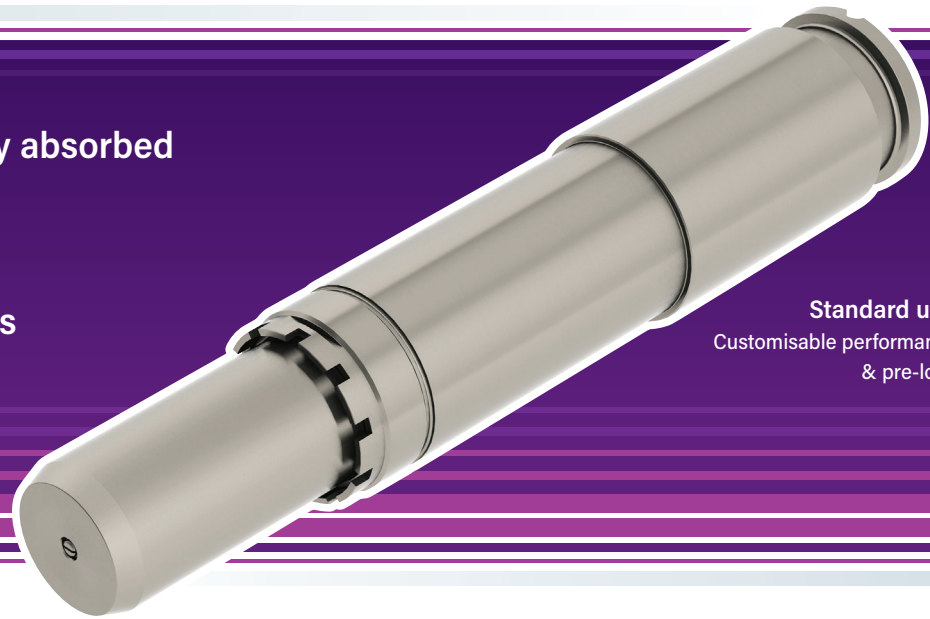


Majority of impact energy absorbed  
 Almost no recoil energy  
 Standard range  
 Shorter project lead times

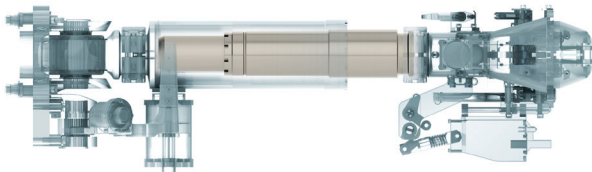


Standard unit  
 Customisable performance  
 & pre-load

### Gas Hydraulic 1500

The rail market requires lower costs with shorter lead times for delivering projects. Oleo has produced a range of standard gas hydraulic capsules delivering lower cost and shorter lead time solutions.

The main structure of the capsule is made standard, whilst maintaining Oleo's unique ability to optimise the performance of the capsule at no extra cost, using Oleo 1D Train™ simulation software.



### Product Details

- Standard range of Oleo Gas Hydraulic capsules.
- Fully customisable force/stroke characteristics at no extra cost.
- Standard fixed length and design per stroke.
- Available strokes 50, 100, 125, 150, 175 and 200mm.
- No movement below specified pre-load.
- All units are tested by Oleo with validated mathematical models in accordance with EN15227. Available for Radioss and LS-Dyna finite element software.
- The system used by Oleo for the mathematical modelling of crash scenarios is approved by a European Rail Authority as being accurate, appropriate and properly controlled.
- Reduced manufacturing lead-time.
- Standard clamp profiles available.

### Product Advantages

Oleo's Gas Hydraulic Devices enable:

- Lower Life Cycle Costs
- Faster Coupling Speeds
- Reduced Potential Impact Damage
- Increased Passenger Protection
- Performance optimisation at no cost with pre loads ranging from 50kN to 450kN.
- Higher recoverable energy absorption than any alternative solution
- Maintenance free between major train overhaul periods.

