MGSE

Standard Range 280

Quality First

Established in Switzerland in 1992, APCO Technologies is a project-oriented company specialized in heavy machinery for the SPACE, ENERGY, and INDUSTRY sectors. To date, the company has known a continuing growth.

This success is notably due to our stringent quality policy at every scale of the projects which are entrusted to us.

Our strategy is defined as:

- Meeting the customer requirements, be formulated or not.
- Developing a strong corporate culture which allows our collaborators to work and thrive in the best conditions.
- Keeping a step ahead in terms of innovation

Certifications

- **EN 9100 :** Quality Management Systems – Requirements for Aviation, Space and Defense Organizations
- **ISO 9001 :** Quality Management
- **ISO 14001 :** Environmental Management
- **ISO 27001 :** Information Security Management
- **OSHAS 18001 :** Occupational Health and Safety Management
- **Airbus DS IPCA :** Industrial Process Control Assessment

25 Years of Experience

Since its very creation in 1992, APCO Technologies has provided MGSE for space industry, starting with Ariane 4 containers.

Since then, the company has steadily expanded its experience, expertise and resources to be able today to propose tailored ground support solutions and rise to new challenges.

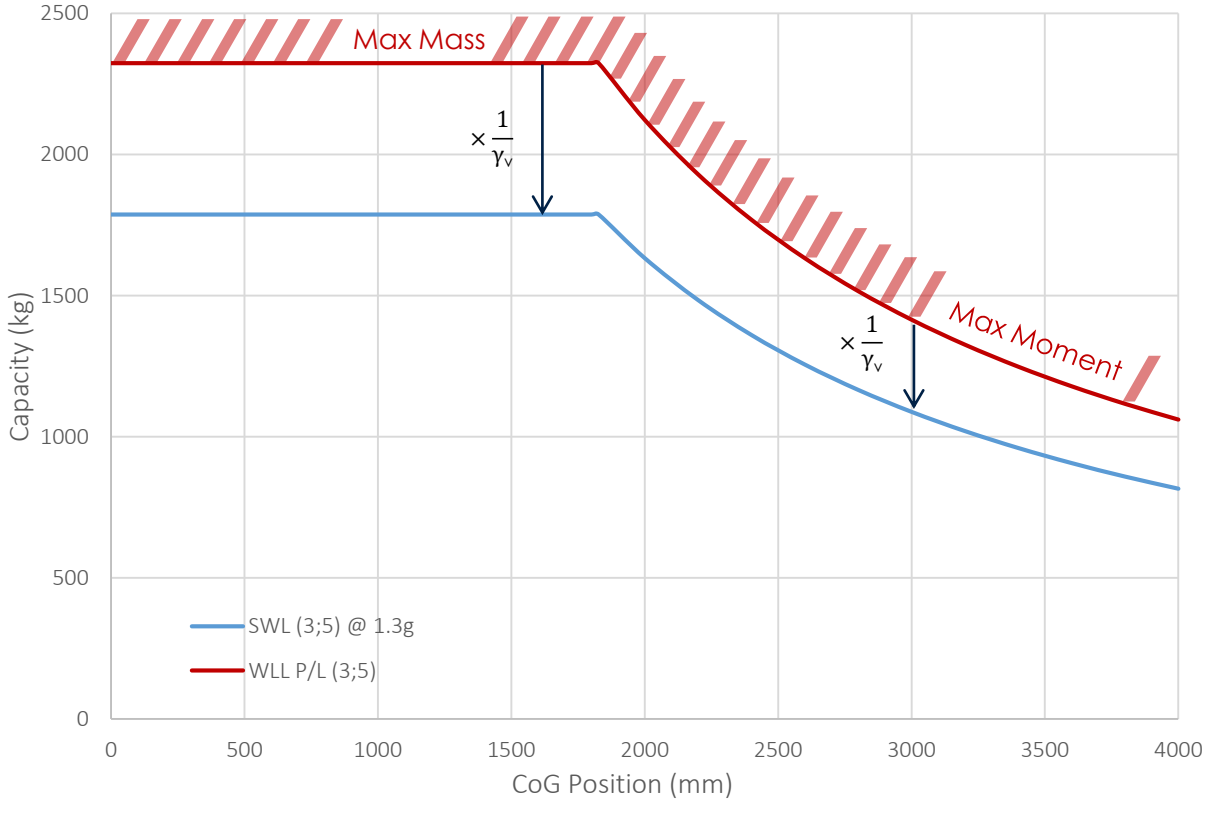
Besides specific requests, APCO Technologies has become an expert in developing satellite transport, lifting and handling equipment as well as adapters allowing test activities.

Orion Service Module, Sandusky, Ohio US

AlphaBus MPT


Sentinel-2B, CSG, Kourou

Mass & Balance Diagram Description 1/3



WLL & SWL (1/2)

Mass & Balance diagrams describe the range of application for each AT family.

In this document is given WLL (Working Load Limits), which is the maximum mass capacity at 1g vertical acceleration for payload or spacecraft (gravity only) a range or MGSE can support.

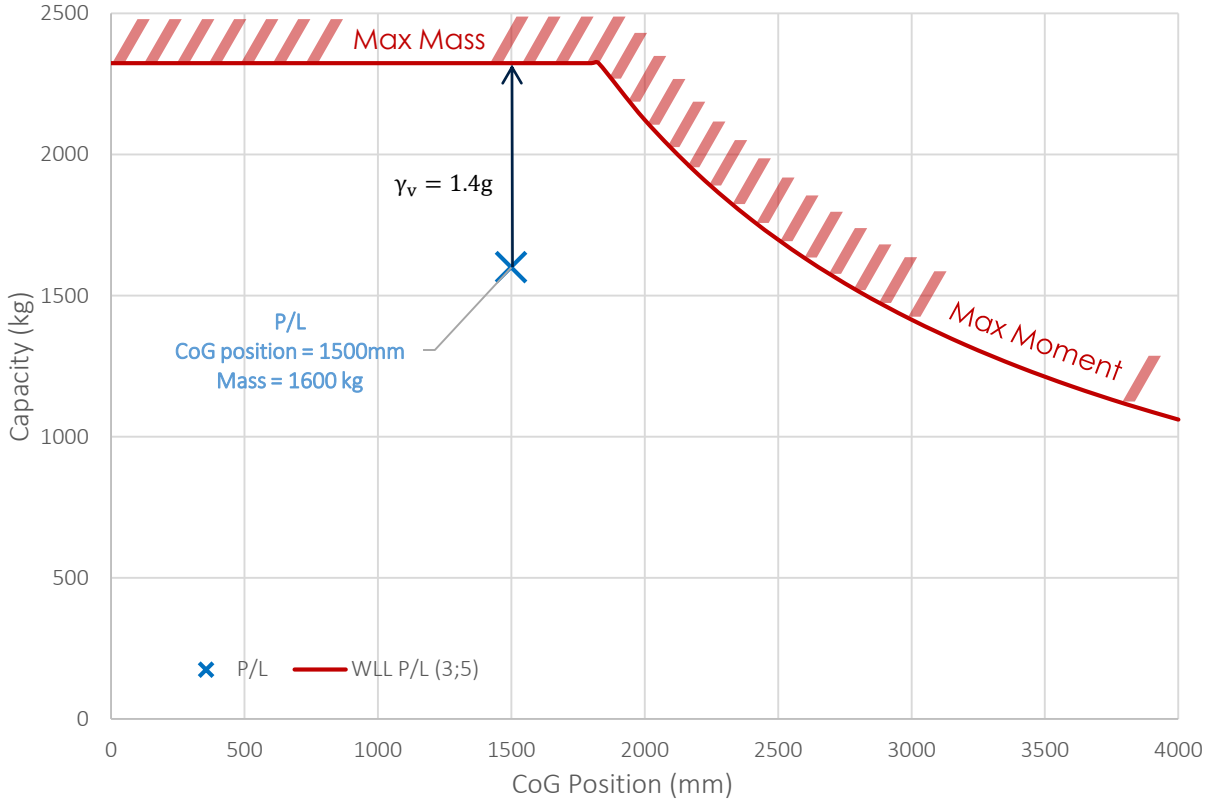
The SWL (Safe Working Load) is the admissible P/L or S/C mass capacity, at a given CoG, with a safety margin to the WLL, expressed in admissible vertical acceleration factor (γ_v).

