FREYSSINET

H-Rod Suspension Bars

Designed to last

Sustainable technology

10/2021

Contents

FREYSSINET

PART 1

Suspension Bar System Design

Architectural tension rod

- Lightweight system
- Economical
- Tested as per Eurocode

Sustainable technology

Suspension Bar System Design

Customized architectural solutions for outstanding projects

Freyssinet has created and fully tested its own line of architectural lightweight tension rods which are aesthetically pleasing, fast to design, readily available, and economical.

- Three grades of carbon steel are available up to a yield strength of 700 Mpa. Higher grades result in a more cost effective solution with smaller bar diameters and easier installation.
- Two grades of a full stainless steel range with thread diameters M16 to M98 are also available, should this be required by the aesthetics of the project.
- Cold rolled ISO Metric threads
- Length adjustment is possible at the turnbuckle for all diameters, as well as at each Clevis and Spade to match site requirements.

Suspension Bar System Design

System designed as a whole:

- ❑ EN 1993-1-11 – Group A, Class 4
- ❑ EN 1993-1-8
- ❑ PTI DC45.1-12

System designed and qualified considering:

- ❑ Mainly axial fatigue actions

  $\sigma_{sup} = 0{,}45\sigma_{uk}$

  σ_{uk} is the characteristic ultimate tensile stress of the bar (MPa)

  $\Delta\sigma = 105$MPa

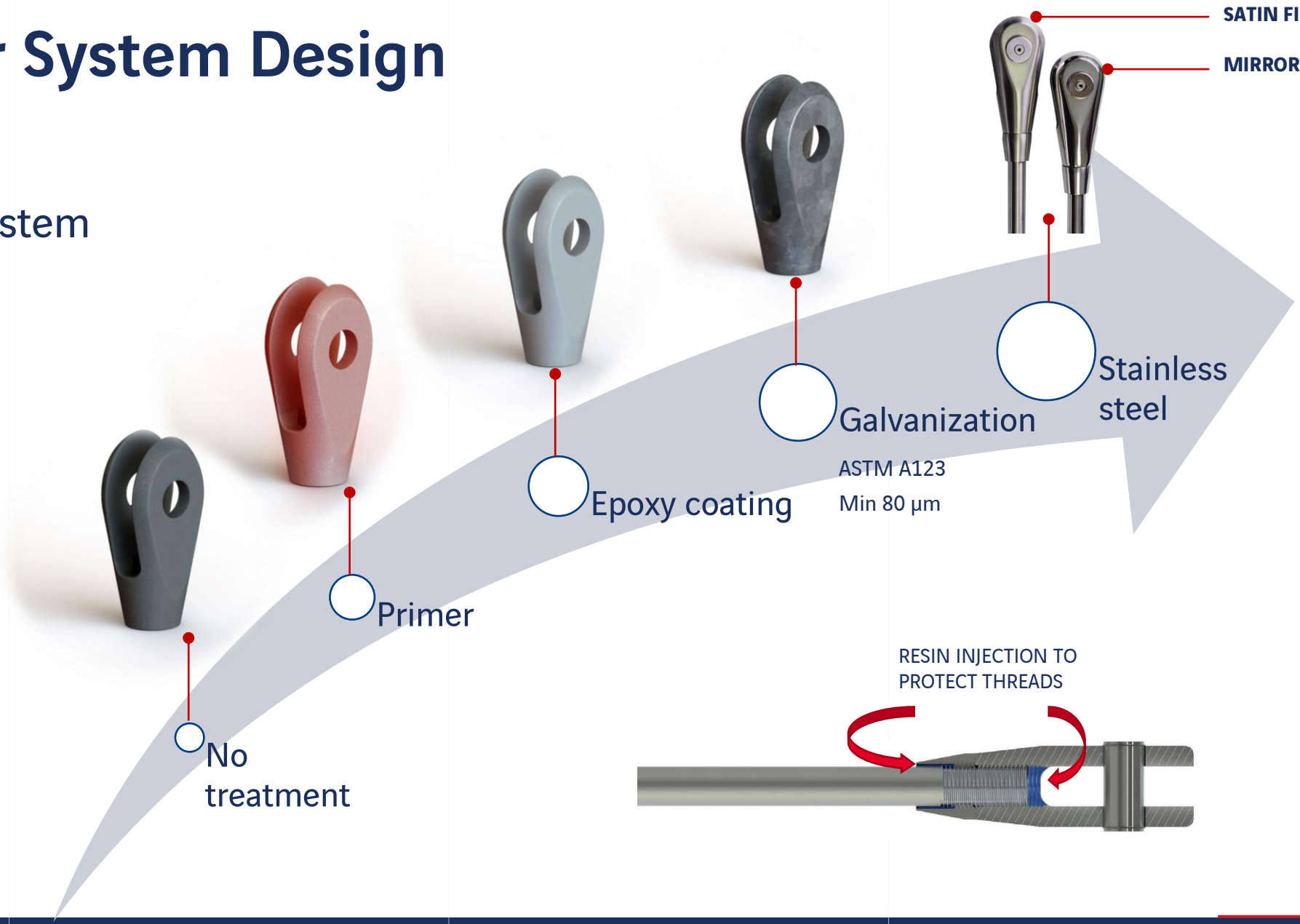
  Number of cycles: 2 millions

  Subsequent static test to failure

- ❑ Plastic yield of the tension rod occurs at 90% FGUTS before connecting parts are plasticized