### Applications



Metro



Light Rail



Locomotive & Freight



High Speed



Mainline



## Gas Hydraulic Coupler Capsule Example Train Configurations - 1500kN Range

Metro		Description	Unit Code	Recoverable Coupling Speed Km/h				Coupler Deformation Speed Km/h				Maximum Collision Speed Km/h					
				AW0	AW1	AW2	AW3	AW0	AW1	AW2	AW3	AW0	AW1	AW2	AW3		
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C215														
Empty Vehicle Weight (AW0)	16T	Oleo Gas Hydraulic - Intermediate	C215	16.0	15.5	15.3	15.0	22.5	21.5	20.5	20.3	29.3	28.3	27.0	25.0		
Passenger Weight (AW3)	8T	Oleo Anti Climber - Front	AB 20-75														
Vehicle Strength	1400kN																
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C415														
Empty Vehicle Weight (AW0)	24T	Oleo Gas Hydraulic - Intermediate	C415	18.3	17.8	17.0	16.8	23.5	22.3	21.5	21.0	29.3	27.8	26.5	25.0		
Passenger Weight (AW3)	12T	Oleo Anti Climber - Front	AB 30-75														
Vehicle Strength	1200kN																
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C515														
Empty Vehicle Weight (AW0)	28T	Oleo Gas Hydraulic - Intermediate	C515	17.0	16.8	16.5	16.3	22.5	21.5	20.8	20.3	28.3	27.0	26.0	25.0		
Passenger Weight (AW3)	14T	Oleo Anti Climber - Front	AF 30-75														
Vehicle Strength	1200kN																
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C615														
Empty Vehicle Weight (AW0)	32T	Oleo Gas Hydraulic - Intermediate	C615	18.0	17.5	17.3	16.8	22.8	21.5	20.5	20.3	28.0	26.8	25.8	25.0		
Passenger Weight (AW3)	16T	Oleo Anti Climber - Front	AB 30-75														
Vehicle Strength	1400kN																
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C715														
Empty Vehicle Weight (AW0)	32T	Oleo Gas Hydraulic - Intermediate	C715	19.0	18.8	18.3	18.0	24.0	23.0	22.0	21.5	29.3	28.0	27.0	25.0		
Passenger Weight (AW3)	16T	Oleo Anti Climber - Front	AB 30-75														
Vehicle Strength	1400kN																
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C815														
Empty Vehicle Weight (AW0)	32T	Oleo Gas Hydraulic - Intermediate	C815	20.3	19.8	19.3	18.8	25.5	24.3	23.3	22.8	30.5	29.3	28.0	25.0		
Passenger Weight (AW3)	16T	Oleo Anti Climber - Front	AF 30-75														
Vehicle Strength	1500kN																

