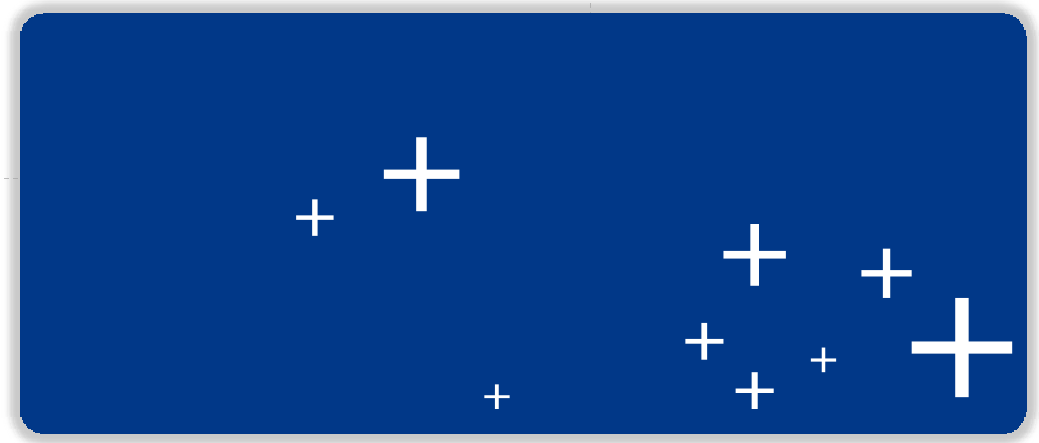
HUTCHINSON RAILWAYS



A forward-looking company

+ FLUID TRANSFER SYSTEMS
+ SEALING SYSTEMS
+ INSULATION
+ TRANSMISSION AND MOBILITY

HUTCHINSON

Teaming up for comfort and safety

Innovate, invest,
improve and share:
such is our conception
of what we do.

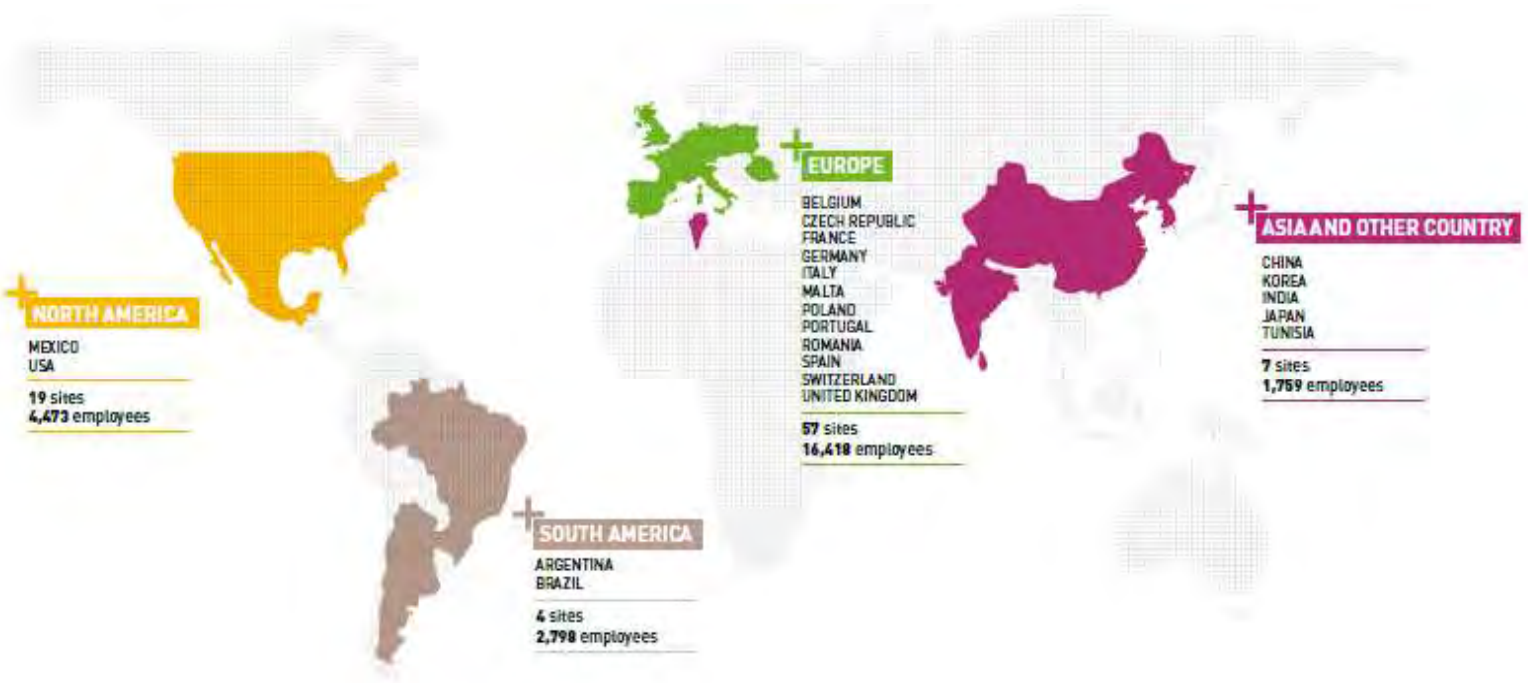
Created in 1853, and definitely a forward-looking company

87 sites in 21 countries

25,448 employees

HUTCHINSON WORLDWIDE

Close to our custo mers



A COMPANY OF TOTAL

100% -owned subsidiary of TOTAL,
the world's 5th largest oil corporation

TOTAL

of turnover

5th oil and gas company

96 950 employees

130 countries


UPSTREAM

DOWNSTREAM


CHEMICALS

HUTCHINSON

KEY FIGURES

HUTCHINSON…

100% -owned subsidiary of TOTAL,
the world's 5th largest oil corporation

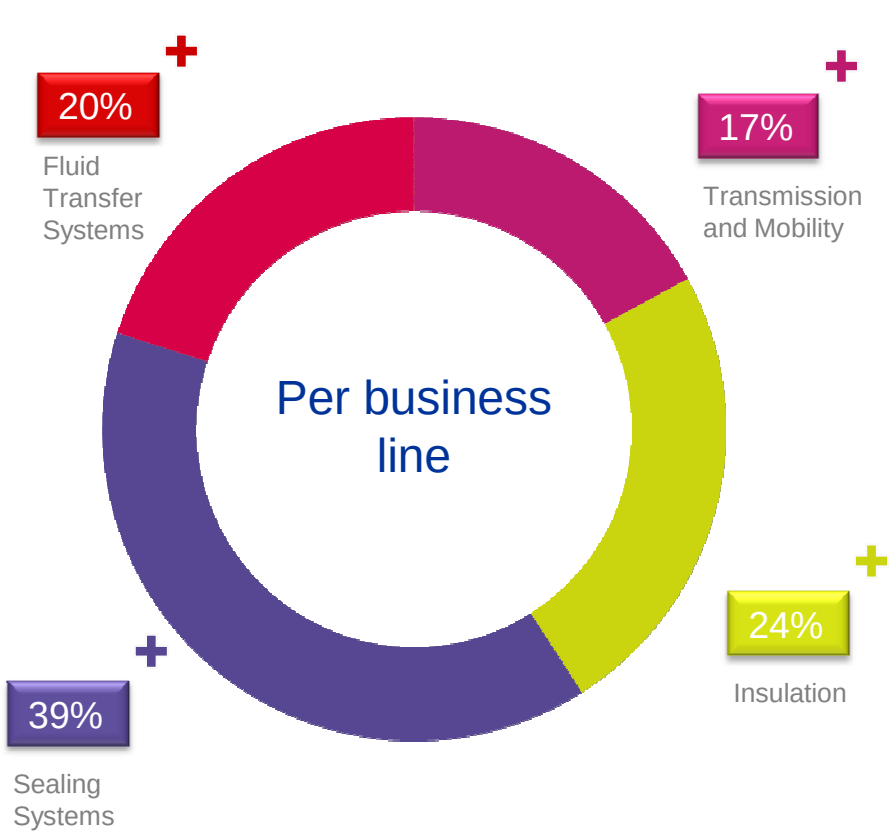
25,448 employees

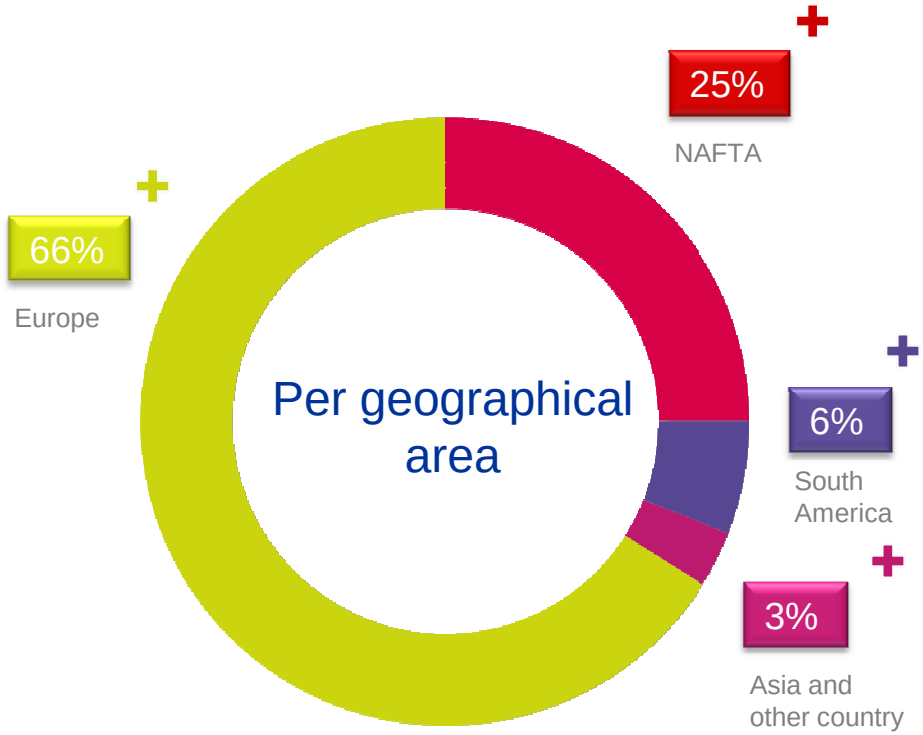
87 sites
worldwide

5.4% of sales
invested in R&D

Operations in **21** countries

KEY FIGURES


Per business line
20%
Fluid Transfer Systems
17%
Transmission and Mobility
24%
Insulation
39%
Sealing Systems