Suspension Bar System Design

Corrosion protection system



PART 2

Freyssinet Suspension Bar System

Designed to last

- Compact architectural solution
- Optimised to meet your needs

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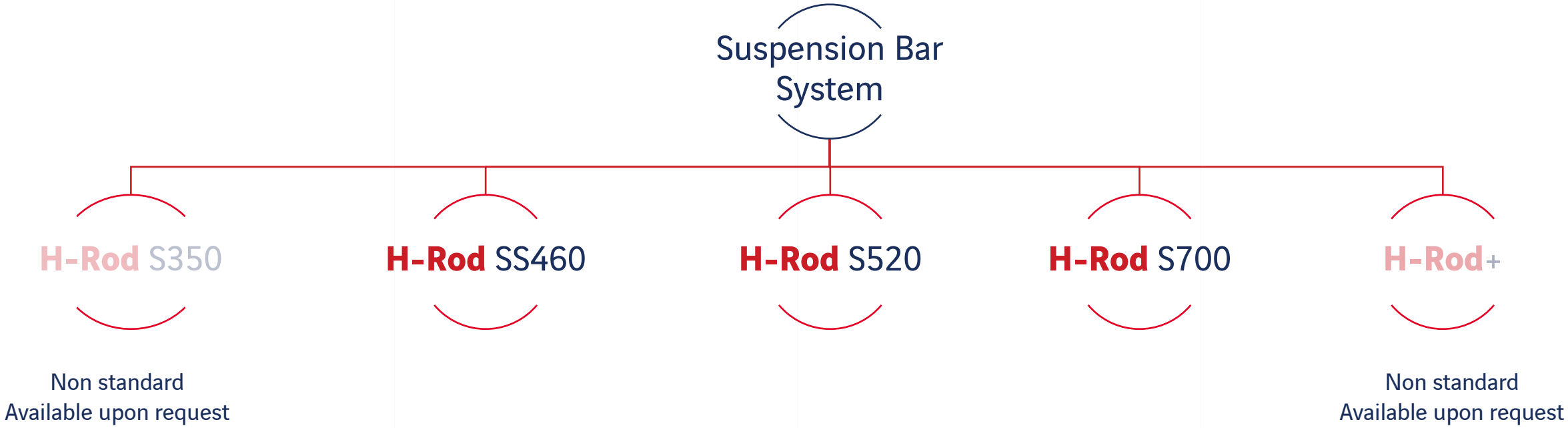
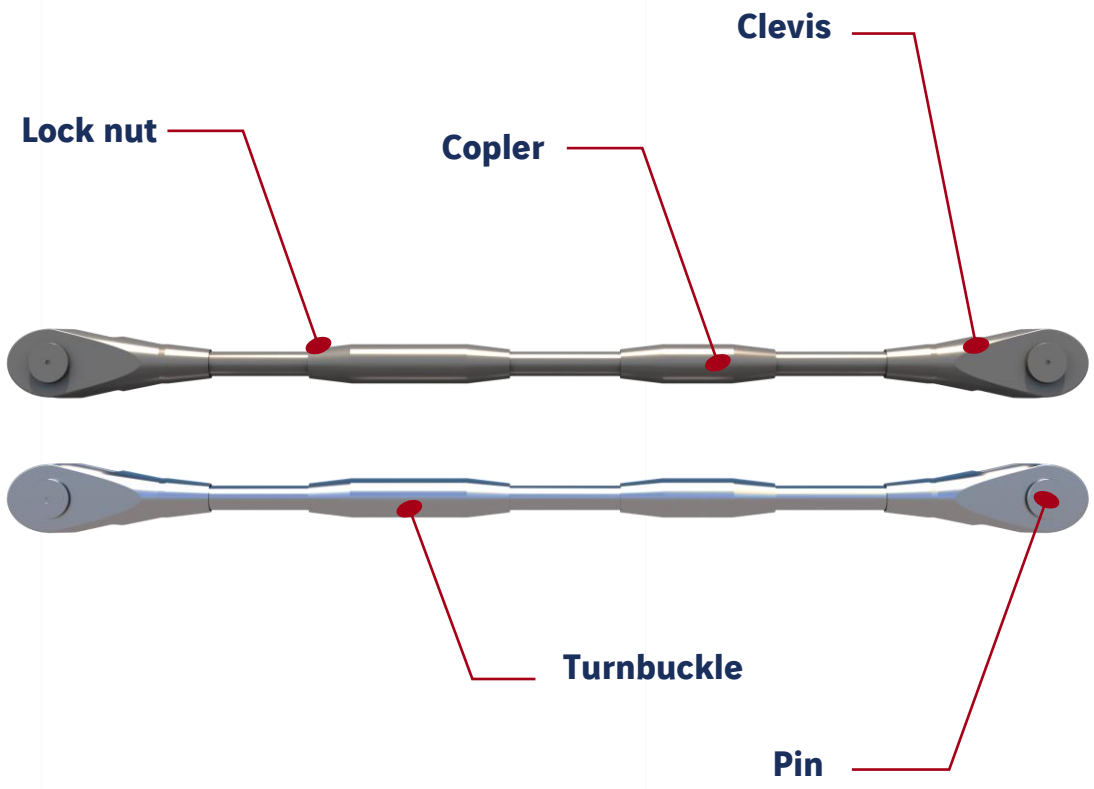
Freyssinet Technology

Freyssinet provides sleek architectural tension rod systems



Freyssinet Technology



Load transfer

- Designed for bar grade up to 700 Mpa, tested as per EN 10138
- **Connecting parts** designed according to EN 1991-1-8
- **Optional out of plane deviation angle** capacity up to 80 mrad

Sustainable

- Corrosion protection by epoxy paint, galvanization or stainless steel C3 minimum according to ISO12944-2.
- Threads uncoated or cold galvanized < 30 µm seals at completion with protective filler
- **Optional painting** RAL code selection