Main Line & High Speed		Description	Unit Code	Recoverable Coupling Speed Km/h				Coupler Deformation Speed Km/h				Maximum Collision Speed Km/h					
				AW0	AW1	AW2	AW3	AW0	AW1	AW2	AW3	AW0	AW1	AW2	AW3		
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C215														
Empty Vehicle Weight (AW0)	36T	Oleo Gas Hydraulic - Intermediate	C215	10.8	10.5	9.8	9.5	15.8	15.0	14.3	14.0	42.0	40.3	38.5	36.0		
Passenger Weight (AW3)	18T	Oleo Anti Climber - Front	AB 70-100														
Vehicle Strength	1500kN	Oleo Anti Climber - Intermediate	AB 40-80														
Number of Vehicles	10	Oleo Gas Hydraulic - Front	C415														
Empty Vehicle Weight (AW0)	28T	Oleo Gas Hydraulic - Intermediate	C415	14.0	13.5	13.3	13.3	22.8	21.5	20.5	20.3	42.0	40.3	38.8	36.0		
Passenger Weight (AW3)	14T	Oleo Anti Climber - Front	AF 50-100														
Vehicle Strength	1500kN	Oleo Anti Climber - Intermediate	AF 50-80														
Number of Vehicles	15	Oleo Gas Hydraulic - Front	C515														
Empty Vehicle Weight (AW0)	24T	Oleo Gas Hydraulic - Intermediate	C515	19.8	18.8	17.8	17.5	19.8	22.5	21.5	21.0	43.3	41.3	39.8	36.0		
Passenger Weight (AW3)	12T	Oleo Anti Climber - Front	AB 50-1000														
Vehicle Strength	1500kN	Oleo Anti Climber - Intermediate	AB 60-80														
Number of Vehicles	6	Oleo Gas Hydraulic - Front	C615														
Empty Vehicle Weight (AW0)	59T	Oleo Gas Hydraulic - Intermediate	C615	13.3	12.8	11.8	11.5	23.5	22.8	22.0	21.8	40.8	39.0	36.3	36.0		
Passenger Weight (AW3)	30T	Oleo Anti Climber - Front	AF 90-100														
Vehicle Strength	1500kN	Oleo Anti Climber - Intermediate	AF 10-80														
Number of Vehicles	11	Oleo Gas Hydraulic - Front	C715														
Empty Vehicle Weight (AW0)	30T	Oleo Gas Hydraulic - Intermediate	C715	16.5	16.3	16.0	15.8	24.5	23.3	22.3	21.8	40.8	39.3	37.8	36.0		
Passenger Weight (AW3)	15T	Oleo Anti Climber - Front	AB 40-200														
Vehicle Strength	1500kN	Oleo Anti Climber - Intermediate	AB 30-160														
Number of Vehicles	8	Oleo Gas Hydraulic - Front	C815														
Empty Vehicle Weight (AW0)	50T	Oleo Gas Hydraulic - Intermediate	C815	15.0	14.8	14.5	14.5	20.5	19.5	18.8	18.5	41.5	39.8	38.3	36.0		
Passenger Weight (AW3)	25T	Oleo Anti Climber - Front	AB 90-200														
Vehicle Strength	1500kN	Oleo Anti Climber - Intermediate	AB 10-160														

### Notes and assumptions

EN15227 collision speeds for design scenario #1 (identical train units impacting) for:

C-I (Locomotives, coaches and fixed train units) is 36km/h.

C-II (Metro) and CIII (Tram vehicles, peri-urban tram) is 25km/h.

C-IV (Tramway vehicles) is 15km/h.

Car weight designations:

AW0 – empty car weight

AW1 – weight with seated passenger load

AW2 – weight with average peak-hour passenger load

AW3 – crush loaded weight

Recoverable Coupling Speed – maximum speed in which two identical trains are coupled together with no damage to the coupler (i.e. Gas Hydraulic stroke only).

Coupler Deformation Speed – maximum speed in which two identical trains are coupled together with only controlled damage to coupler (i.e. Gas Hydraulic + Deformation tube stroke).

Maximum Collision Speed – maximum speed in which two identical trains are impacted with controlled damage to only coupler and anti-climber. No damage to car body structure.

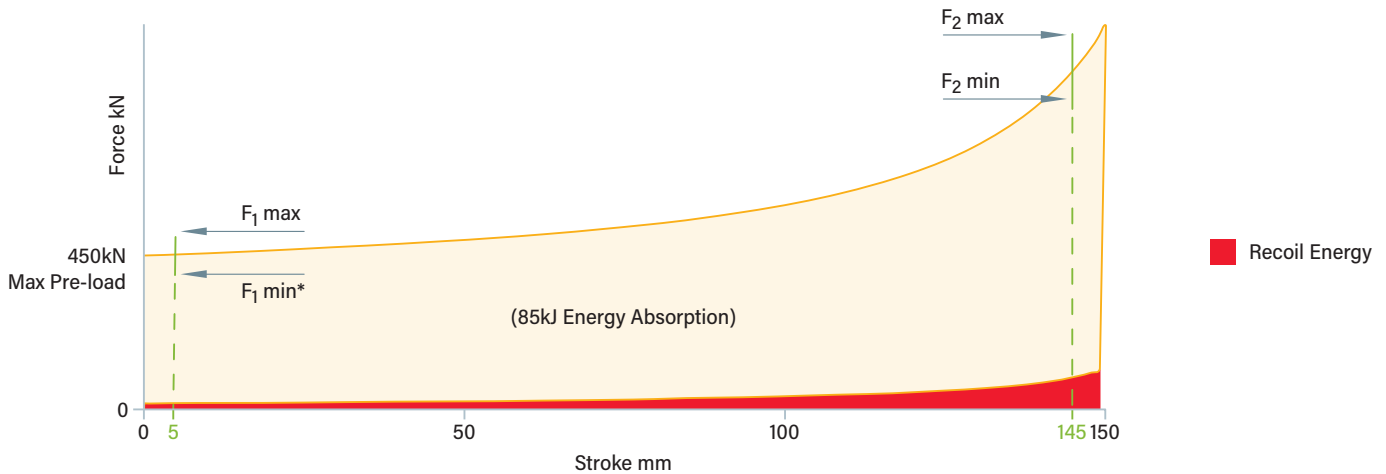
Assumptions made in example simulations:

Effective vehicle mass (AW0) = 100%

Effective passenger mass = 50%

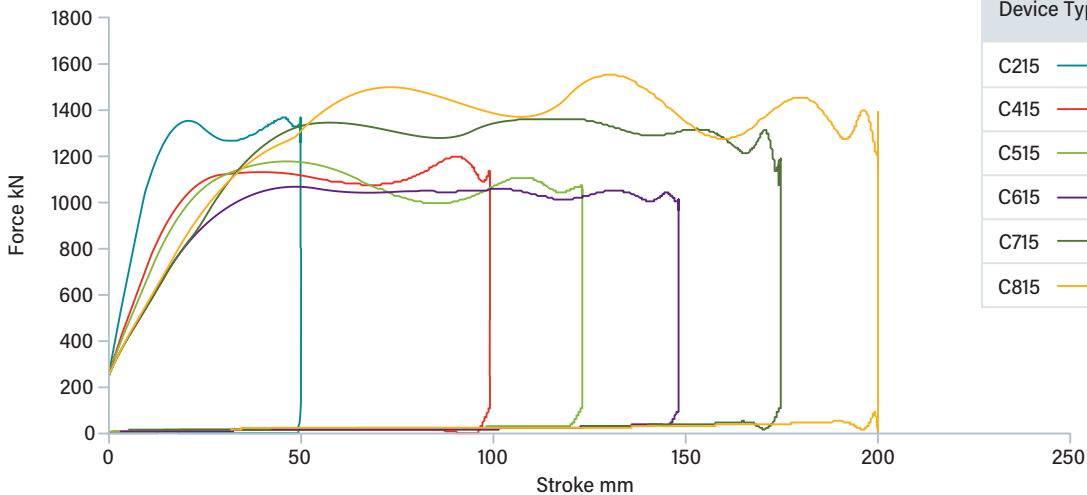
# Gas Hydraulic Coupler Capsule Example Train Configurations - 1500kN Range

