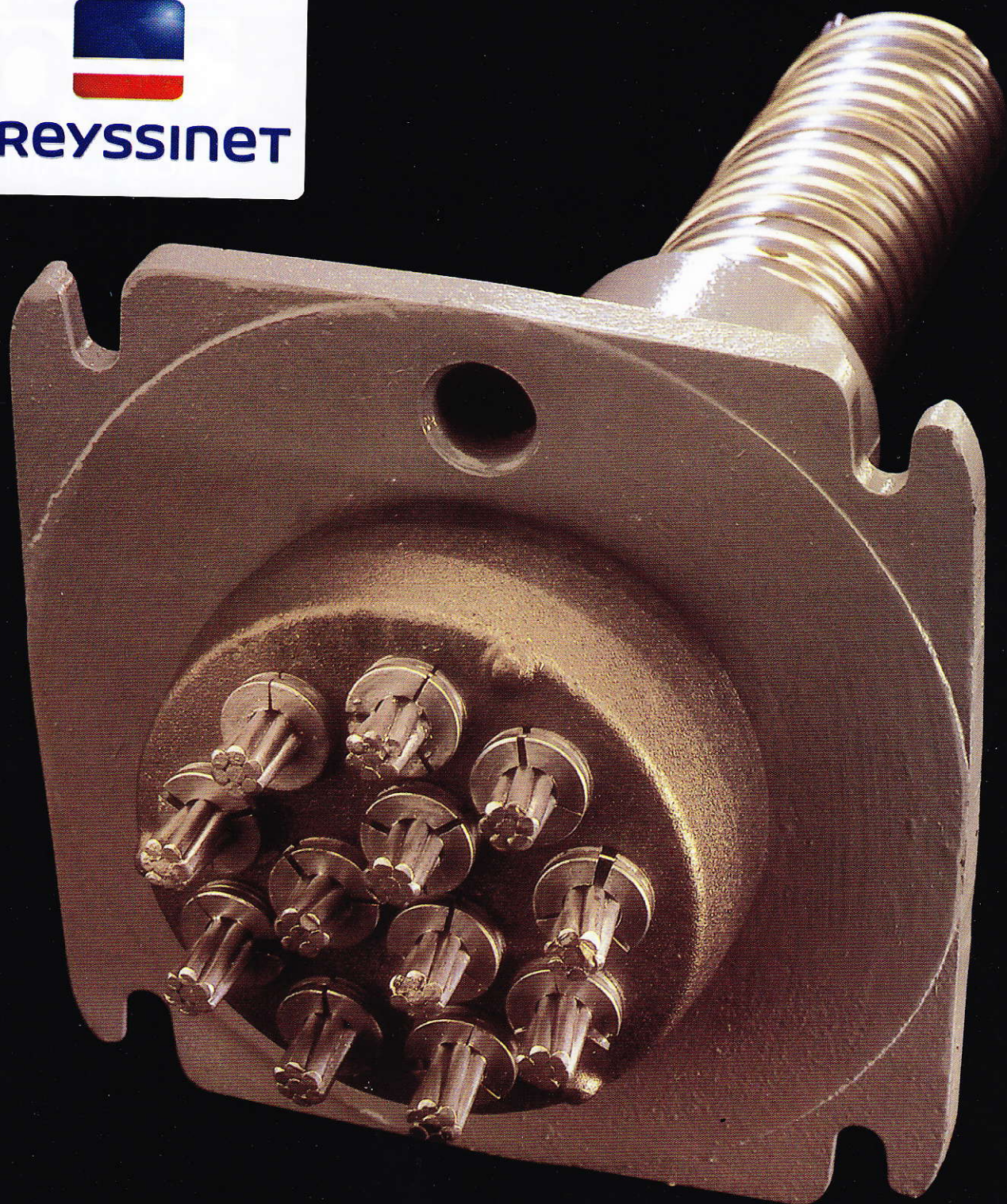


K

range



FREYSSINET

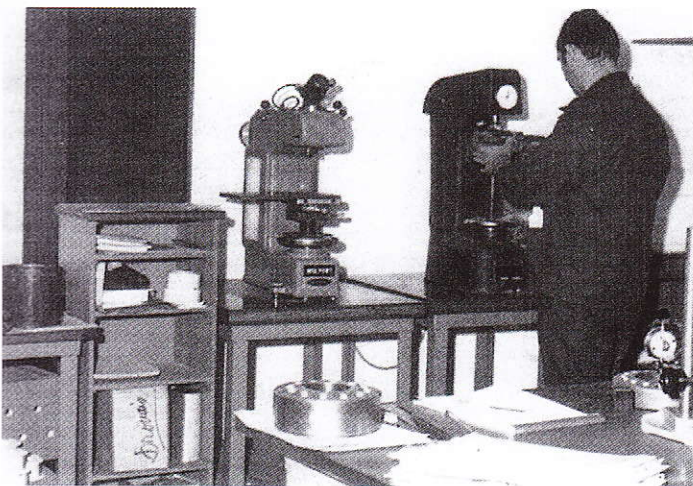
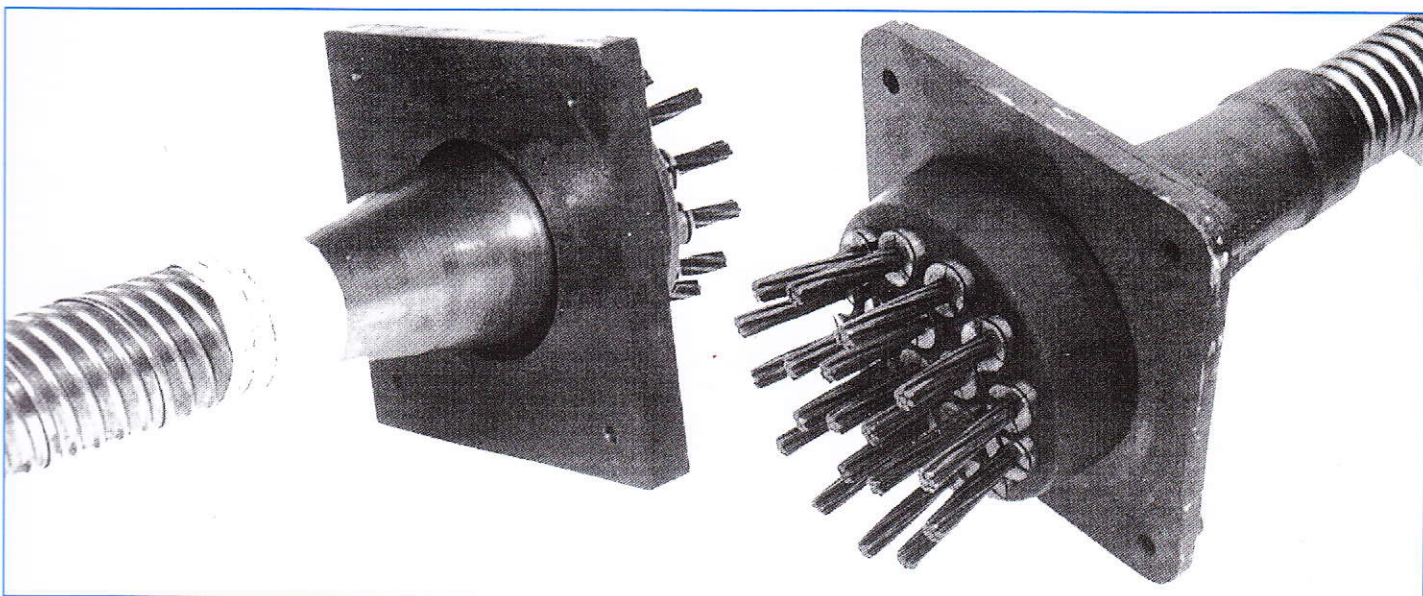


the K system

The Monogroup system was developed as early as 1968 by the FREYSSINET INTERNATIONAL Organization. The K Range described in this brochure comprises the most recent improvements made to this type of anchorage system