$$\gamma_v = \frac{WLL}{SWL}$$

On the adjacent diagram, the vertical acceleration factor is 1.3g. This means if your S/C is on the blue curve, it has a vertical acceleration margin of +1.3g.

In most cases, WLL for each AT family is given for specific lateral acceleration factors (γ_{lat}).

Mass & Balance Diagram Description 2/3



WLL & SWL (2/2)

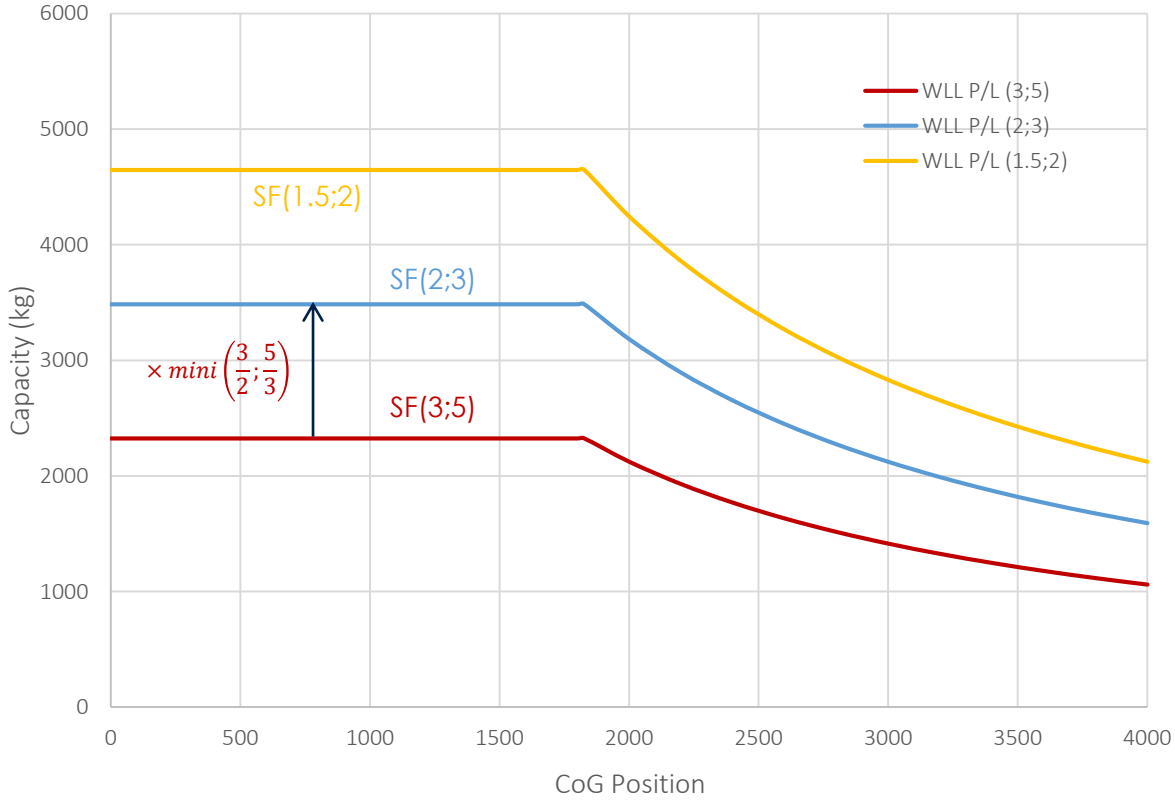
According to P/L position on the diagram (Mass & CoG), it is therefore possible to extract admissible acceleration factors (γ_v et γ_{lat}).

In this example, the payload SWL (CoG ; Mass) has been entered in the diagram.

This payload is under the WLL of the equipment, thus it is compatible in terms of mass & balance.

The vertical margin between the WLL and the P/L dot gives the admissible vertical acceleration factor. In this example, γ_v is +1.4g.

Mass & Balance Diagram Description 3/3



Safety Factors

For the purpose of harmonisation, WLL in this document are given in most cases with the following safety factors:

- SFy (Yield): 3
- SFu (Ultimate): 5

However, it is simple to extract a new WLL (2) associated with different safety factors by multiplying the initial WLL (1) by the minimum ratio $\left(\frac{SFy\_1}{SFy\_2};\frac{SFu\_1}{SFu\_2}\right)$.

Inside a range, safety factors associated with test adapters such as VTA, TTA and PPA can differ from the general safety factors.

Eigen Frequency

Minimal Eigen frequencies curves are determined for each VTA (Vibration Test Adapter) according to S/C WLL for each AT family.