Per geographical area
25%
NAFTA
66%
Europe
6%
South America
3%
Asia and other country









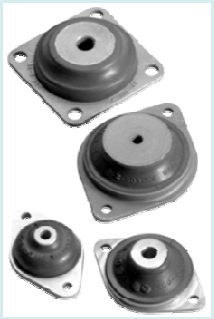
ANTIVIBRATION
INDUSTRY & DEFENSE

HUTCHINSON

PRODUCTS RANGE

Industry

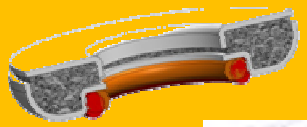
Offshore



Defense

Navy

Railway

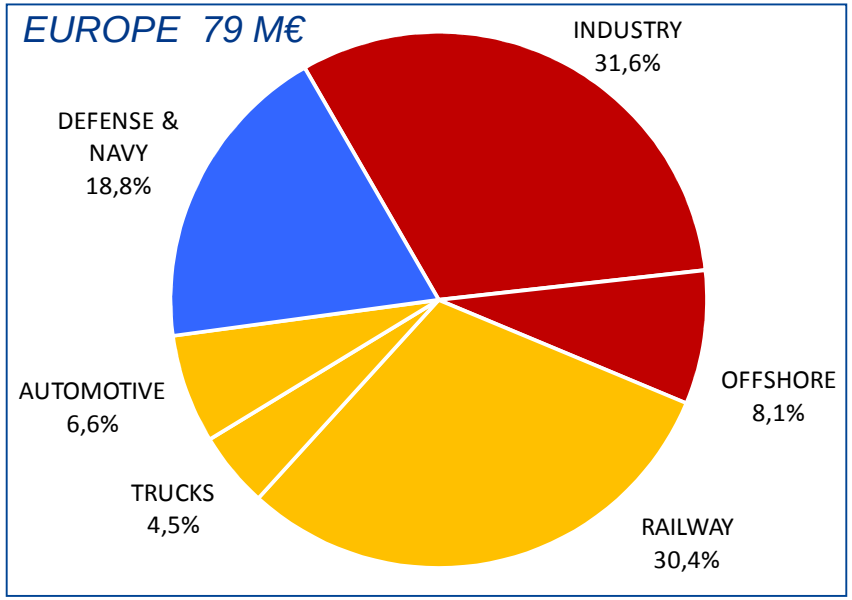


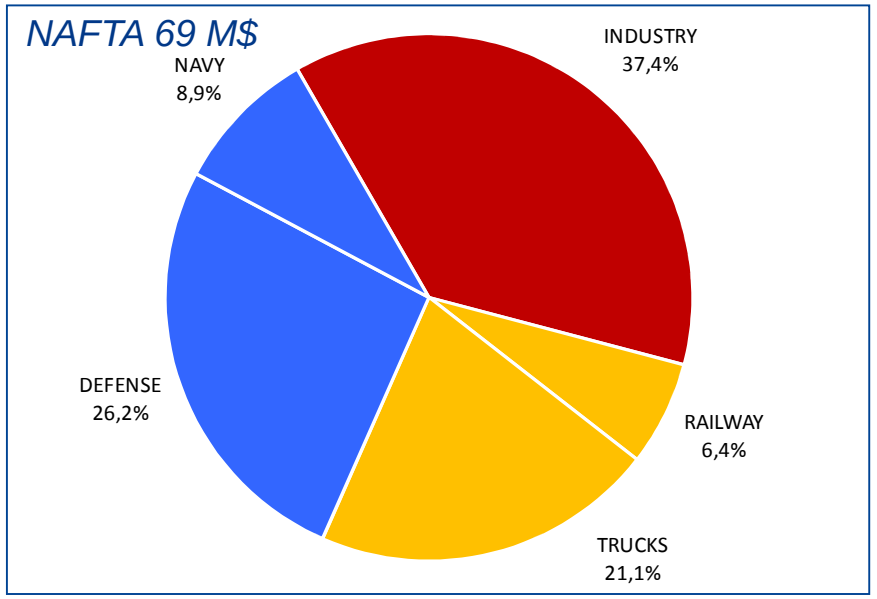
Automotive

Truck

Products & Systems provider for Vibration, noise, shock control.