Endurance

- Successful Fatigue test as per latest **EN1993-1-11** and **PTI DC45.1-12**
- Improved durability following exposure Class 4
- $\Delta\sigma c$=105 MPa stress range

Installation

- **Coplers** to extend H-Rod length
- Up to +/-100 mm setting pin to pin length for large diameter over M24
- Installation without tension subject to specific construction stages on falsework
- **Optional stroke** length on **turnbuckle** for adjustment up to +/-20 mm after loading

Maintenance

- Active & reversible seal solution for thread protection
- Possible **weighing operations** with Freyssinet equipment
- Possible adjustment up to +/-20 mm after loading

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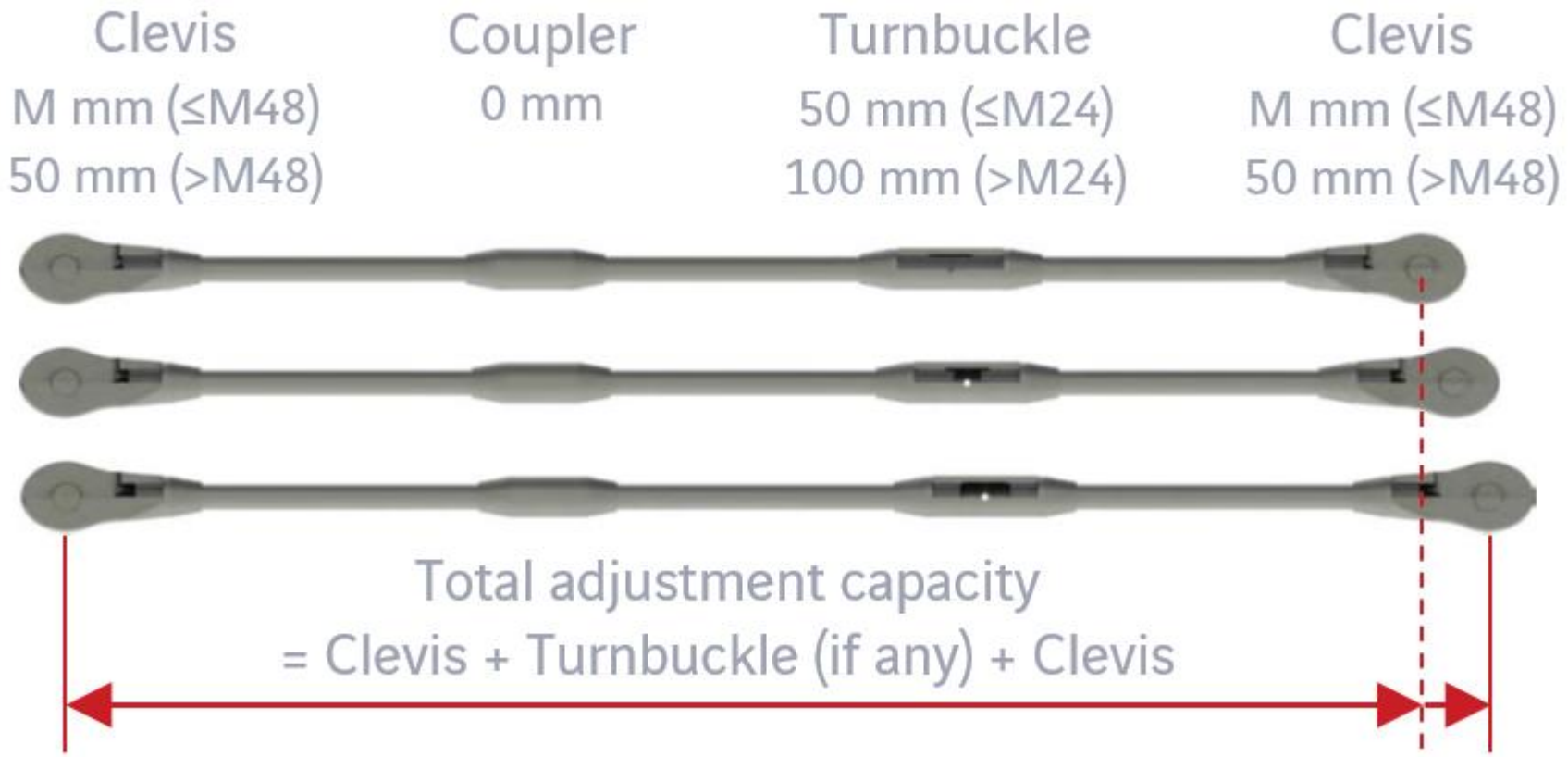
		Carbon steel		Stainless steel
		S520	S700	SS460
Yield strength	N/mm²	520	700	460
Ultimate strength	N/mm²	670	900	650
Bar Elongation at break acc. EN10138-4	%	17	15	25
Resilience	KV (J)	27 at -20°C	27 at 0°C	100 at 20°C
Avalaible diameters	mm	M16 to M133	M16 to M133	M16 to M98

Freyssinet Technology



Up to +/-100 mm adjustment capacity

- Turnbuckle + Clevis Up to 100 mm => For possible pin to pin length setting before installation
- Turnbuckle up to +/-20 mm => For possible adjustment after H-Rod loading