to satisfy the most demanding standards. It allows a very great variety of prestressing forces over a range up to 10,200 kN at breaking load.

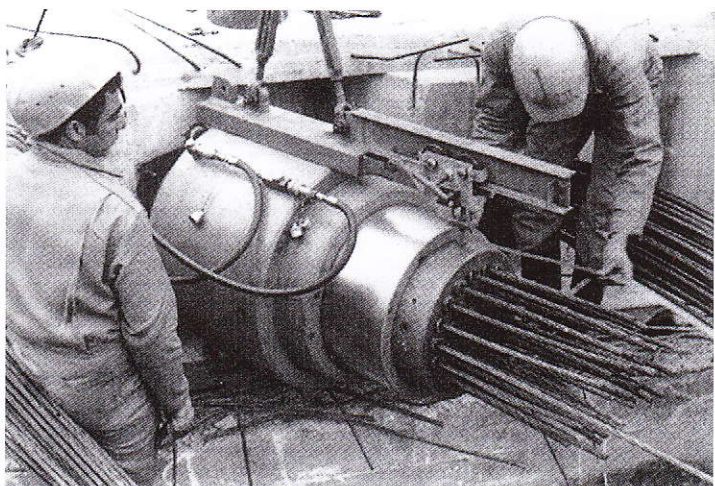
The Monogroup K system combines the method of anchoring by individual jaws that has been proved reliable by experiments on the single strands, with the technique of simultaneous tensioning.