Sales Split by region





ASIA 4.5 M€

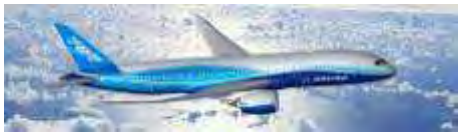
- *Transportation 70%*
- *Industry 30%*

Industry Transportation Defense

Defense market stronger in Nafta than in Europe.
Asia still focusing on Railroad

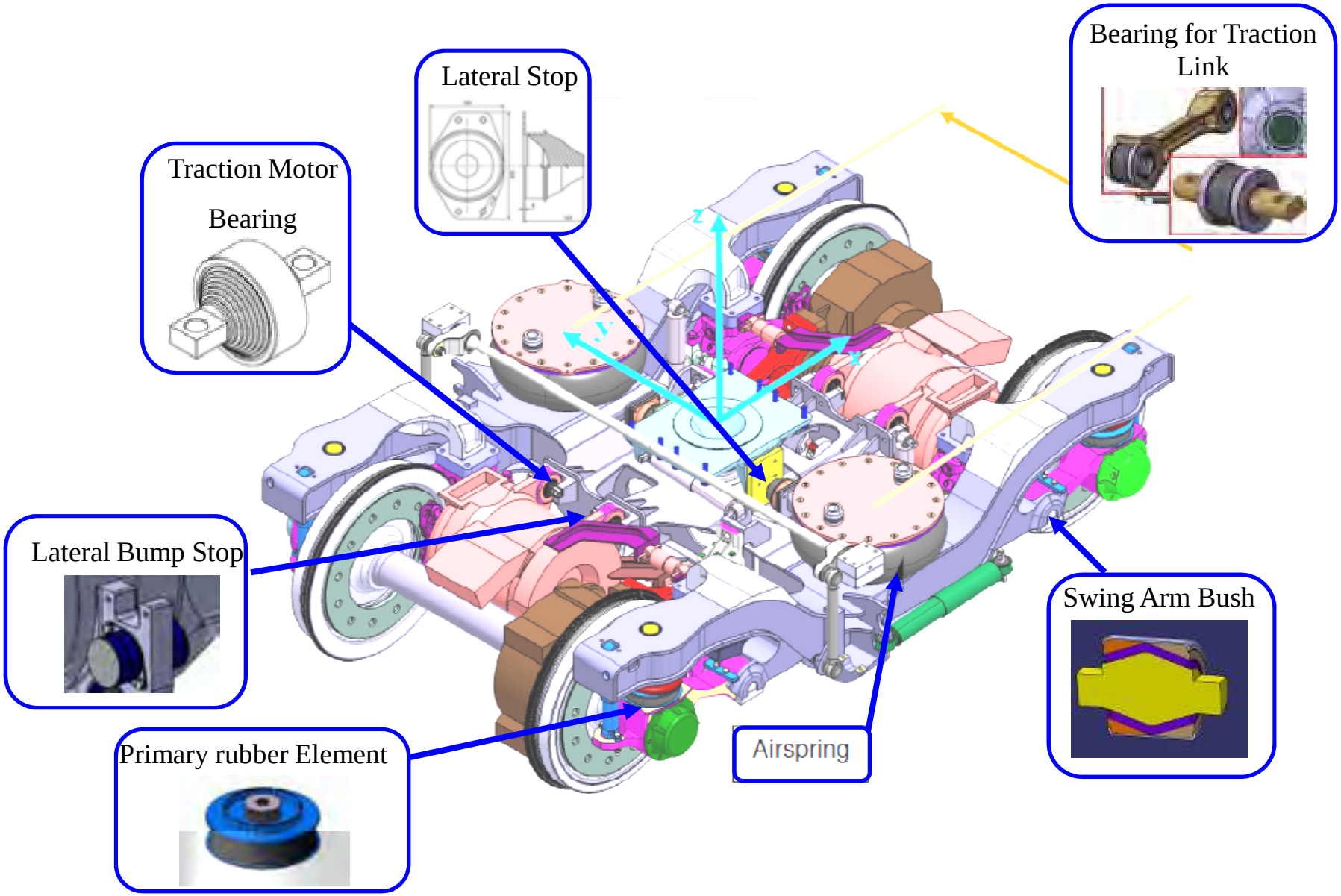
Antivibration – LOCATIONS

Railway range products



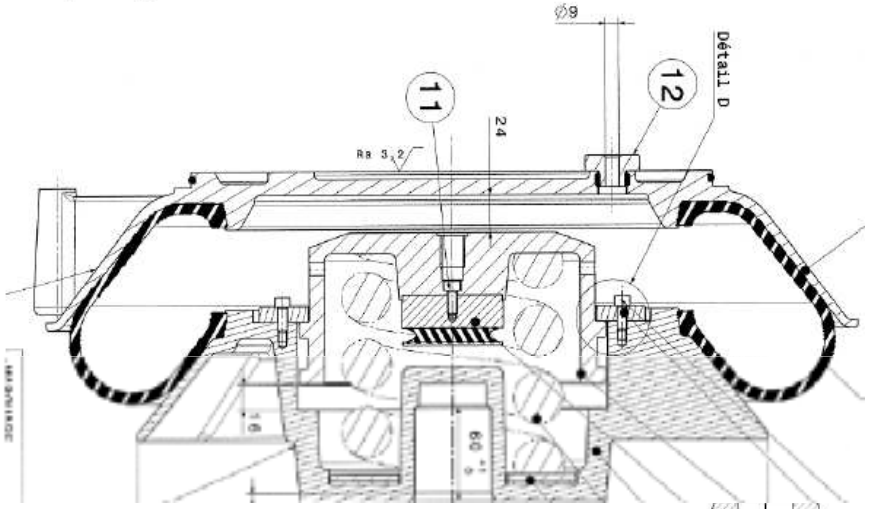
HUTCHINSON WORLDWIDE

1. Railway applications

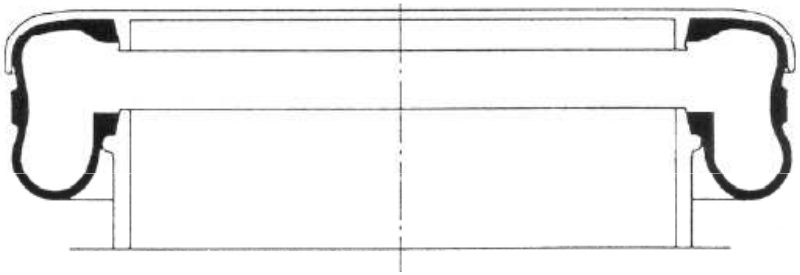


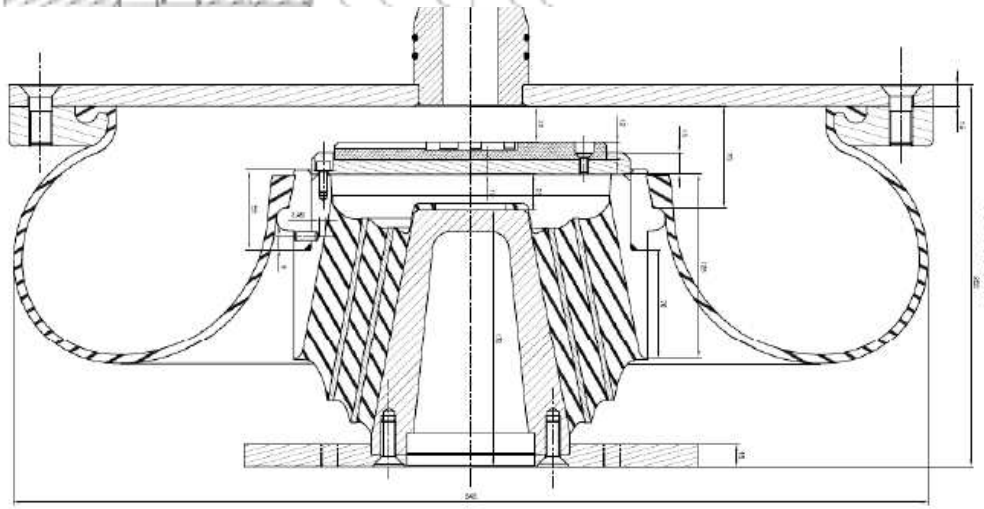
2. AIRSPRING

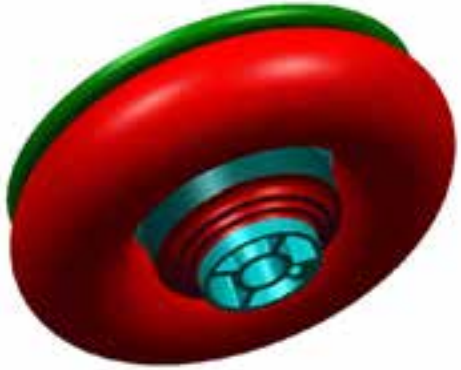
2.b- Déroulantes guidées
Exemple d'application:



3.b- Membranes à "ceinture métallique"

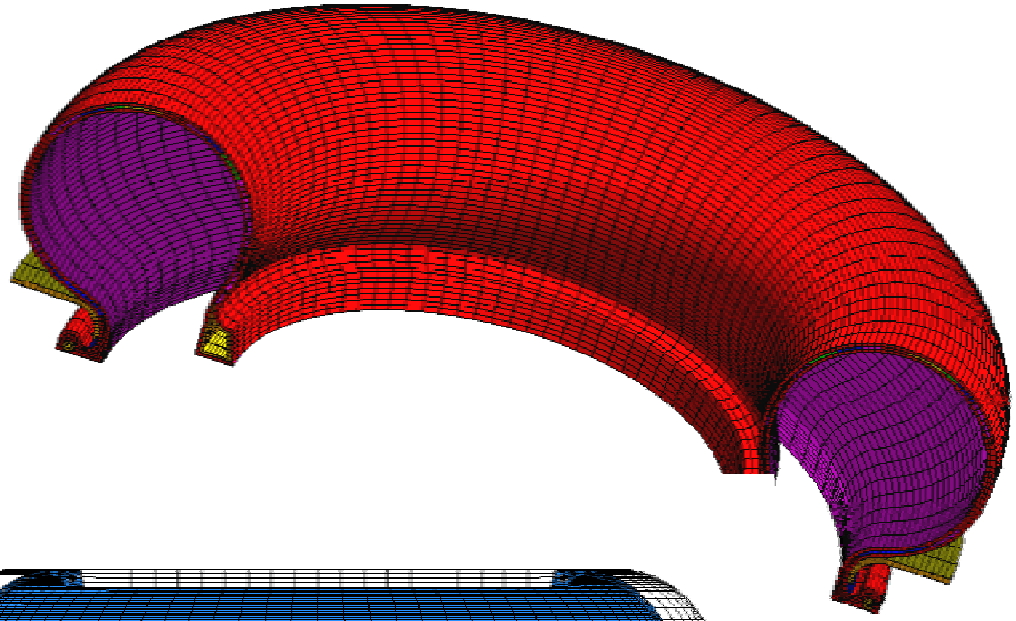


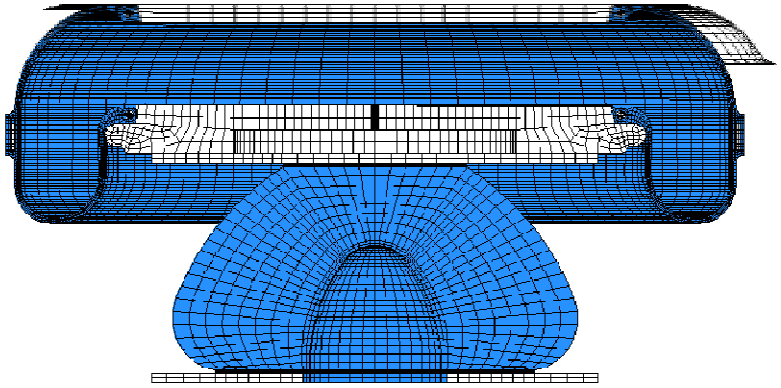


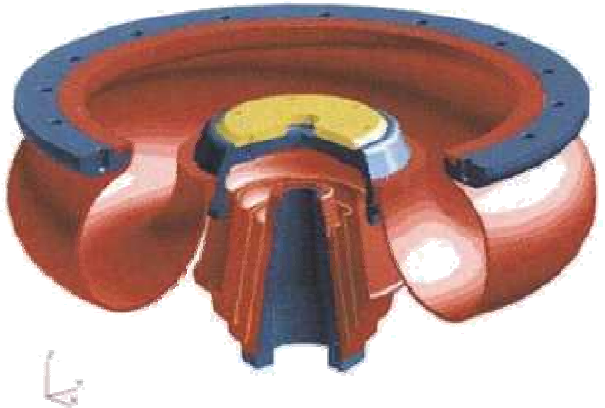


2. AIRSPRING

DESIGN **3D model**







2. AIRSPRING

Caracteristics :

- **Masse supportée / Load : 4 à 18,5 tonnes**
- **Pression de service / pressure : 4 à 7 bars**
- **Pression d'éclatement / Burst Pressure : 18 à 25 bars**
- **Epaisseur / thickness : 4 mm**