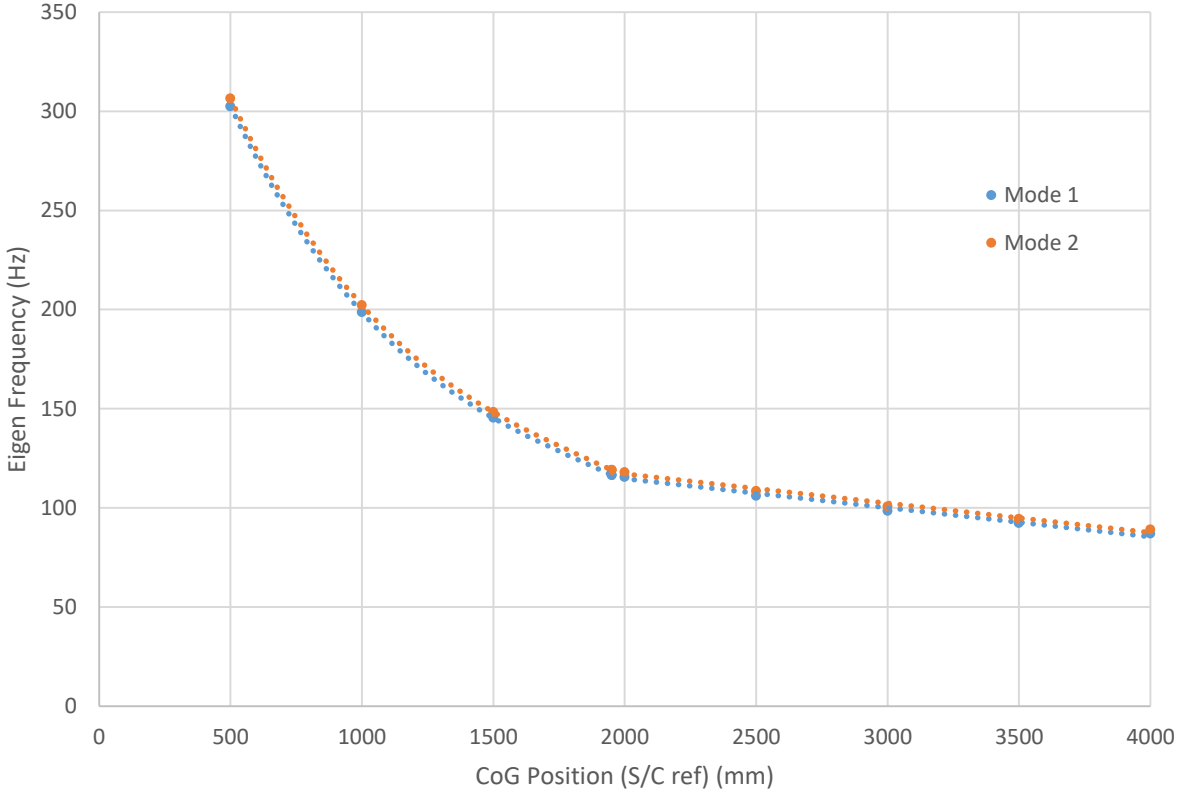
Minimum Eigen frequencies are provided for mode 1, 2 and 3 and for each attachment I/F with the test machine (if several are available).

To obtain the Eigen frequency of a VTA, whatever the mode, with S/C Mass and CoG position known :

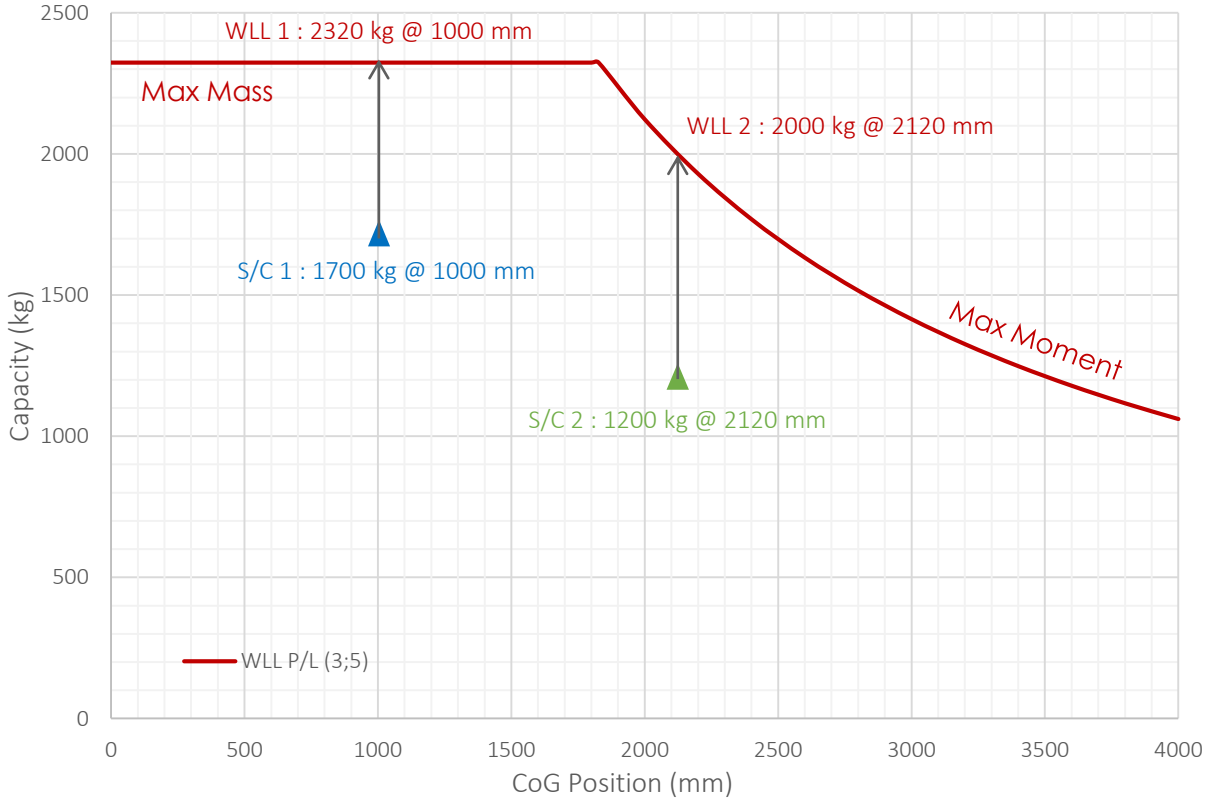
$$Fp_{SWL\,S/C} = Fp_{WWL\,S/C} \times \sqrt{\frac{WLL\,S/C}{SWL\,S/C}}$$

Avec: $\frac{WLL\,S/C}{SWL\,S/C} = \gamma_v$

Maximum CoG excentricity with respect to the S/C longitudinal axis will be given for each diagram.



VTA Admissible Accelerations



Launch Accelerations

Accelerations given in the Vibration Test Adaptor (VTA) characteristics are the minimum real accelerations that can be supported by the VTA at the S/C WLL for each boundary conditions, if there are several.

Given the conduct of vibration tests, accelerations are given by pair : one limit vertical acceleration coupled with one limit lateral acceleration for each test, and each boundary conditions.

Limit accelerations specific to a load, which mass and balance are known, can be obtained by multiplying the accelerations given for the WLL by the ratio $\left(\frac{WLL}{SWL}\right)$ for the same CoG position.

