90-200	500	750	200	Ø90	Ø87	150	120	Ø18	Ø105	Ø105	20	520	20
GHE-90-300	500	970	300	Ø90	Ø87	150	120	Ø18	Ø105	Ø105	20	640	20
GHE-90-400	500	1225	500	Ø90	Ø87	150	120	Ø18	Ø105	Ø105	20	795	20
GHE-90-500	500	1615	500	Ø90	Ø87	150	120	Ø18	Ø105	Ø105	20	1085	20

Gas Hydraulic Energy Absorbers

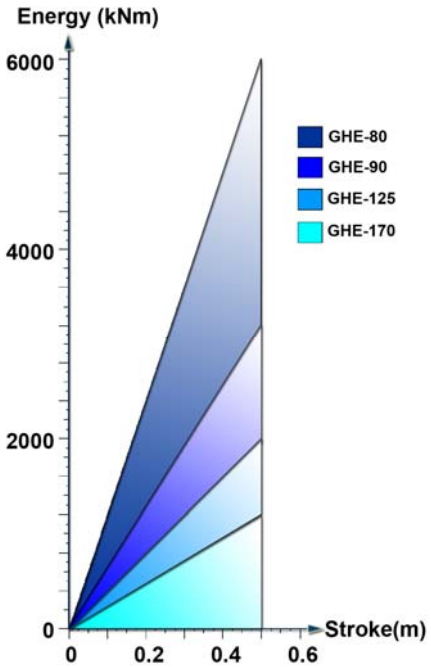
GHE Series

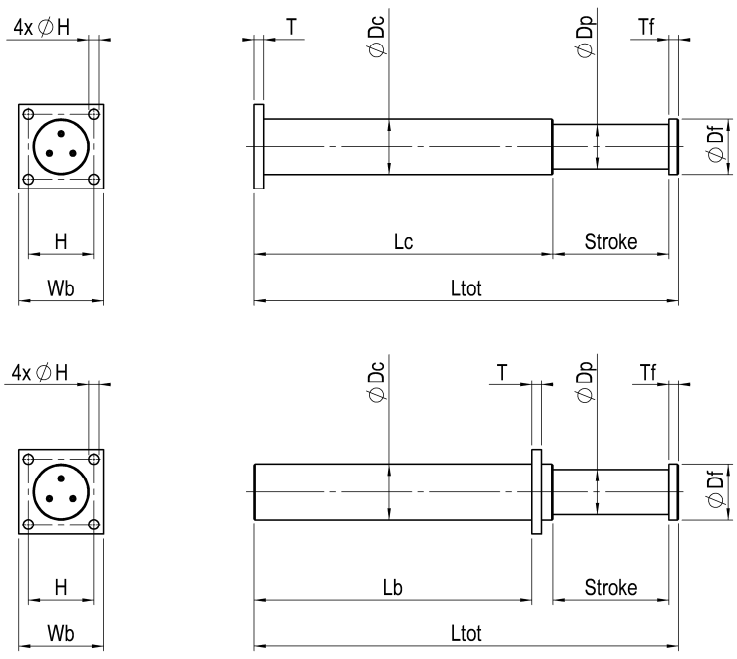
Dellner Damper Technical Data



The GHE Series is developed for applications where an energy stop device is needed. The robust design gives good stiffness suitable for higher forces. It has a cylinder with oil and hollow piston rod containing the reservoir. The hollow rod contains a floating piston, separating oil and gas.
The maximum damping force is 800 kN.

The damping force is achieved by a blow off valve in combination with a metering pin. The metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The blow off valve maximizes the force.





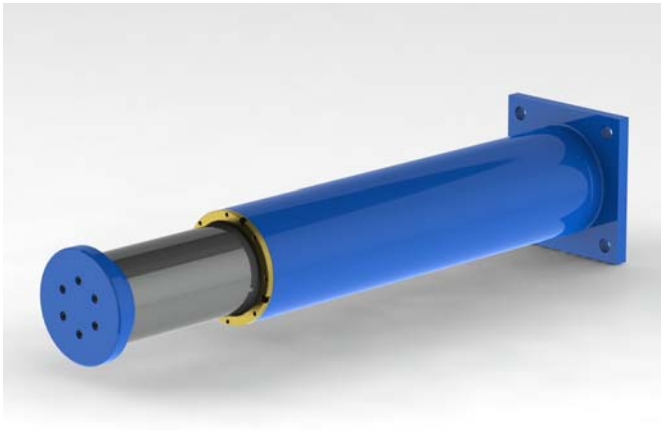
GHE-120

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
GHE-120-50	800	350	50	Ø120	Ø117	220	170	Ø26	Ø145	Ø145	25	265	25
GHE-120-100	800	500	100	Ø120	Ø117	220	170	Ø26	Ø145	Ø145	25	365	25
GHE-120-200	800	800	200	Ø120	Ø117	220	170	Ø26	Ø145	Ø145	25	565	25
GHE-120-300	800	1030	300	Ø120	Ø117	220	170	Ø26	Ø145	Ø145	25	695	25
GHE-120-400	800	1290	400	Ø120	Ø117	220	170	Ø26	Ø145	Ø145	25	855	25
GHE-120-500	800	1650	500	Ø120	Ø117	220	170	Ø26	Ø145	Ø145	25	1115	25