TEST BENCH in ETREPAGNY

Banc Zwick

automatical

Static sollicitations

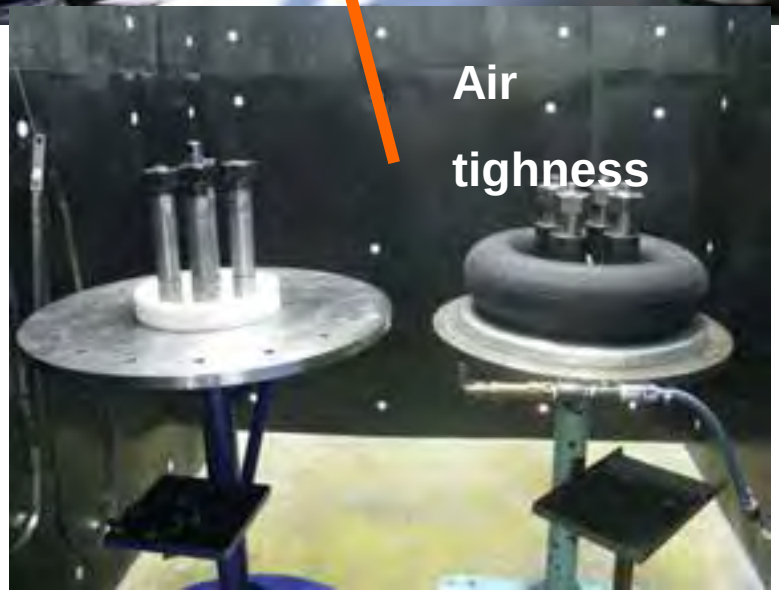
Vertical +/- 100 mm (250 kN)

Horizontal +/- 150 mm (30 kN)

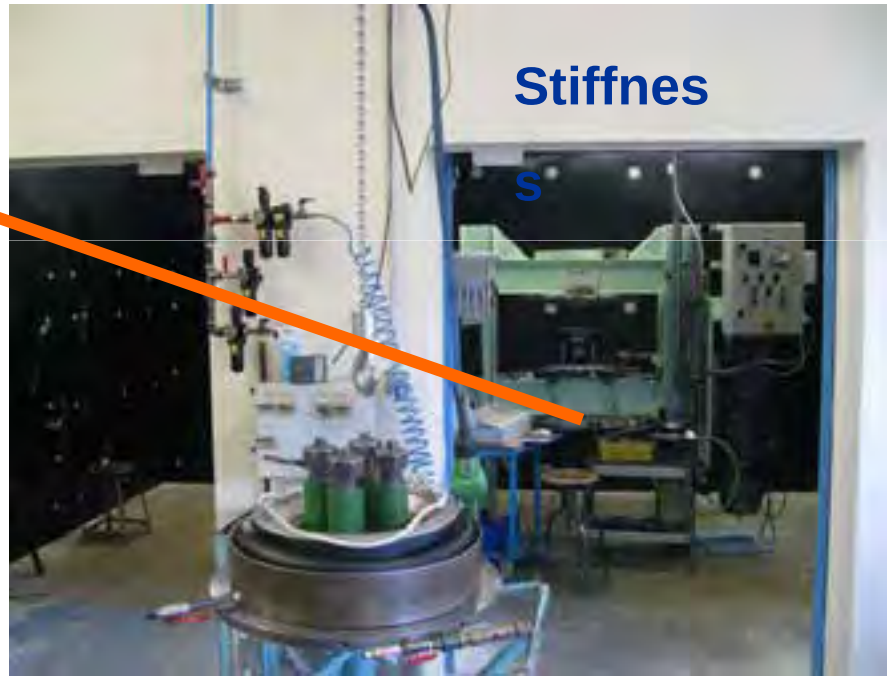
V add 150 l

TEST CAPACITIES in the world

TEST BENCH in MONTARGIS



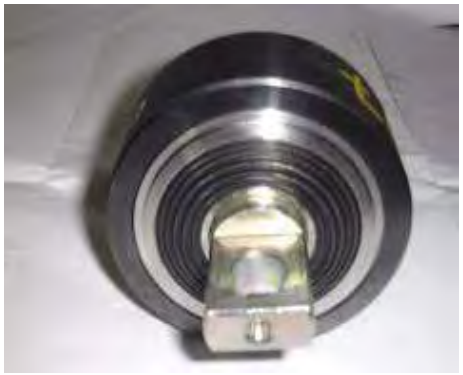
CONTROL BENCHES



HIGH-SPEED TRAINS

Type of trains	PROGRAM NAME	END-USER	COUNTRY	MANUFACTURER	PRODUCT
High-speed	TGV Duplex & 1N	SNCF	France	ALSTOM / BOMBARDIER	Bogie shipset including airspring + rubber-metal parts
High-speed	TGV / Thalys	SNCB	B, NL, D, F	ALSTOM / BOMBARDIER	Bogie shipset including airspring + rubber-metal parts
High-speed	Eurostar	EUROSTAR	UK, F, B	ALSTOM / BOMBARDIER	Bogie shipset including airspring + rubber-metal parts
High-speed	AGV	NTV	Italy	ALSTOM	Bogie shipset including airspring + rubber-metal parts
High-speed	KTX / KTX2	KORAIL	South Korea	ALSTOM and ROTEM	Bogie shipset including airspring + rubber-metal parts
High-speed	ICE3 & Velaro D	DB	Germany	SIEMENS	Traction mechanism parts, primary bush
High-speed	Velaro Spain	Renefe	Spain	SIEMENS	Traction mechanism parts, primary bush
High-speed	Velaro Russia	RZD	Russia	SIEMENS	Traction mechanism parts, primary bush
High-speed	ETR500	Trenitalia	Italy	FIREMA, ANSALDO BREDA	Arm bush & engine suspensions
High-speed	CRH5	MOR	China	CRC / ALSTOM	Secondary suspension
High-speed	CRH1	MOR	China	BST	Secondary suspension
High-speed	CRH3	MOR	China	CRC / SIEMENS	Traction mechanism parts

HIGH-SPEED TRAINS



SNCF APPROVED

2ndary suspension application TGV
+ rubber-metal shipset parts
TGV

TGV DUPLEX, TMST, PBKA, KTX, …

3. PRIMARY SPRINGS

PRIMARY ARM BUSH :

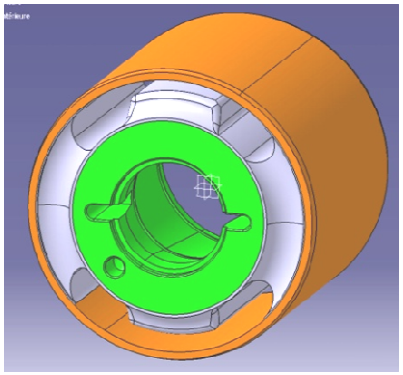
- Radial maximum load : 75 kN
- Axial maximum load : 30 kN
- Max angle in torsion : 3°
- Max conical angle : 1°
- Radial spring rate : 120 kN/mm
- Axial spring rate : 12 kN/mm
- Torsion spring rate : 230 m.N/°
- Conical spring rate : 2,800 m.N/°

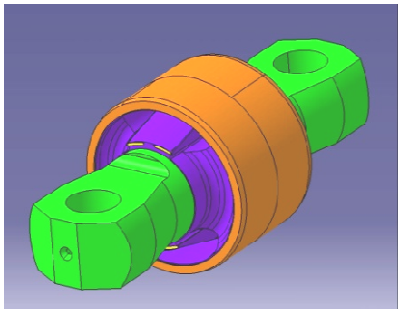
4. BUSHINGS

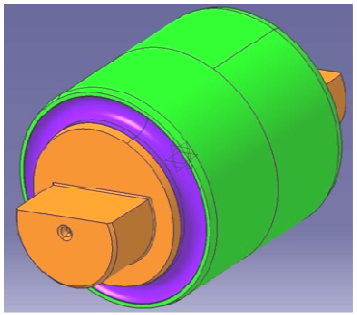
ANTI ROLL BAR BEARING for TGV

- Diameter : 90 mm
- Length : 52 mm
- Radial maximum load : 50 kN
- Max angles torsion / conical : 15°
- Minimum radial spring rate : 220 kN/mm
- Maximum torsion spring rate : 32 m.N/°
- Maximum conical spring rate : 22 m.N/°