Example: If the limit accelerations for the vertical vibration test at WLL are ($a_{vertical} = \pm 9g$; $a_{lateral} = \pm\ 1.5g$)

Point 1 :
$\frac{WLL}{SWL} = 1.36 \rightarrow\ a_{vertical} = \pm 12.2g$; $a_{lateral} = \pm 2.0g$

Point 2 :
$\frac{WLL}{SWL} = 1.67 \rightarrow\ a_{vertical} = \pm 15.0g$; $a_{lateral} = \pm 2.5g$

Range Characteristics

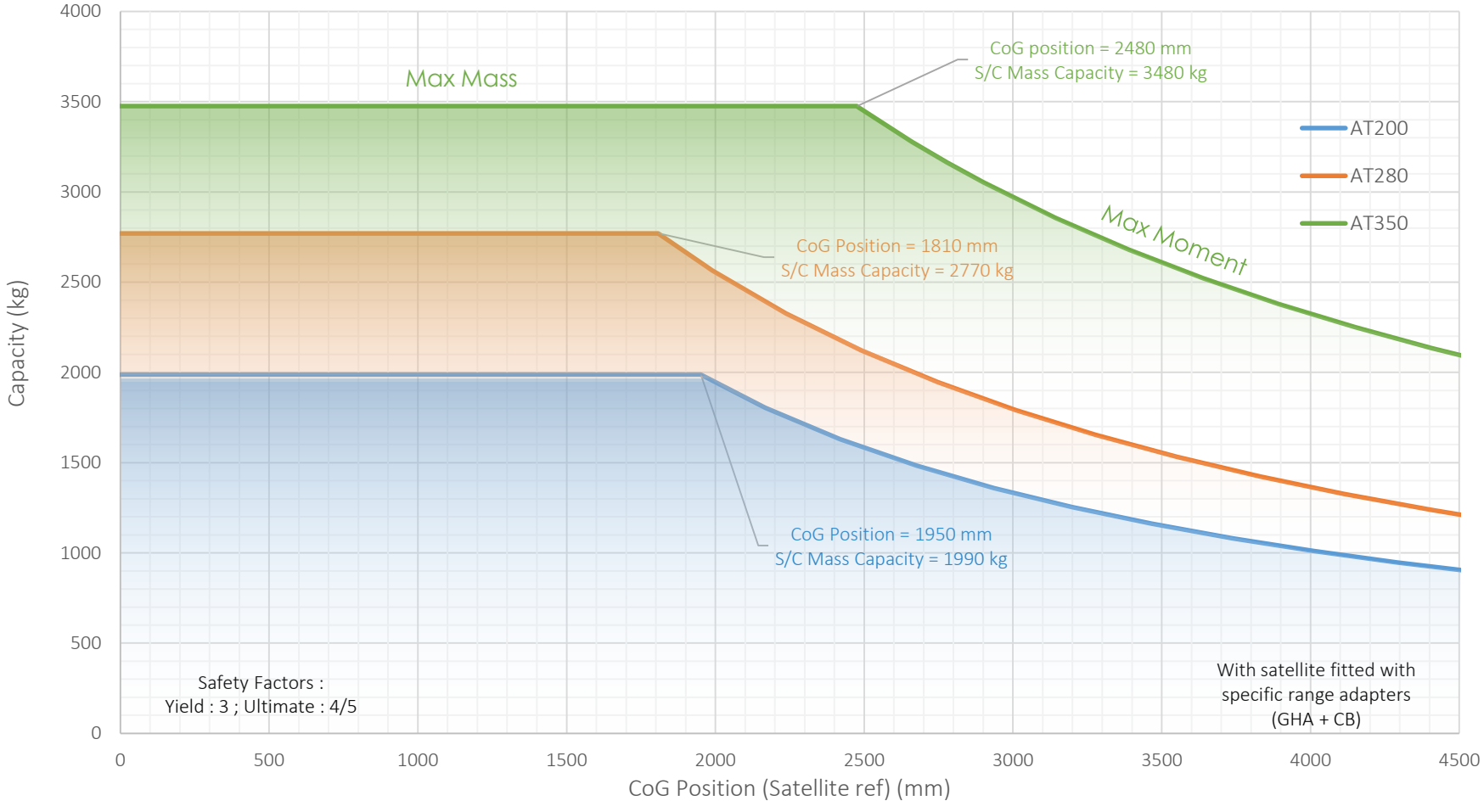
		AT200	*AT280*	*AT350*
S/C Envelop HxØ (mm)		5400 x 3240	5800 x 3300	6200 x 4000
S/C Interface		LIR Ariane 5 1194 C	LIR Ariane 5 1194 C	LIR PSA 1666 MVS
S/C Mass & Balance		See AT Range Performances		
General Design Safety Factors	Yield	3	3	3
	Ultimate	5	5	4
Test Adapters Safety Factors	Yield	2	2	2
	Ultimate	3	3	3

*Available MGSE**

Type	*Acronym*	*AT200*	*AT280*	*AT350*
Storage and Transport Container	*STC*	*AT200-STC*	/	/
Hoisting Device	*HD*	*AT200-HD*	*AT280-HD*	/
Multi-Purpose Trolley	*MPT*	*AT200-MPT*	*AT280-MPT*	*AT350-MPT*
Vertical Integration Stand	*VIS*	*AT200-VIS*	/	*AT350-VIS*
Ground Handling Adapter	*GHA*	*AT200-GHA*	*AT280-GHA*	*AT350-GHA*
Thermal Test Adapter	*TTA*	*AT200-TTA*	/	/
Vibration Test Adapter	*VTA*	*AT200-VTA*	/	*AT350-VTA*
Physical Propreties Adapter	*PPA*	*AT200-PPA*	/	/
Clamp Band	*CB*	*AT200-CB*	*AT280-CB*	*AT350-CB*

*Existing ranges are currently being completed

AT RANGE PERFORMANCES



MGSE RANGE 280 – S/C & RANGE CHARACTERISTICS

S/C Limiting Characteristics

Envelop Dimensions (HxØ)	5800 x 3300	mm
Maximum S/C WLL*	2770	kg
Mass & Balance	See Mass & Balance Diagram	
Interfaces	LIR Ariane 5 1194 C	

* With Safety Factors (3;5)

Range 280 Description

AT280 is a complex MGSE range for medium S/C. It includes in particular a multi-purpose trolley with three motions and a polar hoisting device with CoG compensation feature.