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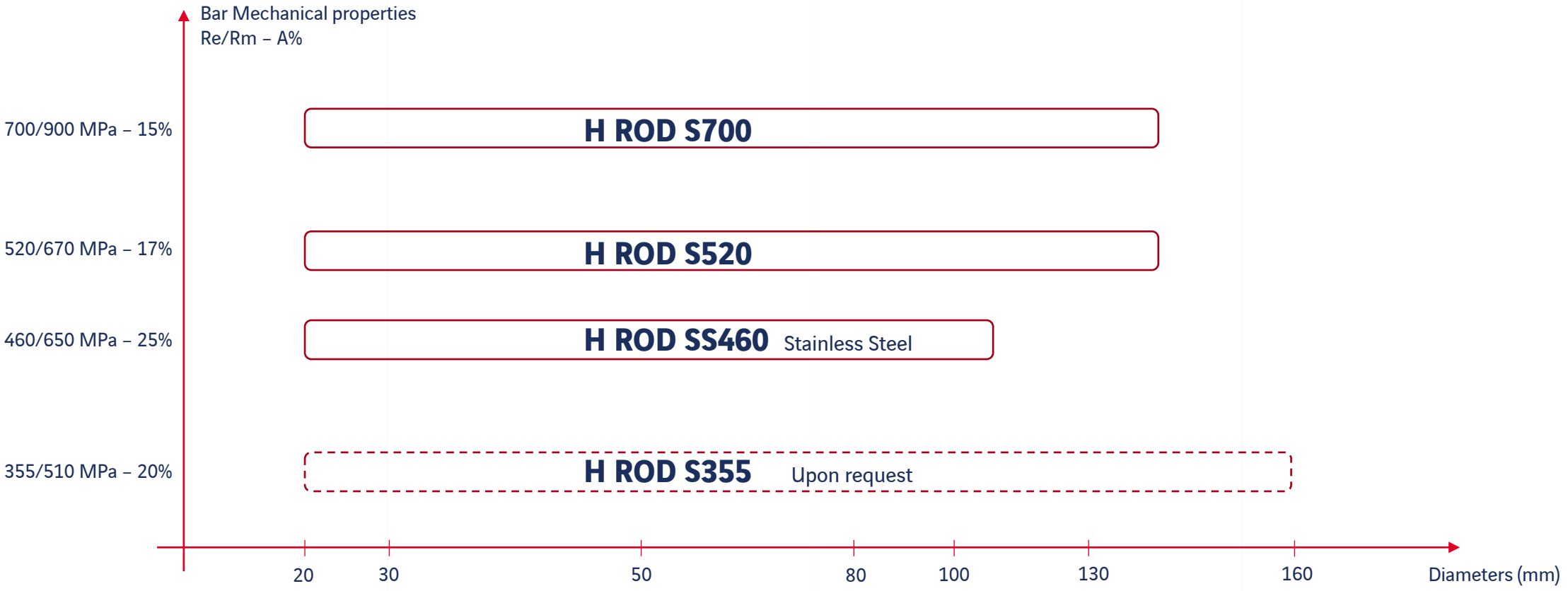
H-Rod Range



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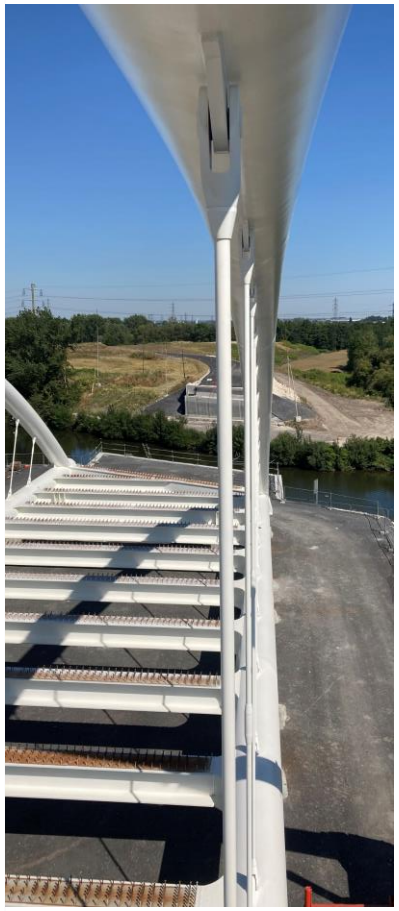
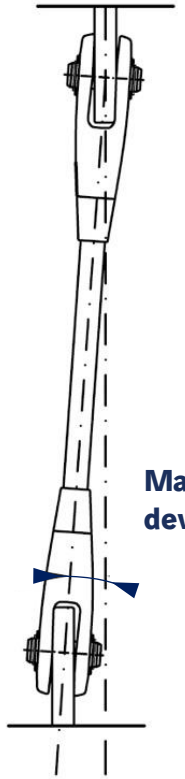
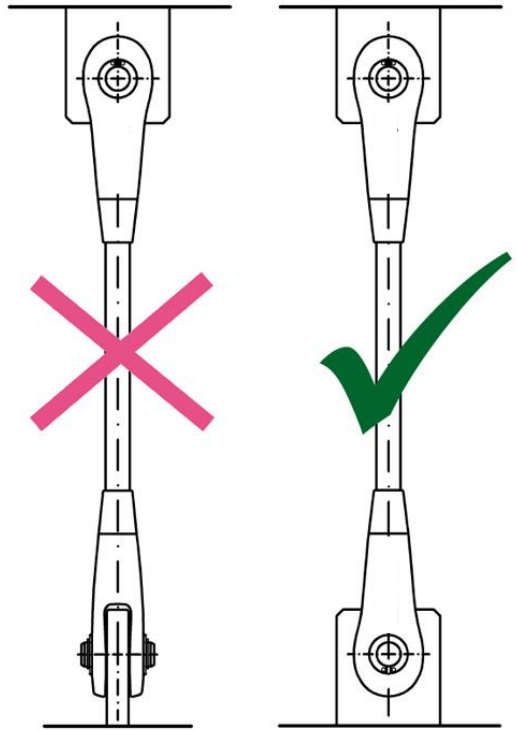
H-Rod Standard