Velaro Russia Bushes and pivot







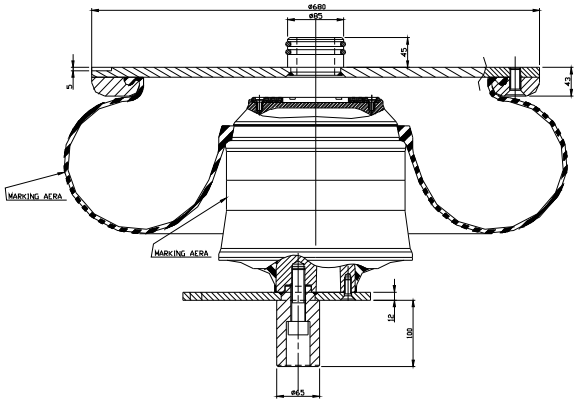
CRH1 _ EMU CHE2 China

Secondary suspensions

CRH5 _ EMU 200 KM/H CHINA

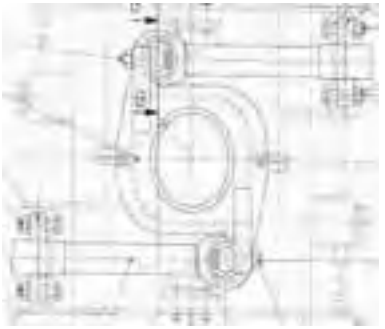
EMU 200km/h China, Alstom CRC

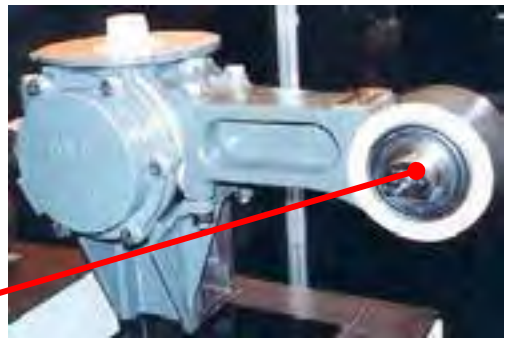
Secondary suspensions



VELARO

Teaming up meeting®





HUTCHINSON

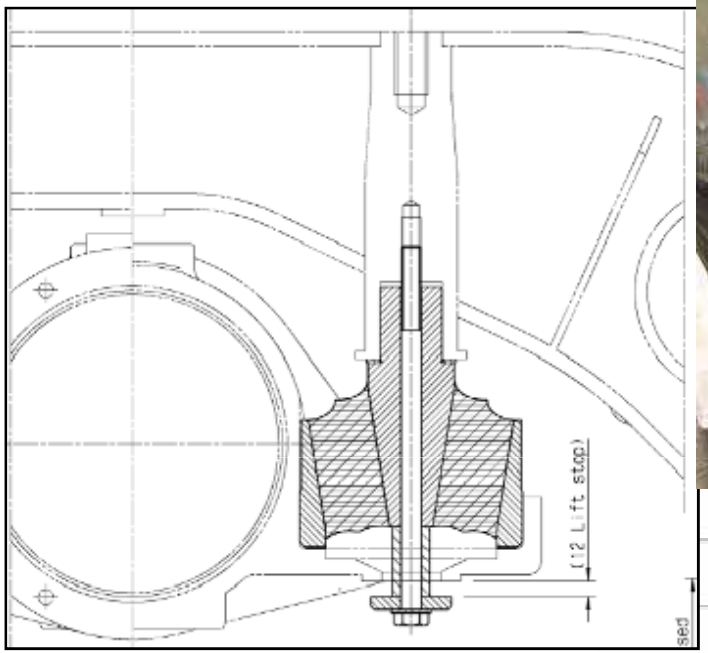
HUTCHINSON

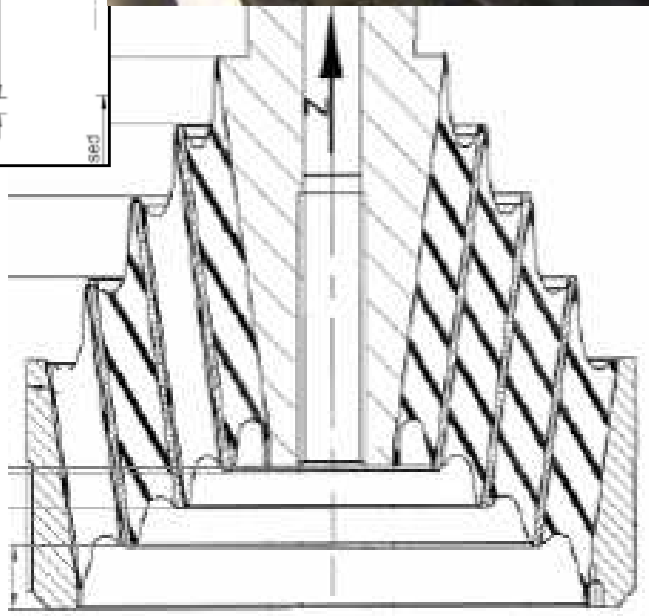
METROS

Type of trains	PROGRAM NAME	END-USER	COUNTRY	MANUFACTURER	PRODUCT
Metro	MF2000	RATP	France	BOMBARDIER	Secondary suspension & primary conical spring
Metro	Brussels	SNCB/STIB	Belgium	SIEMENS	Secondary suspensionn
Metro	Brescia, Milano	Operator	Italy	ANSALDO BREDA	Primary bush
Metro	Budapest	Budapest network	Hungary	ALSTOM	Secondary suspension
Metro	Vancouver	XXX	Canada	ROTEM	Secondary suspension
Metro	Almaty	Operator	Kazaksthan	ROTEM	Secondary suspension
Metro	Shanghaï Yang Pu Line	SMOC	China	PUZHEN / ALSTOM	Secondary suspension + primary conical spring
Metro	Shanghaï L1 Extension	SMOC	China	PUZHEN	Secondary suspension
Metro	Guangzhou Line 3	xxxx	China	SIEMENS / ZHUZHOU	Secondary suspension
Metro	Shanghai L2 East Extension	SMOC	China	PUZHEN	Secondary suspension
Metro	Guangzhou Line 3 North Extension	xxx	China	ZHUZHOU	Secondary suspension
Metro	Wuhan Line 1	Wuhan Operator	China	ZHUZHOU	Secondary suspension
Metro	Shenzhen Line 5	Shenzhen operator	China	ZHUZHOU	Secondary suspension

3. PRIMARY SPRINGS

CONICAL SPRING :

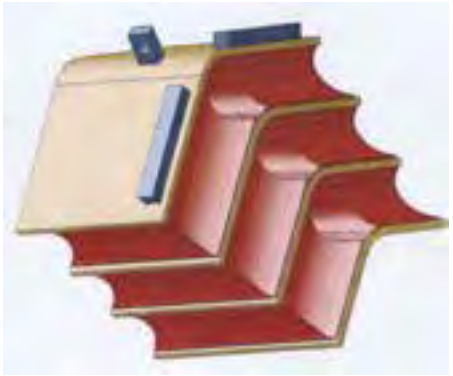


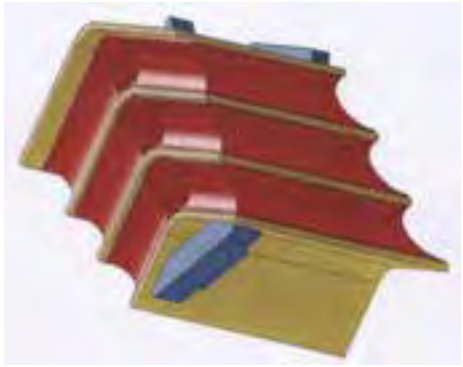


- Tare load : 12,85 kN
- Vertical stiffness : 600 N/mm
- Horizontal stiffness in Y : 2600 N/mm
- Horizontal stiffness in X : 5170 N/mm

3. PRIMARY SPRINGS

METRO CHEVRON SPRING :





- Max load : 5,000 daN
- Vertical spring rate : 80 daN/mm

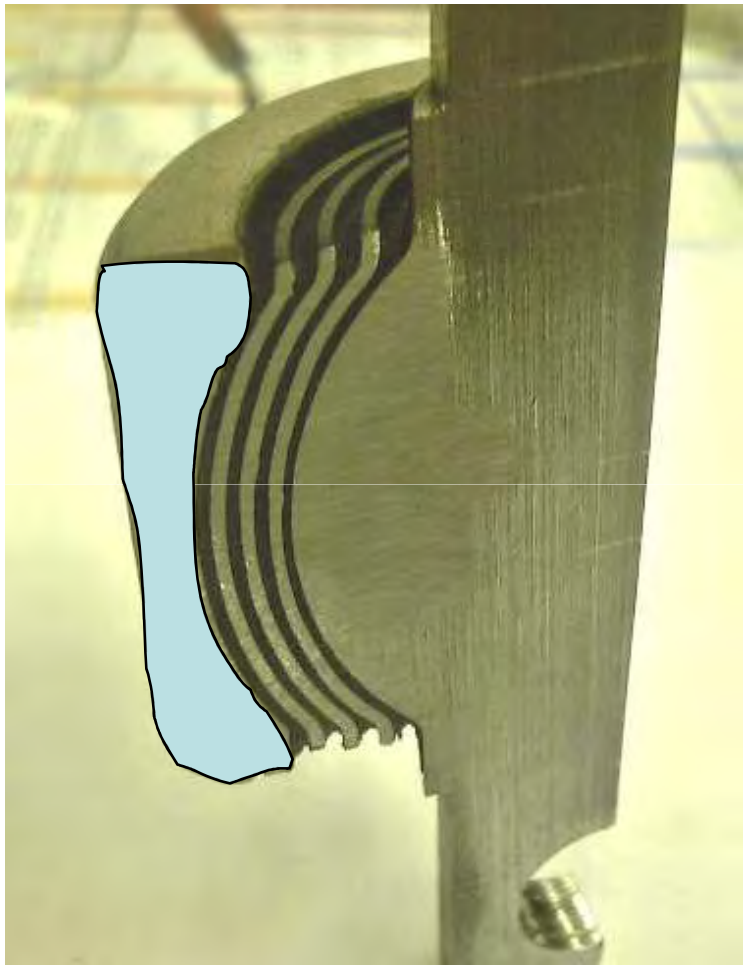
M7 _ LIRR / MNR, NEW YORK, USA

BOGIE RUBBER - METAL SHIPSETS
INCLUDING SECONDARY SUSPENSIONS

4. BUSHINGS

Traction mechanism with laminated bush :

- Laminated bush for traction mechanism
- Very high radial stiffness (500 kN/mm)
- Low torsional and conical stiffnesses
- Improved fatigue behaviour in radial direction



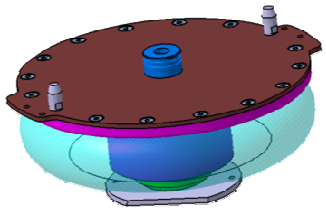
SHANGHAI, YANG PU / LINE 1 EXTENSION / L2 EAST EXTENSION

