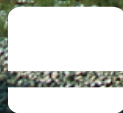


■ H 1000 Stay
Cable System



FREYSSINET

H1000 Stay Cable System

Freyssinet H1000 stay cable is a parallel strand system for use in light structures. Applications include stay cables and hangers for footbridges, arch bridges, suspended roofs and other cable structures. The H1000 colored cable sheath provides a slender cable that meets the expectations of architects for light structures while the parallel strand technology ensures an unmatched durability, making H1000 a sustainable technology.

H1000 Technology

The cable main tensile element consists of a bundle of seven wire strands that can have a service load up to 265 tons. The H1000 is based on each strand being fully independent. It has the following characteristics:

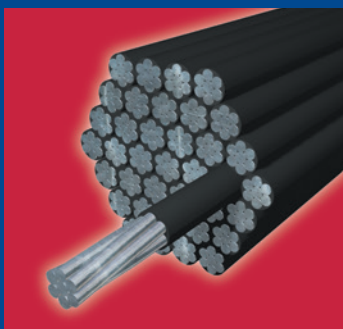
- Each strand is individually anchored by jaws or swages in a steel anchorage block,
- Each strand is individually protected against corrosion by two redundant corrosion barriers,
- The strand bundle is protected by a colored polyethylene outer duct,
- The anchorages can be equipped with fork terminals.

H1000 stay cable system benefits from Freyssinet's 30 year experience in stay cables, and conforms to fib, PTI and CIP recommendations.



Parallel strand technology advantages

- **Modularity:** The number of strands is adjusted to the force in the cable
- **Redundancy:** Each strand is individually protected and anchored, which provides a high level of safety
- **Durability:** The double nested corrosion protection barrier over the complete cable including anchorages and the outstanding fatigue performance provide an unmatched durability
- **No long term effect:** No loss in cable force, no cable elongation after initial tensioning
- **Standard components:** Each cable is assembled on site out of standard components, for a quicker delivery and eliminating risk of unexpected delay due to cable damage during transportation or installation.



Freyssinet Monostrand

The main tensile element consists of a bundle of individually protected parallel seven-wire T15.7 strands. This patented strand, the Freyssinet 'Monostrand', has outstanding durability both mechanically and against ageing. The strand has a double corrosion protection barrier formed by hot dip galvanisation of the individual wires of the strand before the final drawing and a polyethylene sheath extruded around the strand. The interstices between the wires and the sheath are filled with petroleum wax.



Freyssinet H1000 Anchorage

The H1000 range includes five cable sizes for 1, 4, 7, 12, and 19 strands. Several H1000 anchorage configurations are available to cover the needs of the connection to the structures.

An outstanding fatigue behaviour

Passive anchorage use swages specially designed for a high fatigue resistance. Active anchorages use Freyssinet stay cable fatigue wedges. Both comply with international recommendations regarding fatigue design and have passed fatigue tests specified by CIP, fib and PTI: 2 million cycles with an amplitude of 200 Mpa, 45% GUTS as the maximum stress and a 10 mrad angular deviation. Thus the anchorage has a fatigue resistance that is exceptional.