Max out of plane deviation 10 mrad



H-Rod Rotule

Max out of plane deviation 80 mrad

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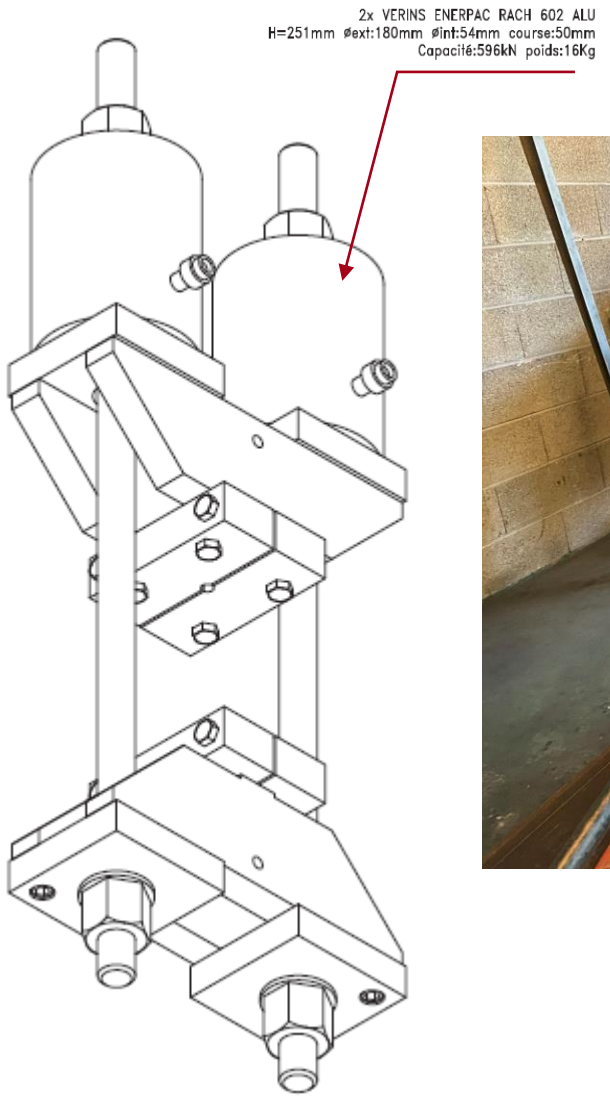
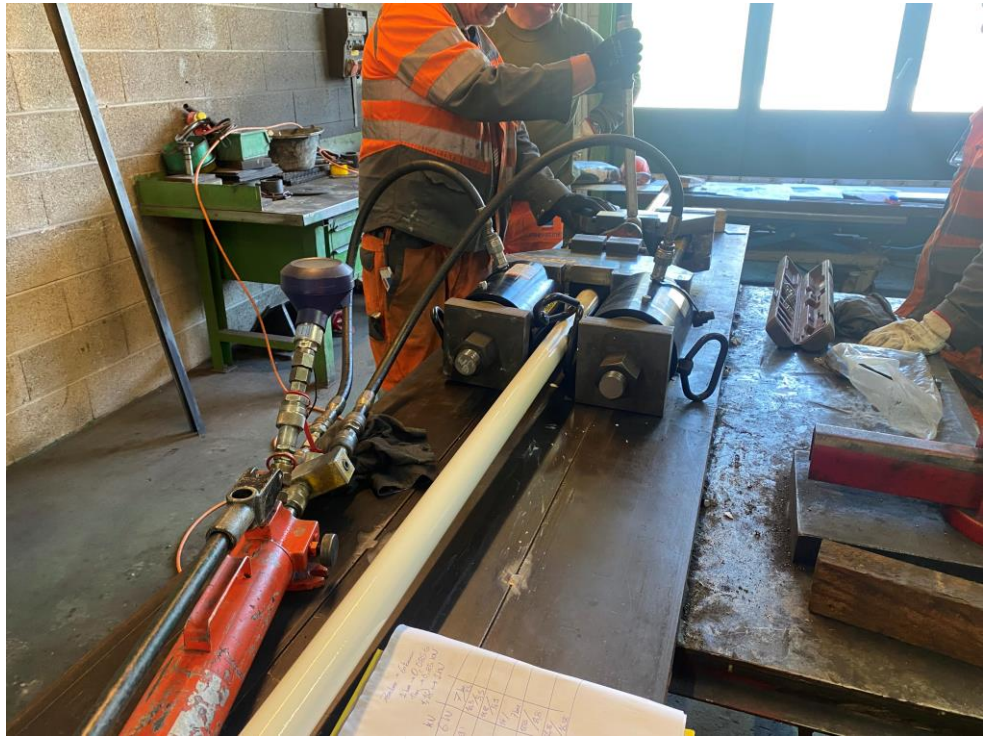
H-Rod Tension Control & Adjustment tool