Gas Hydraulic Energy Absorbers

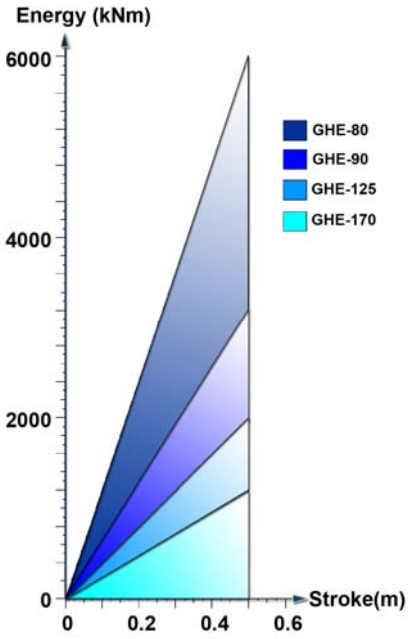
GHE Series

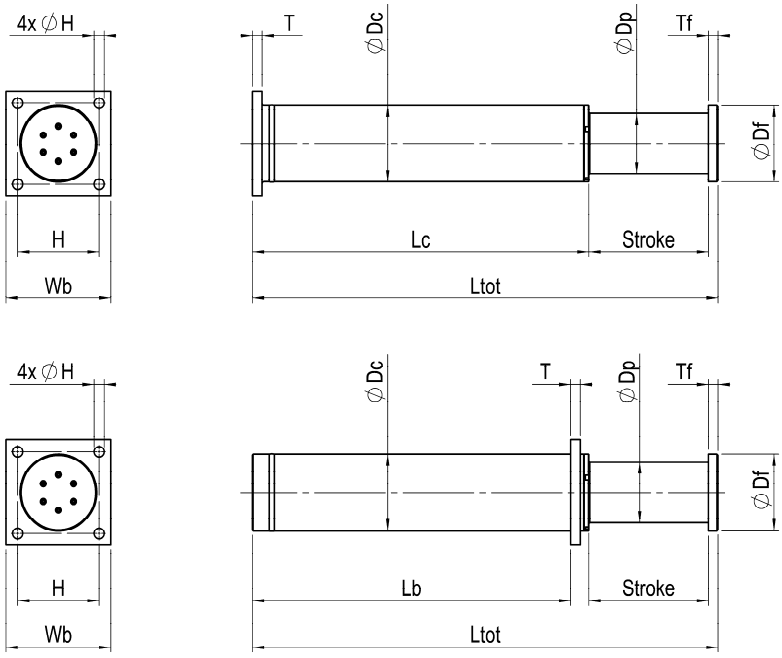
Dellner Damper Technical Data



The GHE Series is developed for applications where an energy stop device is needed. The robust design gives good stiffness suitable for higher forces. It has a cylinder with oil and hollow piston rod containing the reservoir. The hollow rod contains a floating piston, separating oil and gas.
The maximum damping force is 1500 kN.

The damping force is achieved by a blow off valve in combination with a metering pin. The metering pin at the centre of the damper regulates the flow area to be more restricted when the damper is being compressed. The blow off valve maximizes the force.





GHE-170

Part Number	Max. Force	Ltot	Stroke	Piston	Rod [ØDp]	Wb	H	ØH	ØDc	ØDf	T	Lc	Tf
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
GHE-170-50	1500	375	50	Ø170	Ø160	270	210	Ø26	Ø200	Ø200	25	290	25
GHE-170-100	1500	550	100	Ø170	Ø160	270	210	Ø26	Ø200	Ø200	25	415	25
GHE-170-200	1500	875	200	Ø170	Ø160	270	210	Ø26	Ø200	Ø200	25	640	25
GHE-170-300	1500	1100	300	Ø170	Ø160	270	210	Ø26	Ø200	Ø200	25	765	25
GHE-170-400	1500	1400	400	Ø170	Ø160	270	210	Ø26	Ø200	Ø200	25	965	25
GHE-170-500	1500	1800	500	Ø170	Ø160	270	210	Ø26	Ø200	Ø200	25	1265	25