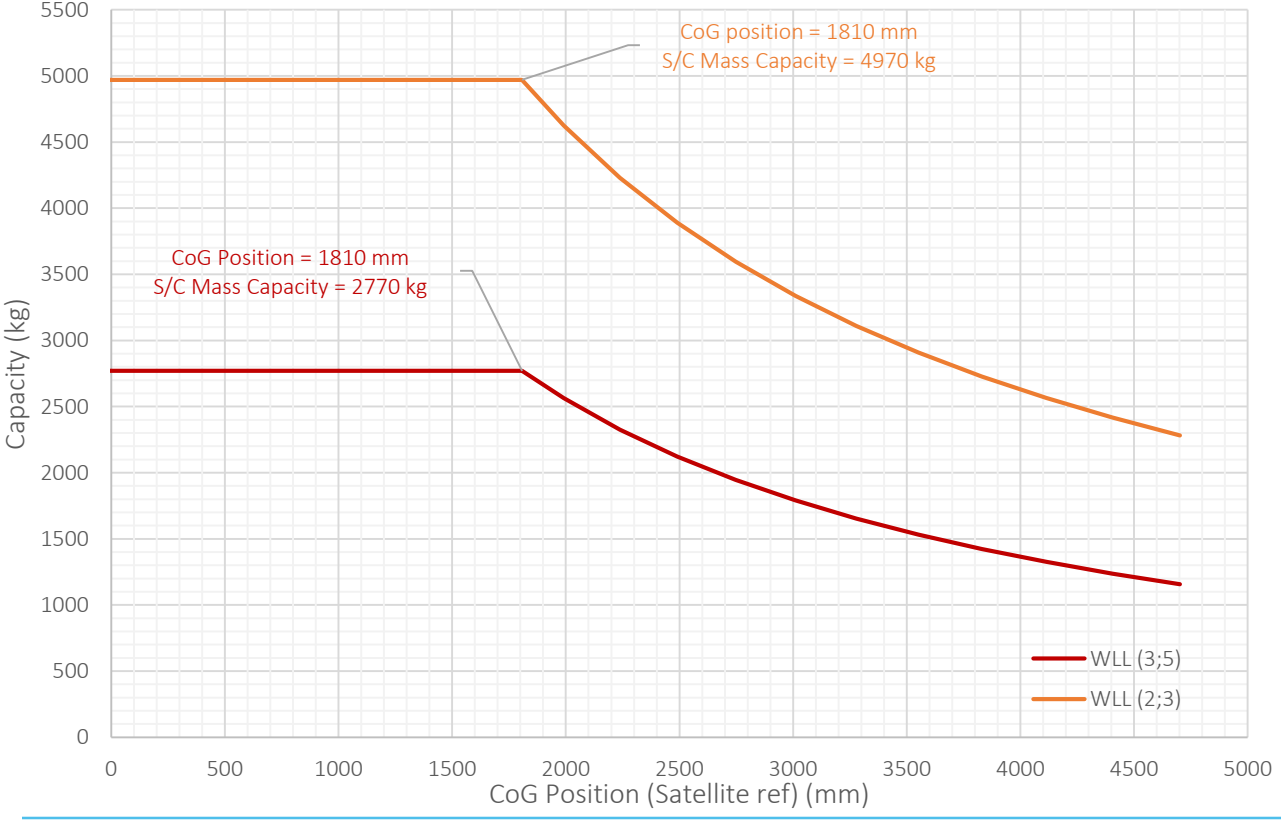
Heritage

Meteosat Third Generation (MTG)

MTG

Type	Acronym	Ref
Hoisting Device	*HD*	*AT280-HD*
Multi-Purpose Trolley	*MPT*	*AT280-MPT*
Ground Handling Adapter	*GHA*	*AT280-GHA*
Clamp Band	*CB*	*AT280-CB*

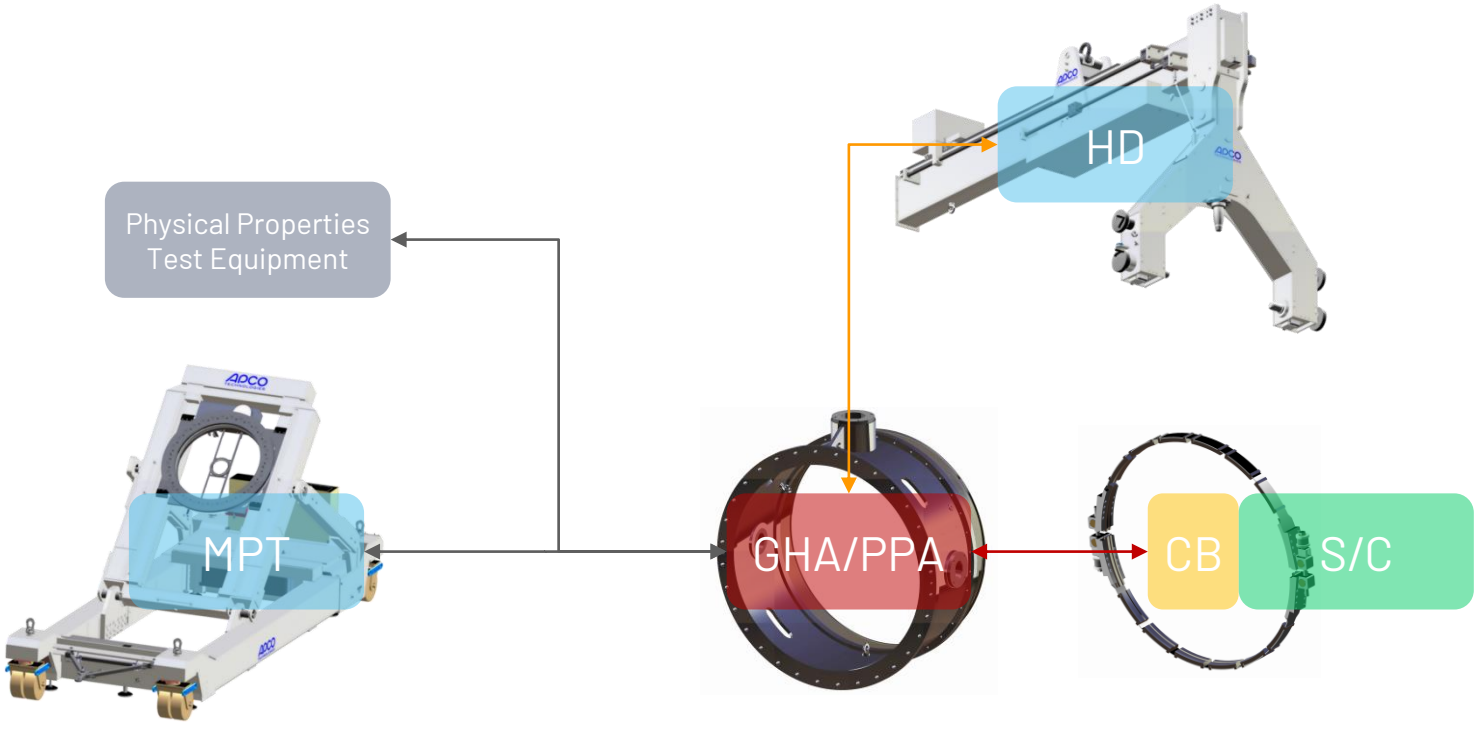
MASS & BALANCE FOR S/C IN RANGE 280



Characteristics

Lateral Accelerations	± 0.2 g		
Vertical Acceleration	1 g		
Safety Factors	Yield	2	3
	Ultimate	3	5