This combination offers the design engineer the advantage of being able to select a number of compact tendons of great or of low strength. These tendons can be tensioned in one operation and are suitable for all prestressed structures, for example, nuclear reactor containment vessels for which very big tendons are needed, or building floor slabs or thin walls that only require units of low force.



The work of quality control that FREYSSINET carries out at all stages of manufacture of anchorages meets the most severe specifications, particularly those of the nuclear, offshore, liquified gas and other industries.

FREYSSINET INTERNATIONAL has also developed design and site quality assurance procedures in conformity with the requirements of all the major international control authorities and committees.



FREYSSINET INTERNATIONAL carried out in its testing center and in official laboratories, a program of exhaustive tests in order to demonstrate the conformity of all the 'K' range anchorages with the specifications laid down in the principal national standards such as French regulations for approval of prestressing processes, British Standards BS 4447, A.C.I. code 301, etc.

basic components

All anchorages are designed to the same principles, varying only in size and numbers of strands. Each consists of a malleable cast iron (or fabricated) guide incorporated in the structure which distributes the tendon force into the concrete end-block. On the guide sits the anchorage block, into which the strands are anchored by means of three-piece jaws, each locked into a tapered hole.

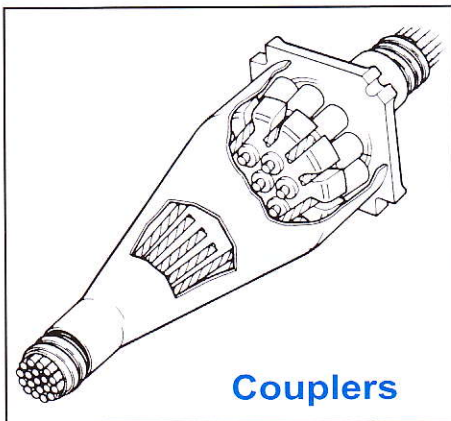
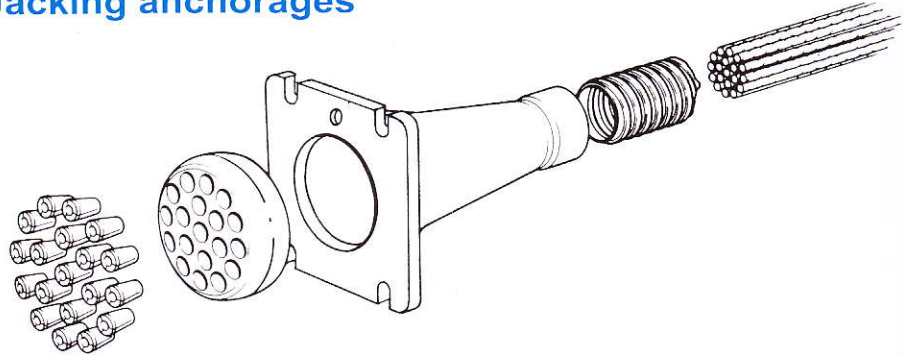
To achieve the maximum static and dynamic security in the tendon, each hole is drilled at its correct angle in relation to the tendon pattern and all kinks and unwanted deviations in tendons are avoided.

The anchorage guide is provided with an

accurate and robust method of fixing and aligning the tendon, as it is provided with substantial shutter fixing holes and, at its opposite end, a firm screw-type fixing

for the sheath. In addition it incorporates a large front-access grout injection point which, by its careful transition design, is blockage-free.