Lock nuts open for by-pass tooling installation

Note: lock nuts are not sliding on smooth part



3D Rendering By Pass tool For H-Rod



Control & adjustment tool trial installation

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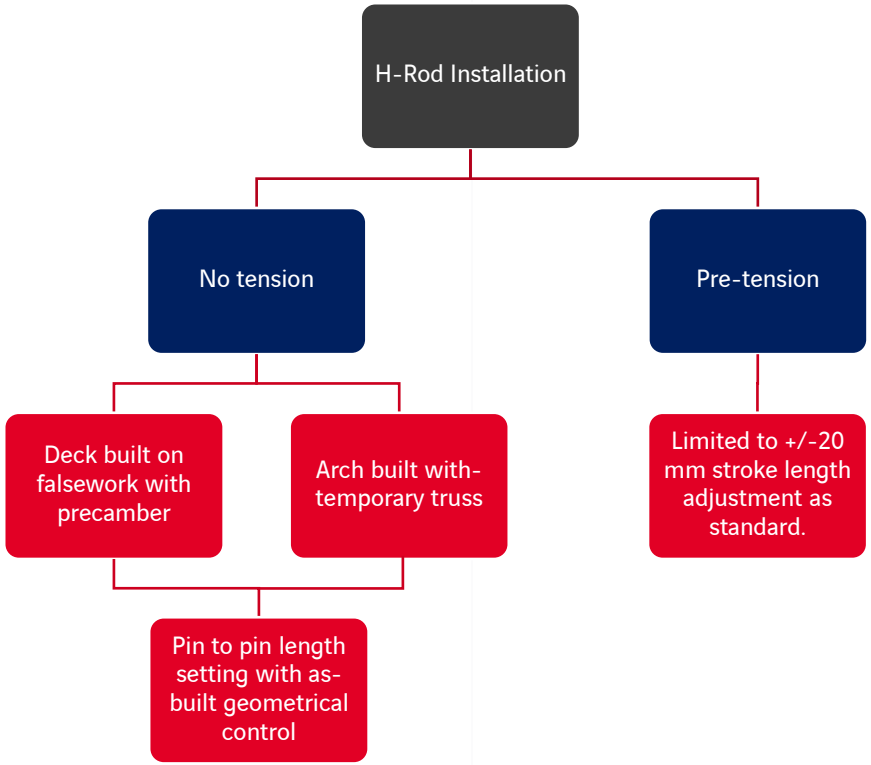
H-Rod Installation – Possible construction sequences



Note: +/-100 mm adjustement available on pin to pin length to cope with potential as-built deviations

Note: +/-20 mm adjustement available on turnbuckle to cope with potential deck loading deviations or deck pre-camber deviations

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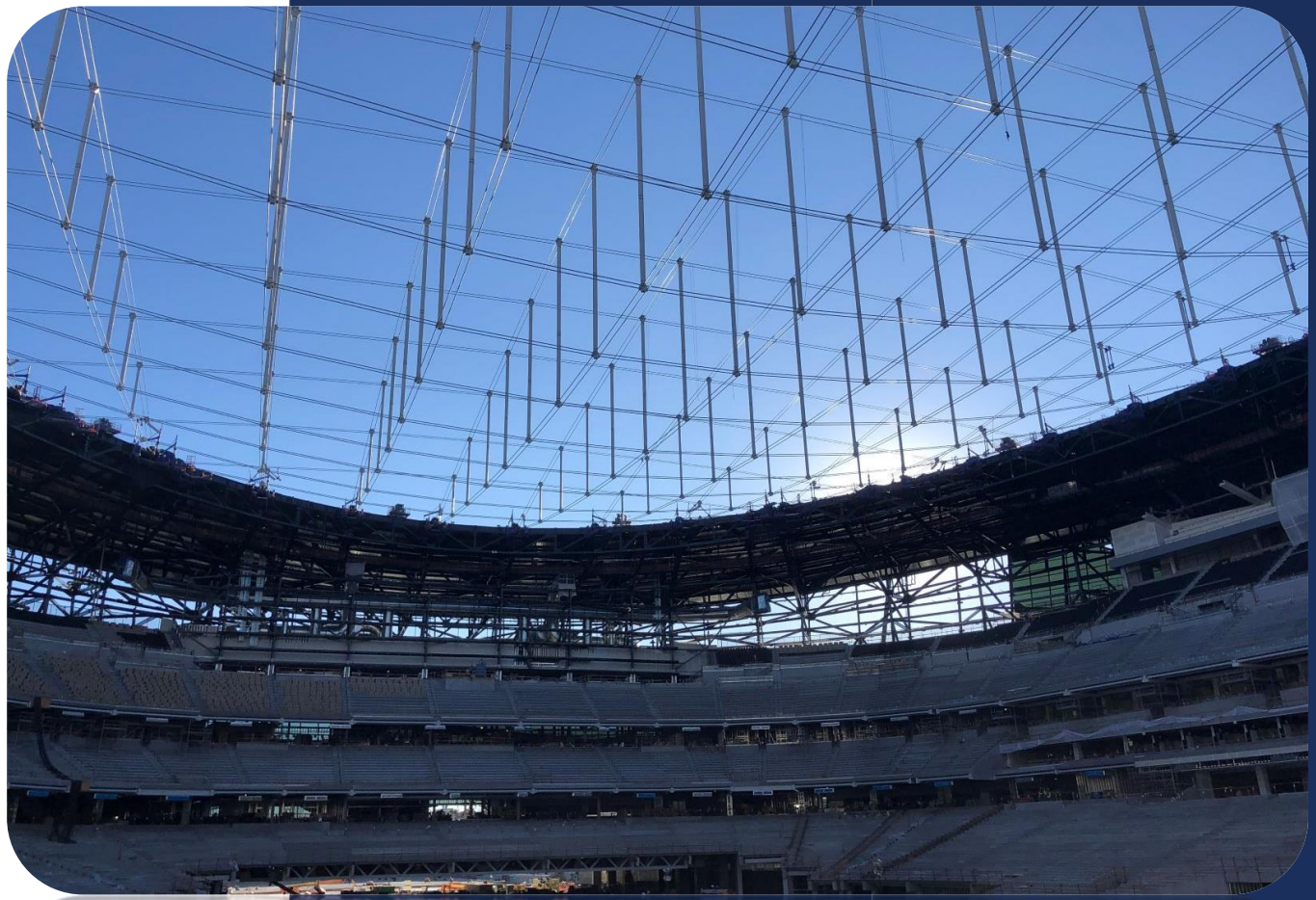
PART 3

Applications

Versatile

- Whether it be truss systems, back-braced façades, suspensions or cross bracings' the diversity of applications of H-Rod system provide a high-quality solution for virtually any application.