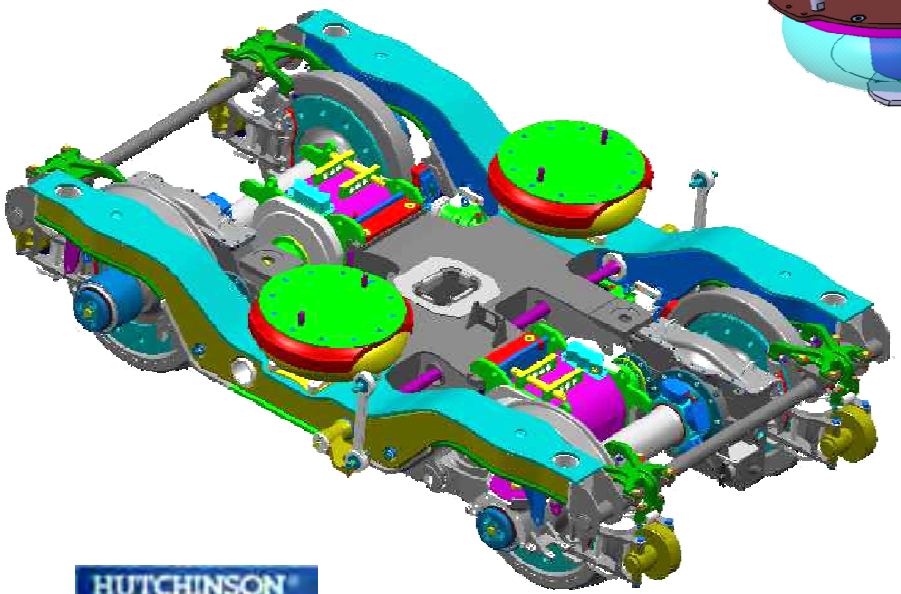
Primary suspensions
Yang Pu

Secondary suspensions
Yang Pu, L1 Ext, L2 East Extension

SUZHOU, LINE 1

Teaming up meeting®





HUTCHINSON
railfield

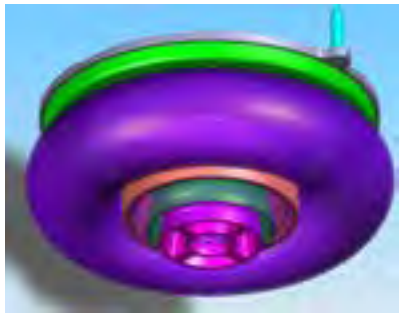
HUTCHINSON
HUTCHINSON

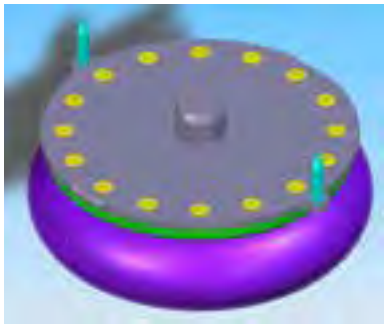
REGIONAL, SUBURBANS

Type of trains	PROGRAM NAME	END-USER	COUNTRY	MANUFACTURER	PRODUCT
Regional / suburbs	X TER / Z TER / MI2N / TER 2N	SNCF	France	ALSTOM BOMBARDIER	Bellow + emergency spring, r-m bogie parts
Regional / suburbs	AGC	SNCF	France	BOMBARDIER	End and Jacob's bogies secondary suspensions, antiroll bar bush
Regional / suburbs	IDF / NAT	SNCF	France	BOMBARDIER	End and Jacob's bogies secondary suspensions
Regional / suburbs	M6	SNCB	Belgium	BOMBARDIER	Bellow + emergency spring
Regional / suburbs	NS	Net Train	Netherlands	SIEMENS	End and Jacob's bogies secondary suspensions
Regional / suburbs	Talent 2	DB	Germany	BOMBARDIER	End and Jacob's bogies secondary suspensions
Regional / suburbs	ET425	DB	Germany	SIEMENS	Emergency spring
Regional / suburbs	Talgo Tilting serie 7	Renefe	Spain	TALGO	Auxiliary spring
Regional / suburbs	MELBOURNE BAYSIDE	Operator	Australia	SIEMENS	Secondary suspension
Regional / suburbs	Long Island Railroad & Metro North	Long Island Railroad & Metro North	USA	BOMBARDIER	Bogie shipset including airspring + rubber-metal parts
Regional / suburbs	New Jersey Transit	New Jersey Transit	USA	BOMBARDIER	Bogie shipset including airspring + rubber-metal parts
Regional / suburbs	NYCT	NYCT	USA	ALSTOM BOMBARDIER	Bogie shipset including airspring + rubber-metal parts
Regional / suburbs	AMT	AMT	Canada	BOMBARDIER	Bogie shipset including airspring + rubber-metal parts

ILE DE FRANCE

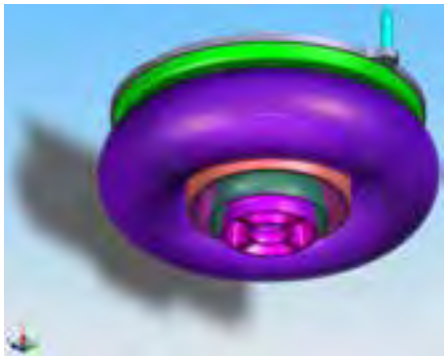
- **Motor’s bogie**
- **Jacob's bogie**

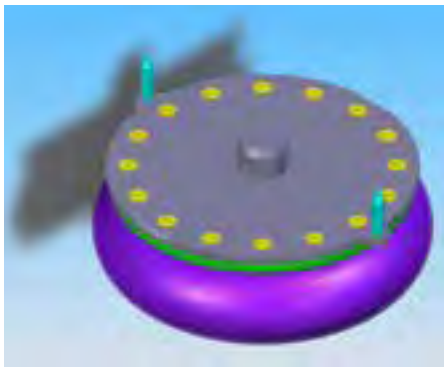




TALENT 2

Teaming up meeting®



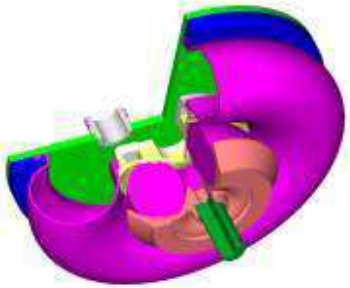


HUTCHINSON
caoutchouc

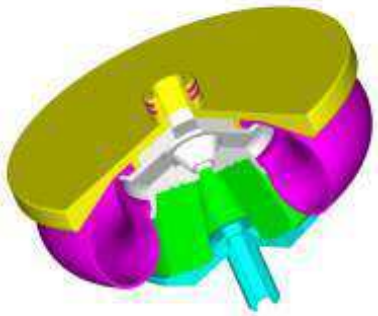
HUTCHINSON
HUTCHINSON

NL REGIONAL LIGHT TRAIN

Suspensions secondaires



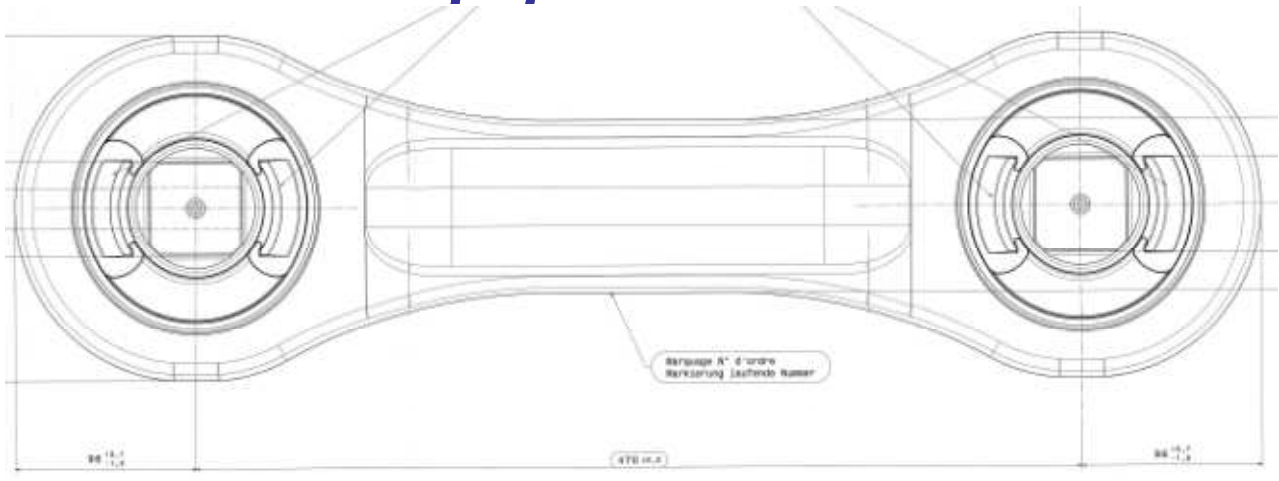
Bogie moteur



Bogie Jacob

4. BUSHINGS

Equiped rod :