With Satellite fitted with AT280-GHA and AT280-CB


Physical Properties
Test Equipment
HD
MPT
GHA/PPA
CB
S/C

AT280 - Hoisting Device (HD)

Physical Characteristics

Dimensions (LxWxH)			4463 x 2142 x 3679		mm
Mass			2900		kg
Safety Factors	Yield	3	Load Factors	Static	2*
	Ultimate	5		Dynamic	1.5
Adapters I/F			On AT280-GHA via 1 vertical pin and 2 lateral pins		

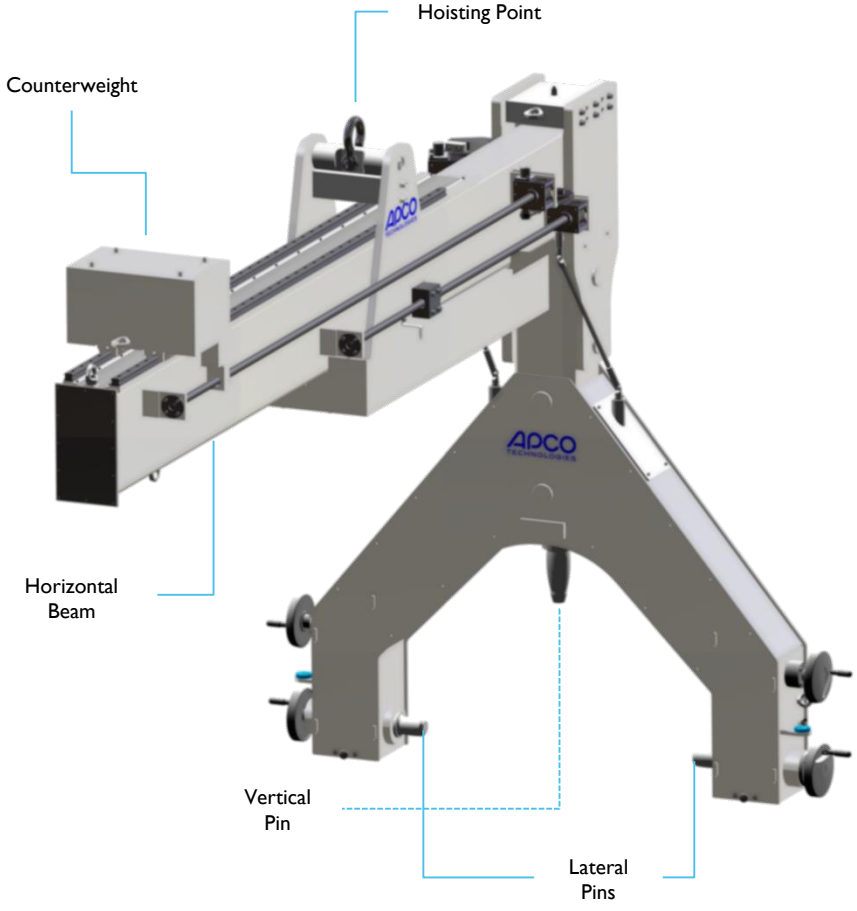
* For a maximum tilting angle of 6°, in accordance with NF EN 13155

Performances (1g vertical and ±0.2g lateral accelerations)

See AT280-HD Mass & Balance Diagram

Operational Characteristics

Motion Mode		Manual
Type of Mouvement		Polar
Mouvement Range	879	mm
CoG Compensation Range (from HD I/F)	1017 - 1906	mm
Environnement Specifications		ISO 8
MGSE Compatibility		AT280-GHA



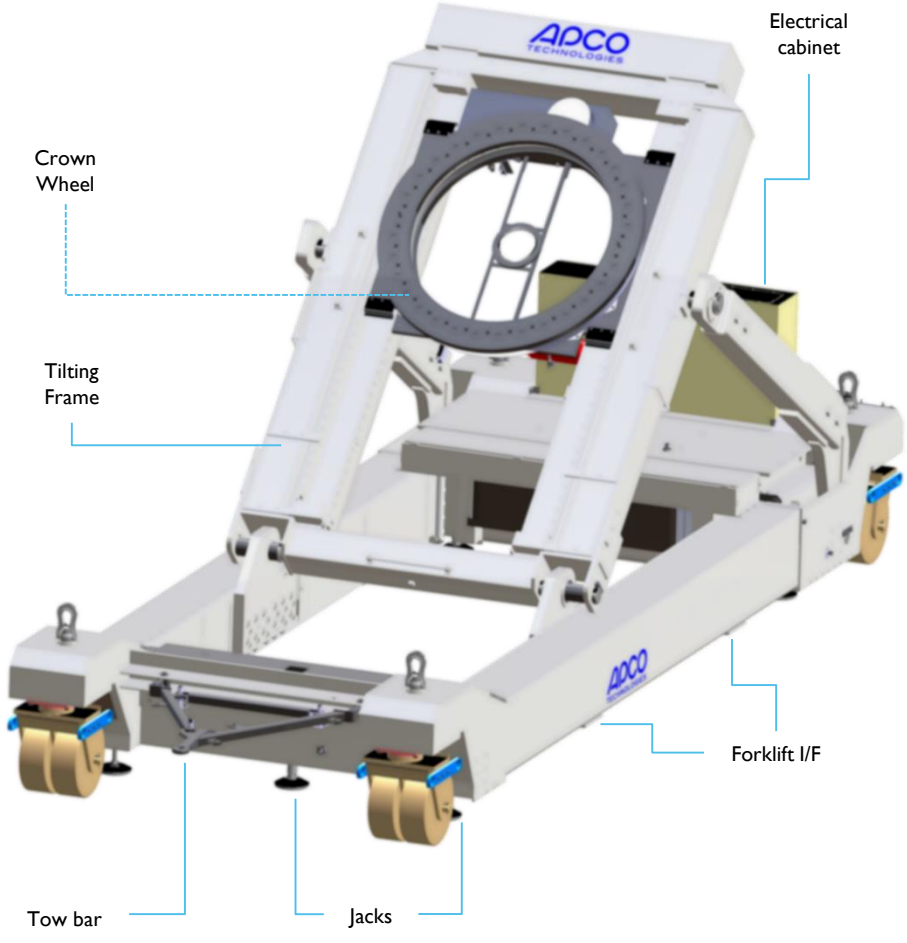
MASS & BALANCE CAPACITY

Characteristics		
Lateral Accelerations	± 0.2 g	
Vertical Acceleration	1 g	
Safety Factors	Yield	3
	Ultimate	5