Sustainable technology

Applications

Our architectural rods are an attractive, high quality, high strength, low maintenance alternative for light structures.

- It can be used in a variety of structural and decorative applications.

Applications

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TYPE OF PROJECTS

SUSPENDED ROOF

ARCH BRIDGES

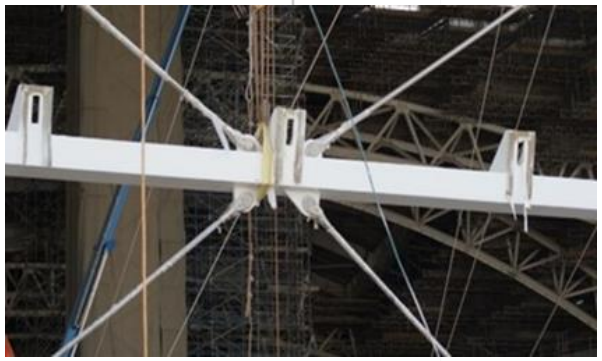
FACADES

SUSPENSION FOOTBRIDGE

Applications

FREYSSINET

TYPE OF INTEGRATION



CROSS BRACING

STABILIZERS

SUSPENSION

TRUSS STIFFENING ELEMENTS

Applications

- **10 years of experience with different integrations**
- **More than 1500 tons of H-Rod installed.**

Projects	Countries	Business Unit	Year	Products
PUENTE SOBRE EL RIO SAJA	ESPAGNE	FREYSSINET S.A. ESPAGNE	2011	HRod+ M80
JEMEPPES	BELGIQUE	FREYSSINET BELGIUM S.A.	2012	M80 Bars SS460
VENDENHEIM	FRANCE	FREYSSINET FRANCE SCCM	2012	S355M130 M140
FOOT OVER BRIDGE	INDE	FREYSSINET MENARD INDIA PVT LTD	2012	S520 M36
TWENTEKANAAL	PAYS-BAS	FREYSSINET NEDERLAND B.V.	2012	HROD + M100
BOWSTRING JEMEPPE - AUVELAIS	BELGIQUE	FREYSSINET BELGIUM S.A.	2012	SS460 M80
LGV EST - VIADUC DE VENDENHEIM	FRANCE	FREYSSINET FRANCE SCCM	2012	SS355NL D130, SS355NL D140
MUCEM - MARSEILLE	FRANCE	FREYSSINET FRANCE SCCM	2012	SS460 M24, SS460 M33, SS460 M39, SS460 M48
PASSERELLE DE DECINES	FRANCE	FREYSSINET FRANCE SCCM	2012	S520 M48, HRod+ M48
FOB 1 & 2 - NEW DEHLI	INDE	FREYSSINET MENARD INDIA PVT LTD	2012	S520 M36
LAWAS BRIDGE - JAKARTA-SEDAYU	INDONÉSIE	FREYSSINET INTERNATIONAL & CIE	2012	SS460 M56
TALUMOLO BRIDGE - GORONTALO	INDONÉSIE	FREYSSINET INTERNATIONAL & CIE	2012	S520 M56
BOOGBRUG TWENTEKANAAL ZUTPHEN-EEFDE	PAYS-BAS	FREYSSINET NEDERLAND B.V.	2012	HRod+ M100
PONT DE LAICHE	BELGIQUE	FREYSSINET BELGIUM S.A.	2013	SS460 M30
MASHHAD BRIDGE	IRAN, RÉPUBLIQUE ISLAMIQUE D'	FREYSSINET INTERNATIONAL & CIE	2013	S520 M90
CNM BOWSTRING - MONTPELLIER	FRANCE	FREYSSINET FRANCE SCCM	2015	SS355NL D175
SANJENTHON BRIDGE	INDE	FREYSSINET MENARD INDIA PVT LTD	2015	SS460 M76
BTZ -CLOUAGE SUR CULEES	ALGÉRIE	FIC TRAVAUX EXPORT	2016	HRod+ M56, HRod+ M76
PONT SUR LAVAPESSON	SUISSE	FREYSSINET S.A. SUISSE	2016	M48
MCW	INDE	FREYSSINET MENARD INDIA PVT LTD	2017	S520 M36, S520 M48
Pont sur le Flon	SUISSE	FREYSSINET S.A. SUISSE	2017	HRod+ M36
PUENTE SANTA ROSA ET PUENTE VIRU VIRU	PÉROU	FREYSSINET-TIERRA ARMADA S.A.	2021	S520 M42