FPH anchorage

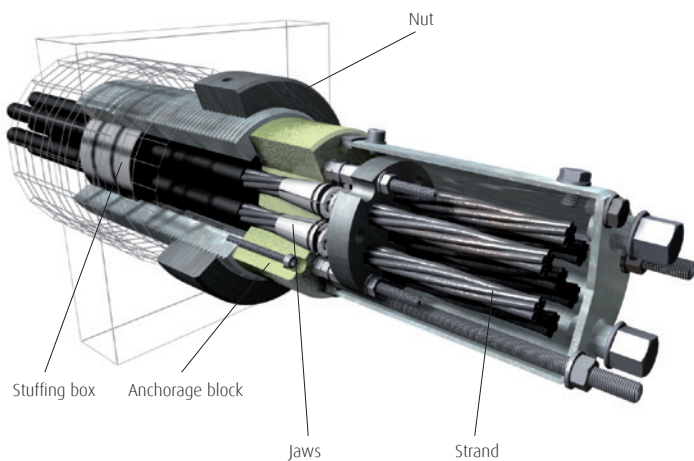


H1000 swages

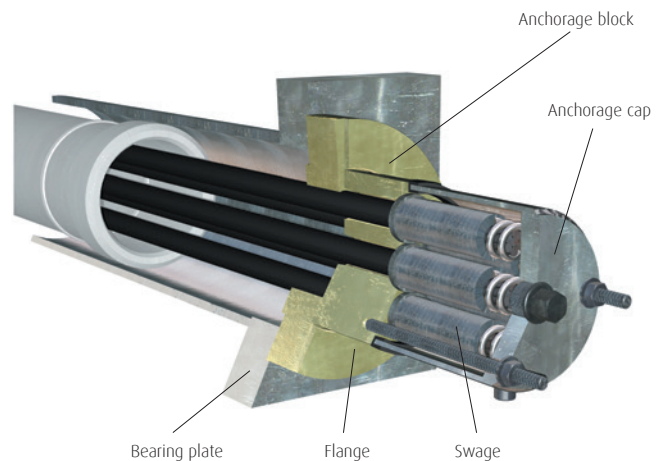
Anchorage options

The H1000 system is fitted with an adjustable lower anchorage and fixed upper anchorage. At both ends, a fork anchorage or a cylindrical anchorage can be used. Lower anchorages can be prefabricated using swages with tensioning applied to the whole cable or partially prefabricated using jaws for monostrand tensioning (Isotension method). Where jaws are used the anchorage is sealed with the patented Freyssinet stuffing box. With swages, individual sealing devices are installed on each strand. In both cases, the anchorage is completely waterproofed by a double protecting barrier. Cable force adjustment is provided by a threaded anchorage and a nut.

Lower partially prefabricated anchorage (RAB type)



Upper fixed anchorage (FPH type)





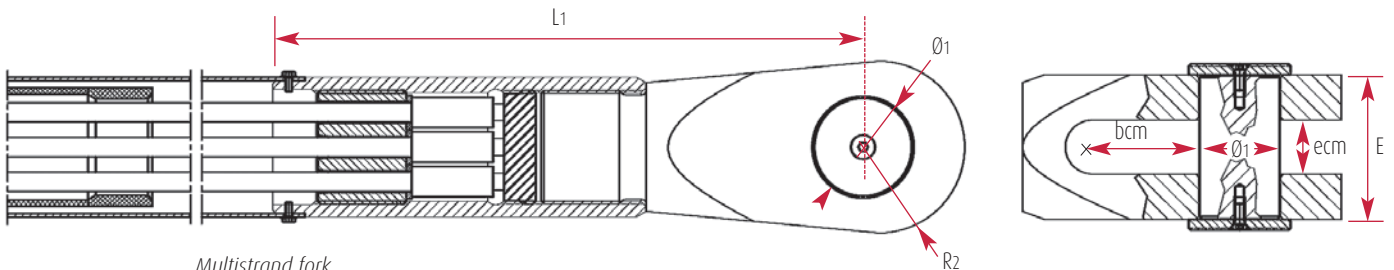
Upper Anchorage

Upper fork anchorage (fixed fork)

The strands in this anchorage are anchored by swages in a block screwed to a fork fixing. The latter, made of machined steel, is hinged to the structure with a pin.



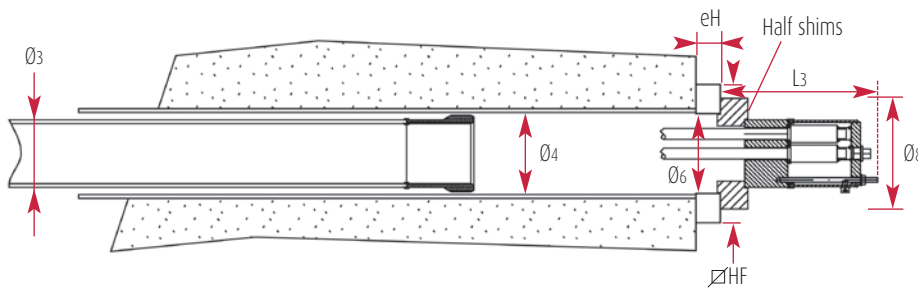
Upper monostrand fork



Multistrand fork

Upper fixed anchorage (FPH type)

The strands are anchored with swages in a block resting on a bearing plate with half shims.