- Assembly of :
  - 2 bush ref 565191 (ϕ130 mm)
  - 1 forged rod

- Key datas* :
  - F rad max = 100 kN
  - K rad bielle = 1 kN/mm

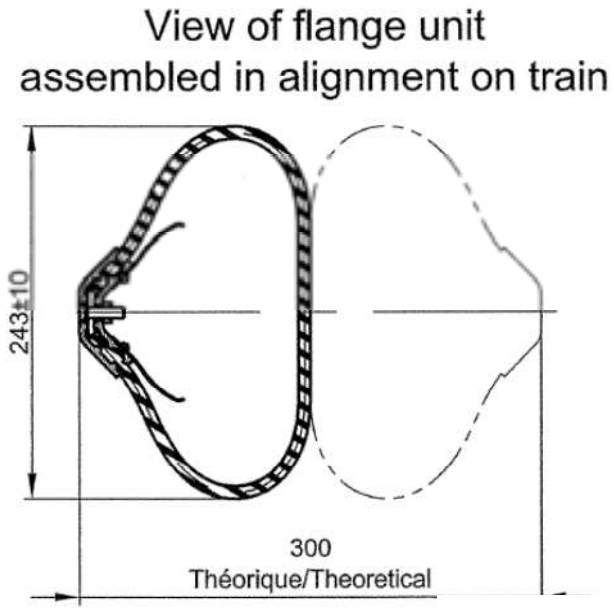
  (on linear part of the curve)

* Indicative values under a certain load and displacement

6. RUBBER FLANGE

Bourrelet horizontal

Bourrelets verticaux

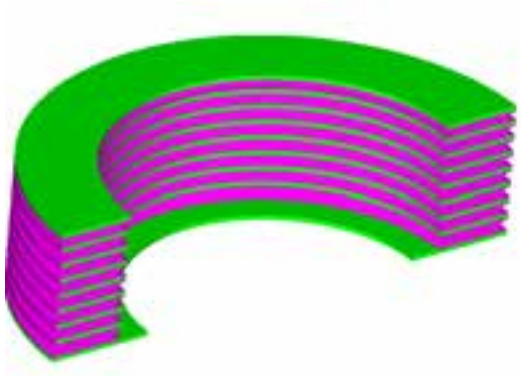


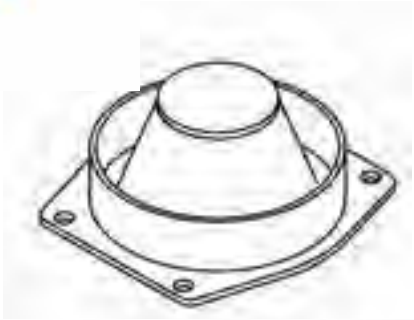
Références Paulstra : 822000 et suivantes, 822500 et suivantes

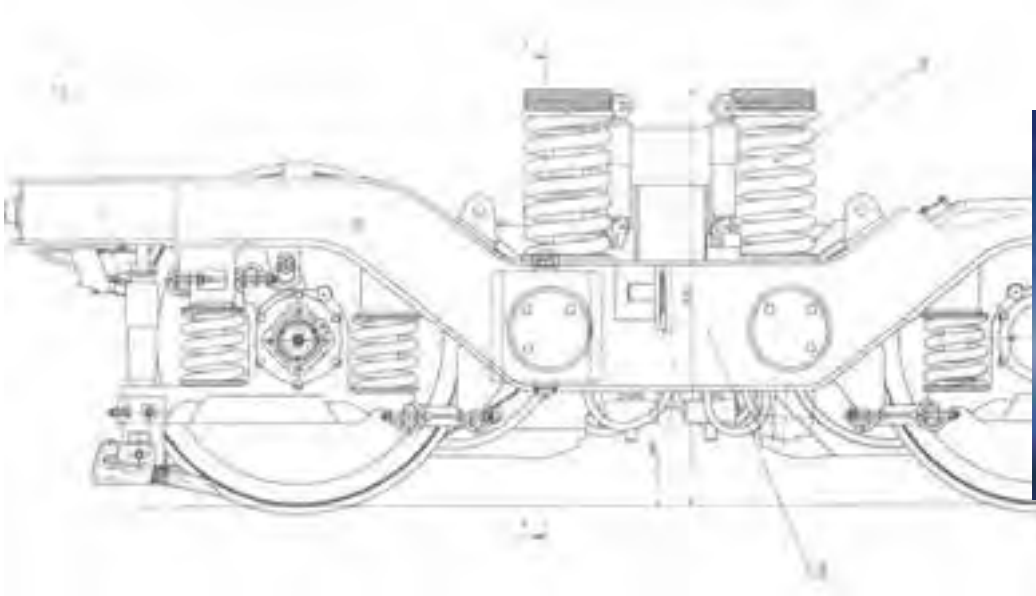
LRV LOCOS

Type of trains	PROGRAM NAME	END-USER	COUNTRY	MANUFACTURER	PRODUCT
LRV	Citadis		France	ALSTOM	Elastic elements for wheels
LRV	Citadis		France	ALSTOM	Bogie parts shipset
LRV	Cityrunner		Austria	BOMBARDIER	Elastic elements for wheels
LRV	Randstadt, Köln, Dockland	Operators	NL, Germany, UK	BOMBARDIER	Primary conical spring
Type of trains	**PROGRAM NAME**	**END-USER**	**COUNTRY**	**MANUFACTURER**	**PRODUCT**
Loco	Locofret	SNCF	France	ALSTOM	Primary bush, resilent stop, resilent bearing, traction bar bush
Loco	DJ4	MOR	China	ALSTOM / DATONG	Primary bush, resilent stop, resilent bearing, traction bar bush
Loco	Loco 632 /633	Trenitalia	Italy	ALSTOM	Primary suspensions
Loco	Loco Iran	Operator	xx	VOSSLOH	Secondary suspensions

LOCO PARTS

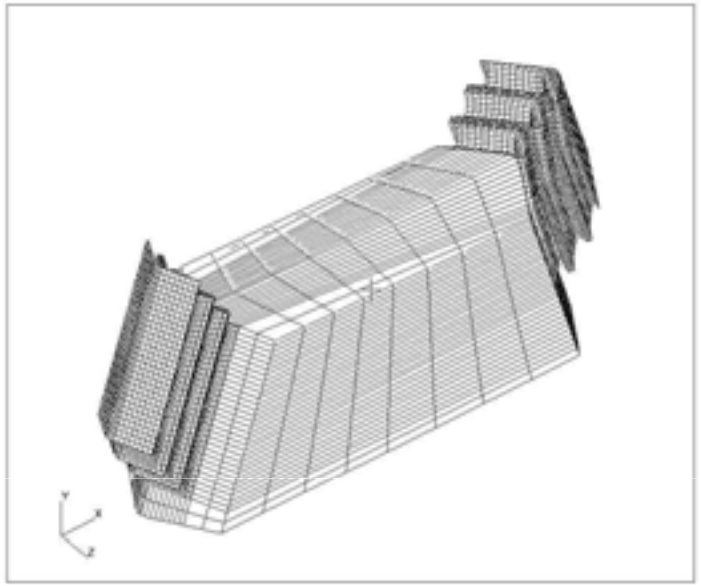






3. PRIMARY SPRINGS

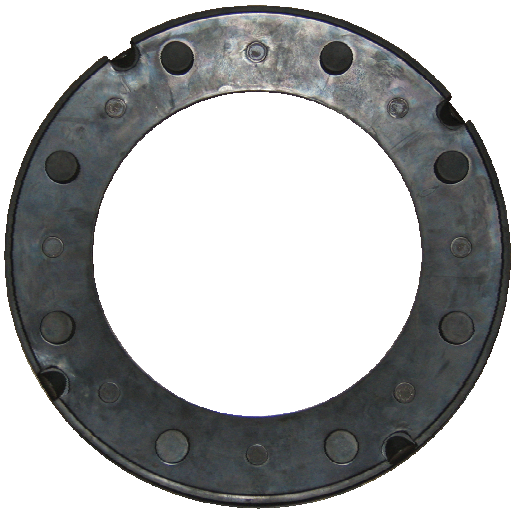
TRAMWAY CHEVRON SPRING :

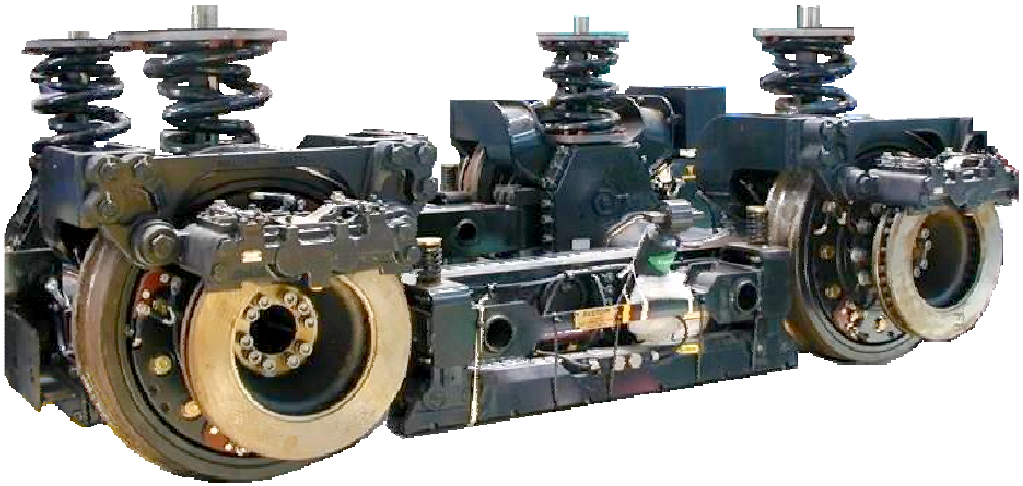


- Heavy weight Corège Tram of Alstom. Application Rotterdam
- Independant wheels
- Assymetrical arrangement of chevrons