With Mass & Balance of the entire payload

AT280 - HOISTING DEVICE (HD)

AT280 - Multi-Purpose Trolley (MPT)



Physical Characteristics

Dimensions (LxWxH)		0°	6780 x 2800 x 1472		mm
		90°	6780 x 2800 x 4165		mm
Mass			9200		kg
Allowable Volume (Ø)			4140		mm
Max Safety Factors	Yield	3	Load Factors	Static	1.5
	Ultimate	5		Dynamic	1.2
Adapters I/F		32 x M20 threaded holes on a Ø1280 mm circle pattern			

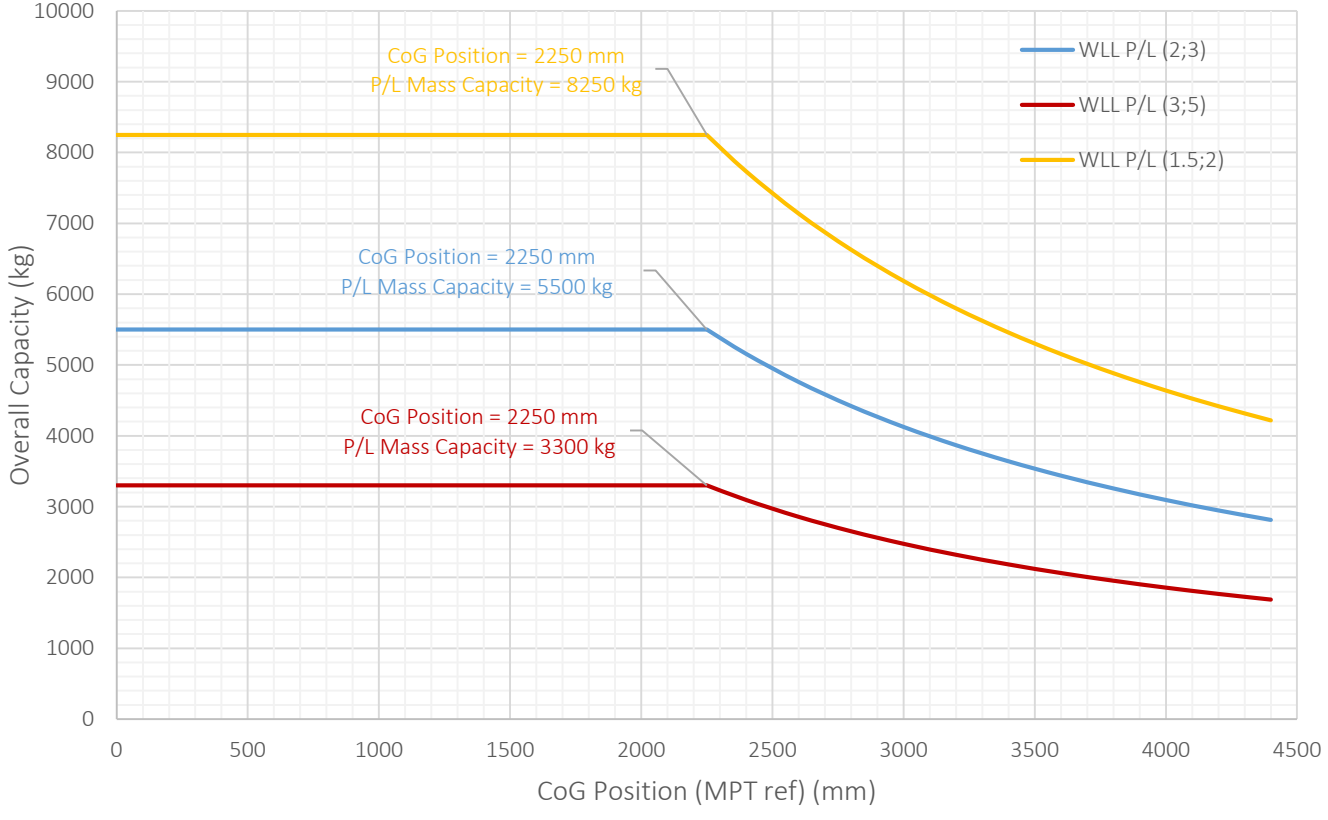
Performances (1g vertical and ±0.2g lateral accelerations)

See AT280-MPT Mass and Balance Diagram

Operational Characteristics

Motion mode			Electrical
Number of Jacks			5
Satellite Access			All around the S/C
Mouvements	Tilting	Rotation	Translation
	0-90°	360°	1200 mm
Facility Handling	Forklift		Tow bar
Environnement Specifications		ISO 8	Non-ATEX
MGSE Compatibility			AT280-GHA

MASS & BALANCE CAPACITY



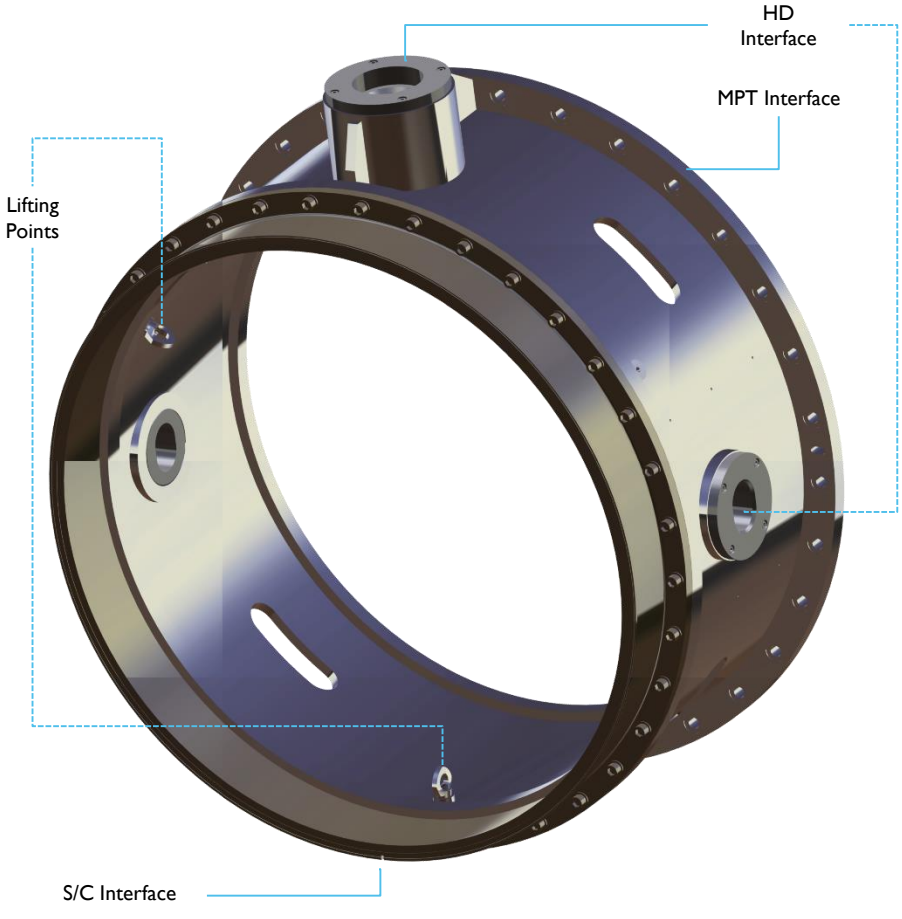
Characteristics

Lateral Accelerations	± 0.2 g			
Vertical Acceleration	1 g			
Safety Factors	Yield	1.5	2	3
	Ultimate	2	3	5