FPH anchorage

Dimensions (mm) for upper and lower anchorage

Unit	Fork						
	Ø1	R2	ecm***	bcm***	L1	L2	E
1	33	40	30	38	222	490	80
4	60	60	40	70	470	700	120
7	75	80	50	100	555	815	140
12	105	110	70	120	645	915	195
19	127	140	80	170	810	1120	240

Unit	Duct Ø3*	Formwork tube		eH*	Bearing plate				General Dimensions						
		Upper	Lower		Upper		Lower		Upper		Lower				
		Ø4 Min. internal	Ø5 Min. internal		HF	Ø6	HR	Ø7 RAB RPB		Ø8	L3	Ø9	L4	Ø10	L5
4	90	120	146	40	210	100	230	132	122	150	265	150	350	160	315
7	110	127	181	40	230	120	260	155	142	180	285	185	365	200	330
12	140	181	206	45	340	165	300	192	182	270	310	225	230	235	350
19	160	206	260	50	400	200	350	230	217	325	345	275	415	285	375

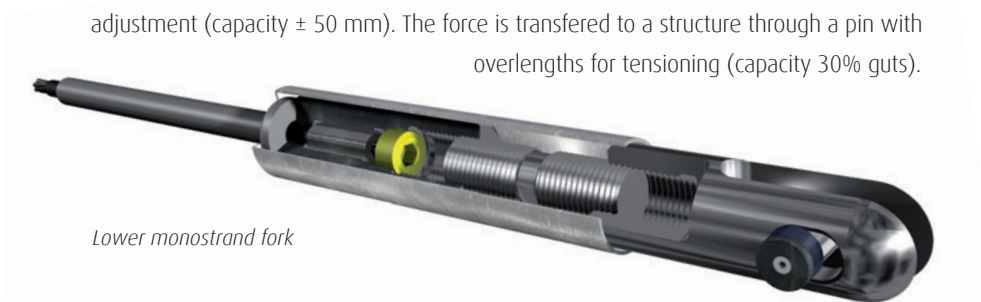
(Ø = diameter, R = radius). *dimensions given for information for a work in concrete, with T28 days ≥ 40 MPa steel S355. To be confirmed by designer.
option : compact duct on request. *maximum allowed dimensions (including tolerance).



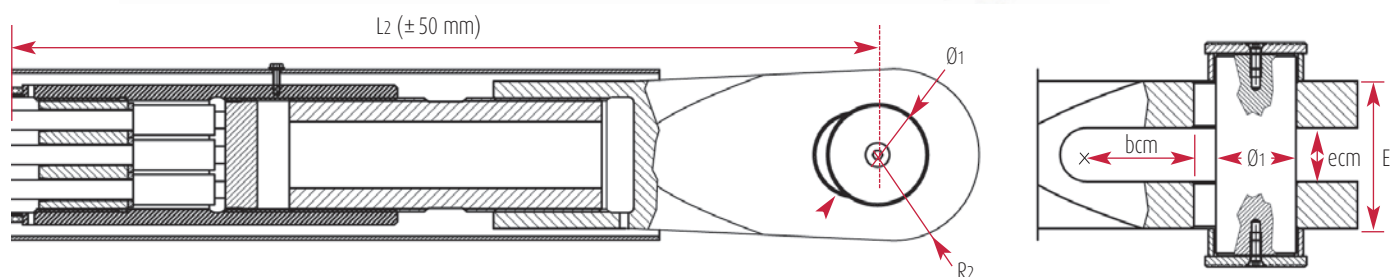
Lower Anchorage

Lower fork anchorage (adjustable fork)

The cable is fully prefabricated. The strands are anchored with swages in a block screwed to a fork creating an articulated connection. This machined steel fork has a turnbuckle for adjustment (capacity ± 50 mm). The force is transferred to a structure through a pin with overlengths for tensioning (capacity 30% guts).

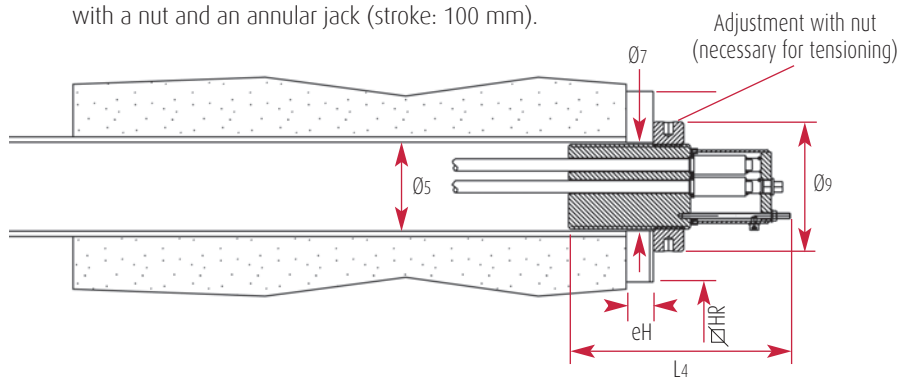


Lower monostrand fork



Lower prefabricated anchorage (RPB type)