- Vertical spring rate : 1,300 N/mm
- Longitudinal spring rate : 3,100 N/mm
- Lateral spring rate : 1,500 N/mm
- Loads up to 40 kN

LRV RUBBER-METAL PARTYS & RESILIENT ELEMENTS FOR ELASTIC WHEELS





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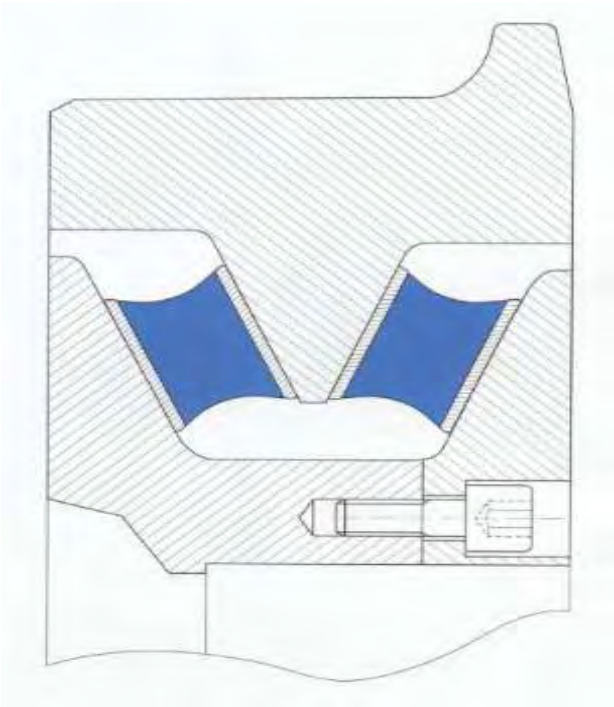
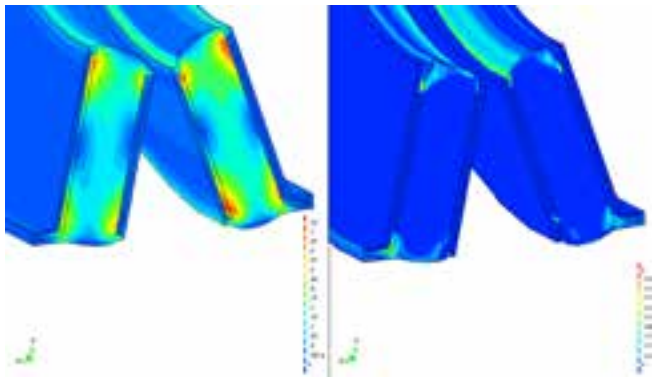
HUTCHINSON

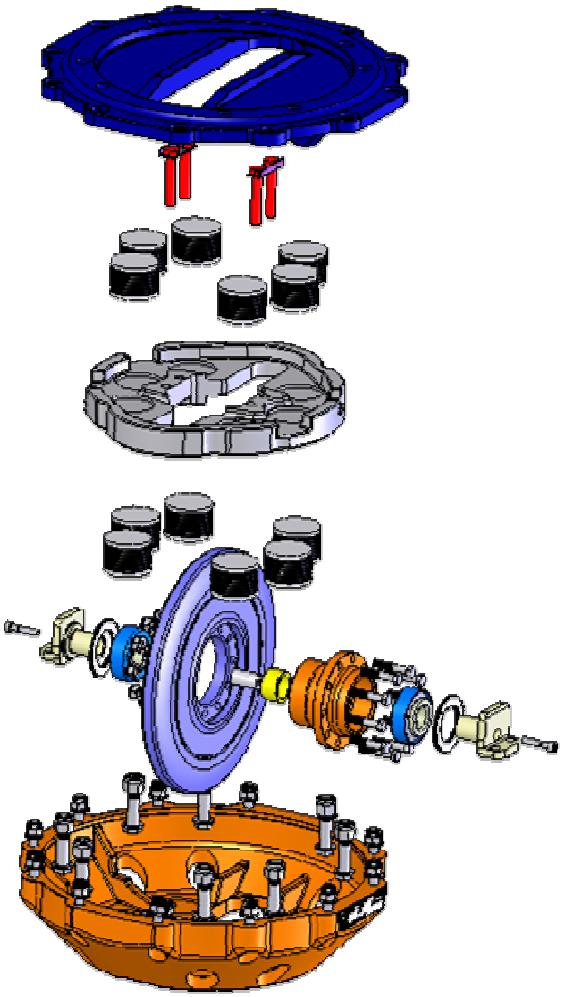
6. RESILIENT WHEEL

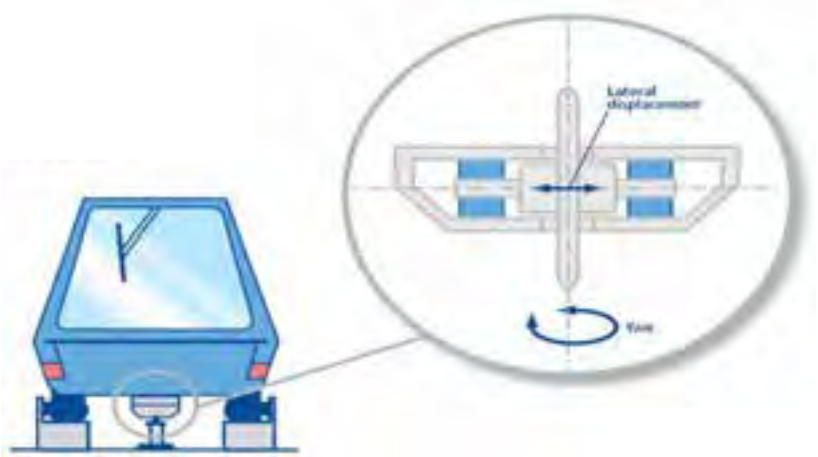




- **Two types of wheels :**
  - **Acoustic (stiff)**
  - **No vibrations (soft)**
- **Applications Citadis Alstom**

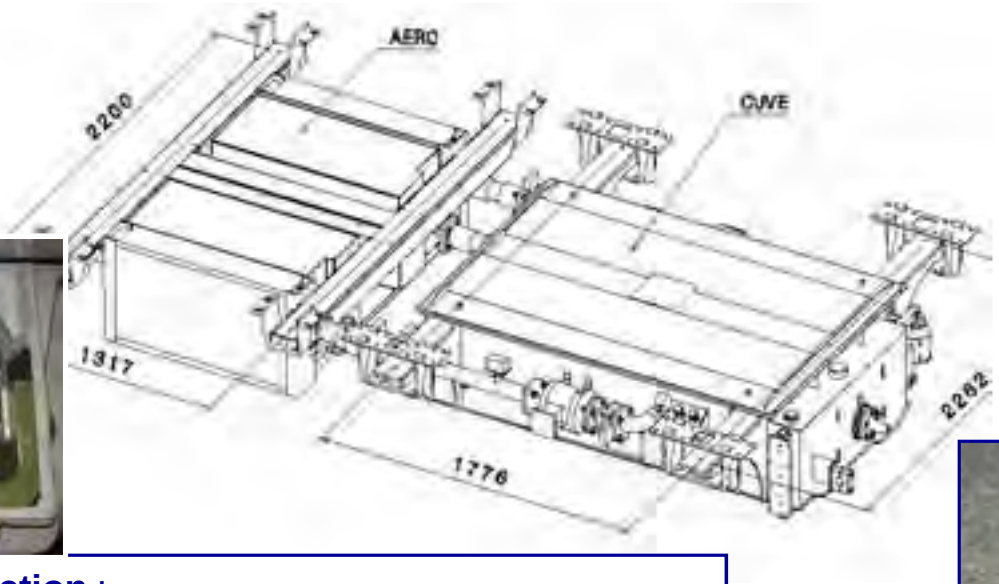
5. GUIDANCE SYSTEM





8. MOUNTS

Main transformer + Oil tank (4400 Kg) - Cool Generator (500 Kg) for AGV Program



544271 11 10

544270 12 00

Fonction :
. Filtre antivibratoire – Confort des passagers.
Exigences :
. Suspension 6 Hz toutes directions
. 1G Trans / 3G Vertical / 3G longi.
. Fatigue 10 millions de cylces à 0.2 G
Quantités :
AGV 7 voitures :
- 8 plots (544271-11 Dureté basse),
- 8 plots (544270-12)

8. MOUNTS

	Ref Paulstra	Désignation	Caracteristiques
	544271 1200	suspension d'équipement sur toiture (125kg/210kg) coffret de clim & ensemble rhéostats	16
	905368 0010	ensemble support transfo d'isolement (13,5 kg)	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G
	905368 0020	ensemble support transfo d'isolement (19 kg)	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G
	544271 1110	suspension d'équipement sous chassis (125kg/210kg) Coffret de traction	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G
	544270 1200	suspension d'équipement forte charge Cuve (500 kg)	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G
	CH739A06	butée de transormateur principale cuve 1000 DAN statique	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G
	544271 1100	suspension d'équipement sous chassis (125kg/210kg) Transfo principale	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G
	544271 1600	suspension d'équipement sur toiture (125kg/210kg)	Frequence 6hz 3 axes Chocs 1G trans, 3g vertical 3g long , fatigue 10 million de cycles 0,2G

Teaming up meeting®

THANK YOU FOR YOUR Attention…