Applications

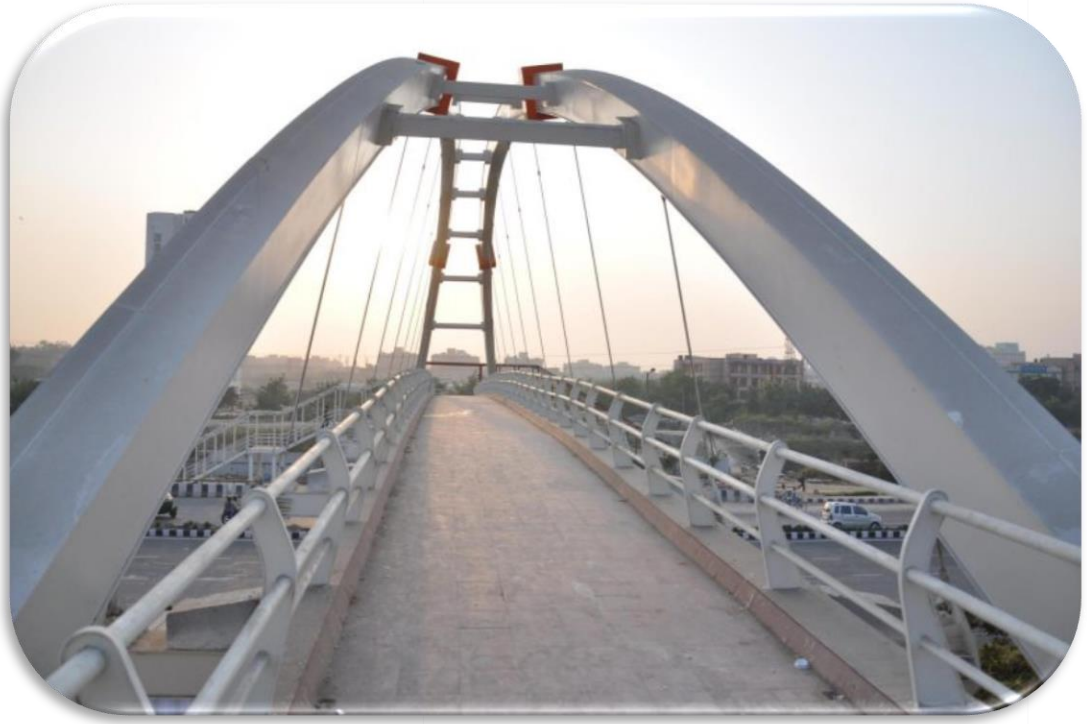
Nelson Mandela Footbridge, Décines-France

(HRod-S520 M48, HRod+ M48)

Applications

Mucem Museum, Marseille-France
(HRod-SS460 M24, SS460 M33, SS460 M39, SS460 M48)

Applications



Bowstring de Vendenheim-France
(HRod-SS355NL Φ130, SS355NL Φ140)

Applications

Imam Reza Stadium, Mashhad-Iran
(HRod-S520 M90)

Applications

Bowstring, Montpellier-France
(HRod - SS355NL Φ175)

PART 4

Our Expertise

Full value chain service

- We accompany our clients from design to implementation and maintenance services
- We take on your toughest challenge, while considering the most stringent durability criteria.

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Our expertise

- Quality and quality assurance are the foundations of our success. Successful product development, process reliability, continuous monitoring, R&D commitment coupled with an experienced team guarantee the high-quality standard of our products.
- H-Rod system **controlled and fatigue** tested

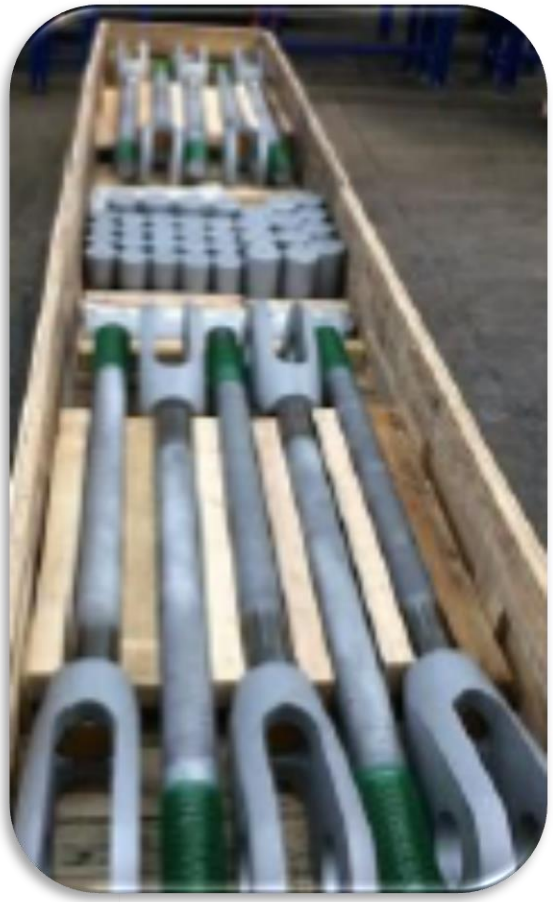
Our expertise

- Material **selection** and **control** in-house.
- **Extensive in-house production control**
- **High level** of corrosion protection

Corrosivity Categories to DIN EN ISO 12944

Corrosion class	Corrosivity	Durability (class)	Durability (years)*	Salt spray test in hours (h)	Examples of typical environments
C1 very low	very low less agressive interior	low	2 to 5 Years	-	Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels
		moderate	5 to 15 Years	-	
		high	more than 15 Years	-	
C2 low	low less agressive exterior/interior	low	2 to 5 Years	-	Unheated buildings where condensation may occur e.g. depots, sports halls
		moderate	5 to 15 Years	-	
		high	more than 15 Years	-	
C3 moderate	moderate moderately aggressive exterior/interior	low	2 to 5 Years	120	Production rooms with high humidity and some air pollution e.g. food-processing plants, laundries, breweries, dairies
		moderate	5 to 15 Years	240	
		high	more than 15 Years	480	
C4 high	high moderately aggressive exterior/interior	low	2 to 5 Years	240	Chemical plants, swimming pools, coastal, ship and boatyards
		moderate	5 to 15 Years	480	
		high	more than 15 Years	720	
C5-I very high (industrial)	high agressive exterior/interior	low	2 to 5 Years	480	Buildings or areas with almost permanent condensation and high pollution
		moderate	5 to 15 Years	720	
		high	more than 15 Years	1440	
C5-M very high (marine)	very high marine exterior/interior	low	2 to 5 Years	480	Buildings or areas with almost permanent condensation and high pollution
		moderate	5 to 15 Years	720	
		high	more than 15 Years	1440	

*Durability is no „warranty period"



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Thank you for your attention

Your Technical Support

Miklos Toth

Vincent Maillet

10/10/2022