With Mass & Balance of the entire payload

AT280 - Multi-Purpose Trolley (MPT)

AT280 - Ground Handling Adapter (GHA)



Physical Characteristics

Dimensions (ØxH)			1440 x 650		mm
Mass			480		kg
Safety Factors*	Yield	2	Load Factors	Static	1.5
	Ultimate	3		Dynamic	/

*Except in hoisting situation coupled with AT280-HD → SF(3;5)

Performances

With AT280-MPT	See AT280-MPT Mass & Balance Diagram
With AT280-HD	See AT280-HD Mass & Balance Diagram

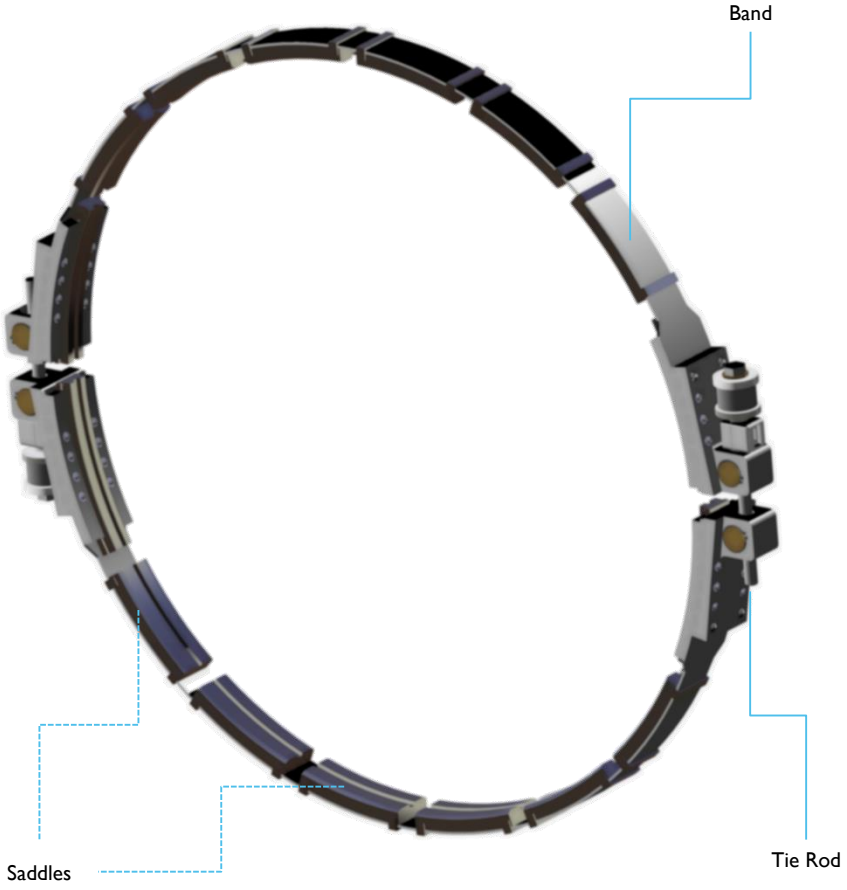
Environnement Specifications

	ISO 8	ATEX II 2 G – II BT 4

AT280 Compatibility & Interfaces

AT280-MPT	32 x M20 threaded holes on a Ø1280 mm circle pattern
AT280-HD	1 vertical Pin + 2 lateral pins
AT280-CB	LIR Ariane 5 1194 C

AT280 – Clamp Band (CB60)



Physical Characteristics

Dimensions (ØxH)			1480 x 100	mm
Mass			50	kg
Safety Factors*	Yield	2		
	Ultimate	3		
Tension			Adapted to Payload and Use	
Number of Bands / Tie Rods			2	
Adapters Interface			Ariane 5 1194 C	

*Except in hoisting situation coupled with AT280-HD → SF(3;5)

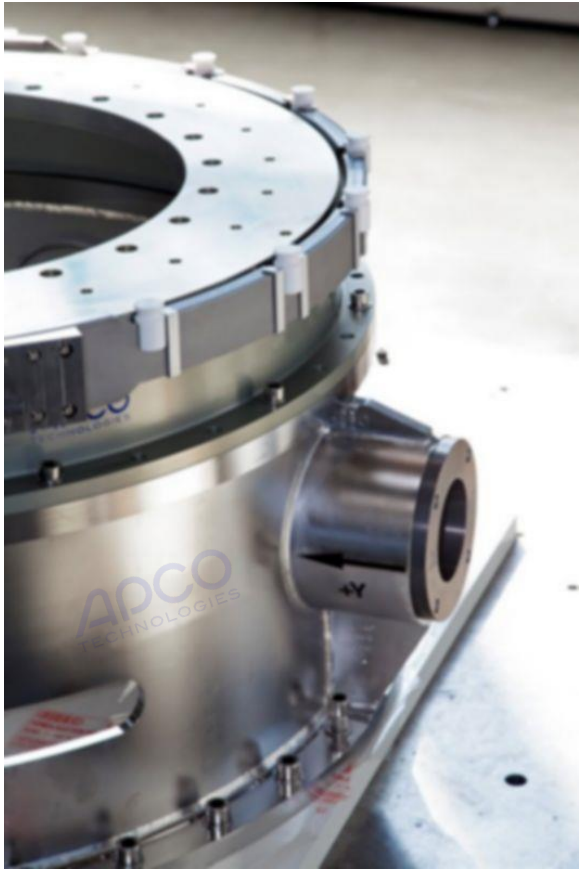
Performances

With GHA on AT280-MPT	See AT280-MPT Mass & Balance Diagram
With GHA on AT280-HD	See AT280-HD Mass & Balance Diagram

Operational Characteristics

Environnement Specifications	ISO 8	ATEX II 2 G – II BT 4
MGSE Compatibility		AT280-GHA

The item must not be used for Vibration tests


APCO
TECHNOLOGIES
+Y


APCO
+Z
ADAPTER TROLLEY

AT280 - ASSEMBLY HD / CB / GHA