Range of available quasi-static characteristics at 4mm/sec



Example shown is for C615 Gas Hydraulic Capsule

## 1500 kN Metro examples - Recoverable Coupling Speed (AW3)

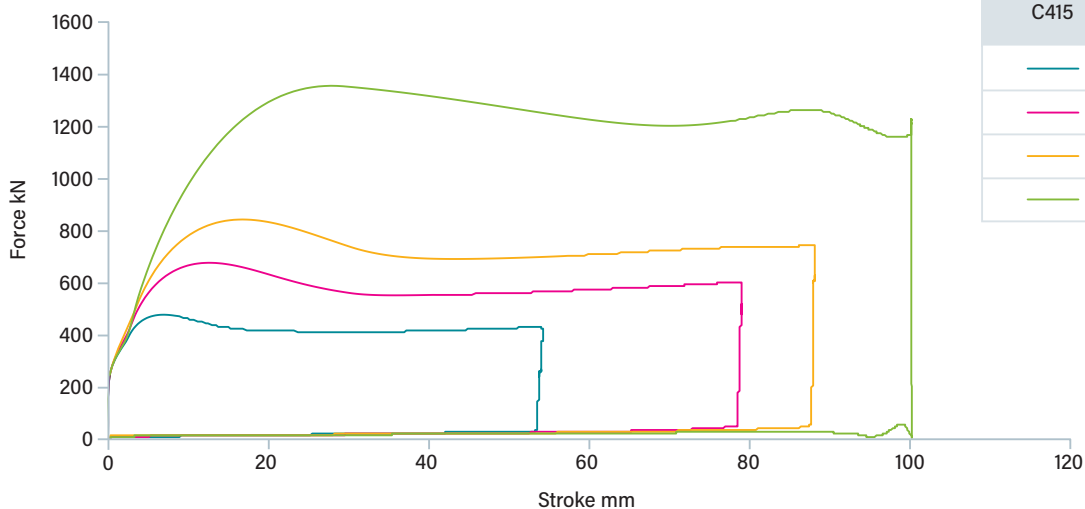


Device Type	Impact Speed Km/h	Energy Absorption (kJ)
C215	15.0	80
C415	16.8	122
C515	16.3	142
C615	16.8	172
C715	18.0	194
C815	18.8	211

Example taken from Metro table for each unit code

Force v Stroke characteristics are shown for front coupler at the Recoverable Coupling Speed under AW3 mass

## OLEO Gas Hydraulic performance at different impact speeds



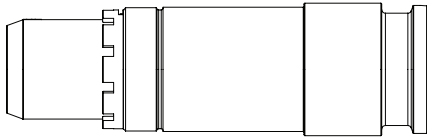




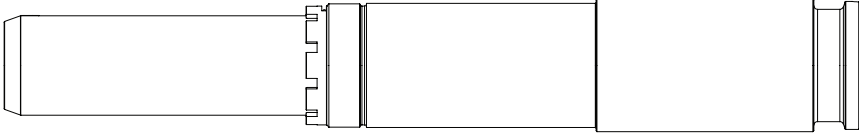
C415	Impact Speed Km/h	Energy Absorption (kJ)
—	5	13
—	8	29
—	10	45
—	15	100

Example shown is C415 Gas Hydraulic Capsule

Impact speeds are of 6 car rake impacting 6 car rake

Force v Stroke characteristics are shown for front coupler only at each speed

## Gas Hydraulic Coupler Capsule Specification - 1500kN Range

Gas Hydraulic (recoverable) Stroke (mm)	Oleo Gas Hydraulic Coupler Capsule Range	Maximum Force Rating	Energy Absorption (kJ)
		1500kN	
50		C215	70
100		C415	145
125		C515	180
150		C615	215
175		C715	250
200		C815	285

Gas Hydraulic Fully Customisable			Operating Temperature	Unit Pre-Load	Allowable Static Movement (mm)					
Stroke	Pre Load	Force			C215	C415	C515	C615	C715	C815
50mm	50kN Min 450kN Max	Up to 1500kN	+60°C -40°C	50kN	3.0	3.0	3.0	3.0	3.0	3.0
100mm				100kN	3.0	3.0	3.0	3.0	3.0	3.0
125mm				150kN	3.0	3.0	3.0	3.0	3.0	3.0
150mm				200kN	3.0	3.0	3.0	3.0	3.0	3.5
175mm				250kN	3.0	3.0	3.0	3.0	3.5	3.5
200mm				300kN	3.0	3.0	3.5	3.5	4.0	4.0
				350kN	3.0	3.5	3.5	4.0	4.0	4.5
				400kN	3.0	3.5	4.0	4.0	4.5	5.0
				450kN	3.0	3.5	4.0	4.5	5.0	5.5

Oleo gas hydraulic coupler capsules provide a high start force and guarantees minimal static movement when the gas hydraulic device is installed into the coupler. The static start force will protect against high draft and snatch loading in normal train running conditions. This can remove the need for heavy draft springs, thereby reducing weight and cost of the complete coupler system.