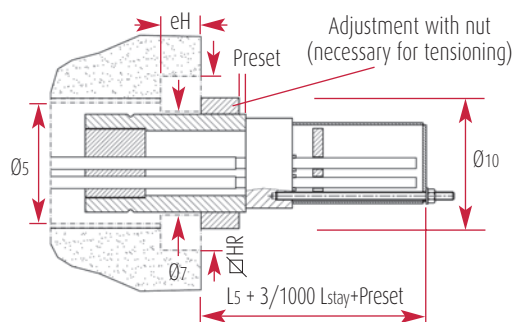
The cable is fully prefabricated with both anchorages. The strands are anchored with swages in a block. This block is threaded to allow the cable tensioning and adjustment with a nut and an annular jack (stroke: 100 mm).



RPB anchorage

Lower partially prefabricated anchorage (RAB type)

The cable is partially prefabricated with the upper anchorage only. The strands are anchored at the deck with conical jaws in an anchorage fitted with a stuffing box.



The cable is tensioned strand by strand using the Isotension system. The anchorage bears on the structure by means of a nut for further cable adjustment (stroke: 100 mm).



Adjustable fork



Outer pipe

An outer high density polyethylene pipe protects the bundle of strands improving the cable aesthetics. The pipe is bi-extruded with an outer coloured layer and is specially formulated for a high durability in sunlight: 50 to 100 years, depending on localisation, supported by labortary testing.

A wide range of colours is available (*non-contractual colour chart, non-exhaustive list*)



Colored duct

Installation

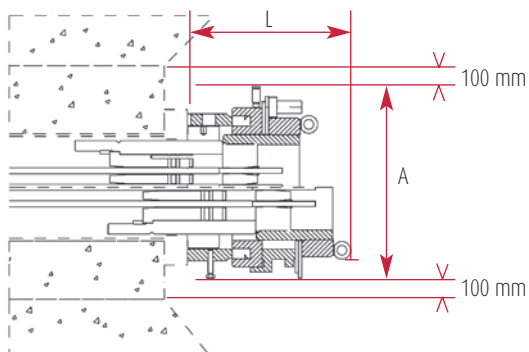
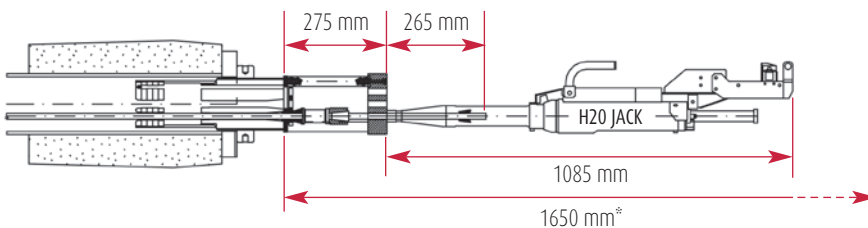
Prefabrication (in factory or on site)

- cutting strands to length,
- welding outer sheaths
- swage threading on strands in the upper anchorage, and possibly the lower one,
- fork installation.

Erection

- hoisting and attaching the upper anchorage to the structure,
- inserting the cable or the lower anchorage in the structure,
- tensioning.

Isotension - jack dimensions



Anular jacks for cable force adjustment Dimensions (mm)

Unit	A	L
4	370	300
7	370	300
12	470	360
19	470	360



Forks installation

*This length is necessary to use the jack, it can be accommodated if requested.

Some references

- 1/ Doomul (Korea) 2004
- 2/ Sarvar Bridge (Hungary) 2004
- 3/ Cairo Airport (Egypt) 2004



1



2



3



4



5



6



7



8



9

- 4/ Kanne Bridge (Belgium) 2005
- 5/ Mateille (France) 2008
- 6/ Astana (Kazakhstan) 2006
- 7/ Minsk Stadium (Bielorussia) 2007
- 8/ Macintosh Island Bridge (Australia) 2007
- 9/ Illarsaz (Switzerland) 2005



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