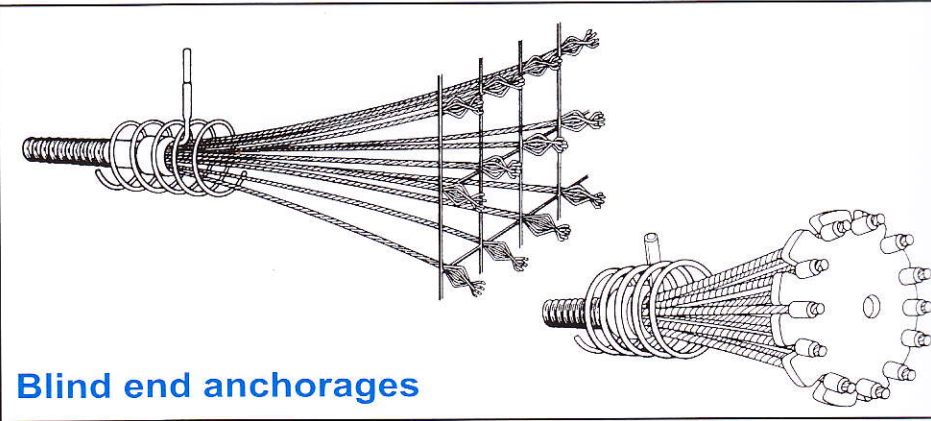
Jacking anchorages



Couplers

An economic range of couplers has been designed for simple assembly on site.

The first-stage tendon is stressed and anchored in the normal way, using standard equipment, and the dead-end of the second tendon is assembled around it, using swaged sleeves on each strand to afford maximum security. The coupler assembly is enclosed in a conical casing which has a grout access point for second stage grouting.



Blind end anchorages

The normal anchorage can be used in accessible dead-end positions, but for situations where the anchorages are to be cast into the concrete, or are inaccessible, a range of blind-end anchorages is provided.

Swaged anchorages are derived from the jacking end anchorages and are provided with swaged sleeves for positive anchorage of the strands embedded in the concrete. They are used when the prestressing force is needed immediately

behind the anchorage in inaccessible locations.

A more economical range of bonded anchorages can be used, but requires more length to develop its full prestressing force.

A compromise between the above types uses bond length and positive anchoring by swaged sleeves.

The K range jacks are centre-hole rams of the hydraulic double-acting type with fixed cylinder and moving piston.

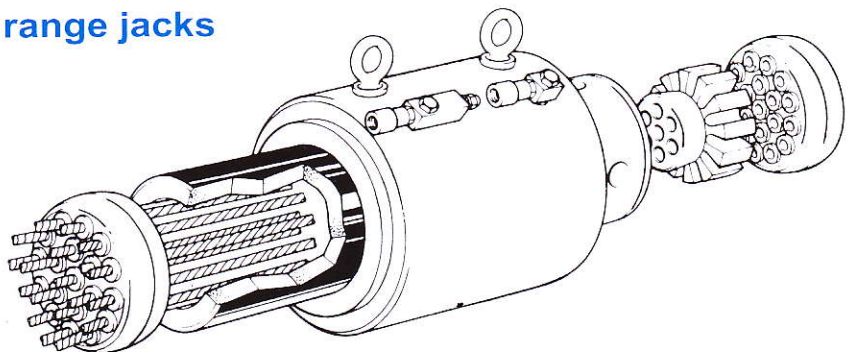
The attachment of the strand to the jack is performed by specially designed wide-angle, multi-use jaws, which are self-releasing on completion of jacking.

The system of ramming the permanent anchorages is by either a retaining plate or mechanical rubber springs which reduce the scatter of anchorage pull-in values to a minimum.

A hydraulic ramming nosepiece is alternatively available.

An automatic strand gripping and hydraulic ramming front pull model is also available.

K range jacks



steel characteristics

The introduction of Super Strand represents a significant development for the Prestressed Concrete industry. It has higher breaking load than normal Strand without sacrificing any of the other mechanical properties.

Higher strength strand means an initial saving in material costs, and fewer strands in a prestressed member result in a further saving due to lower handling costs.

Any prestressing steel, stressed and embedded in concrete losses a part of its initial tension as time goes by. This loss, known as "stress relaxation", must of course be taken into account in the design of prestressed structures. Any reduction in the amount of relaxation losses will substantially improve the efficiency of the prestressed tendons.

"Low relaxation" steels give a relaxation loss not greater than 2.5% (after 1,000 hours, at 20° C/68° F), when initially loaded at 70% of specified minimum breaking strength. Normal stress relieved steels exhibit, in comparison, losses of around 7%.

Main characteristics

STANDARD	GRADE	SIZE	NOMINAL DIA mm	NOMINAL SECTION mm ²	NOMINAL WEIGHT kg/m	SPECIFIED BREAKING LOAD		SPECIFIED LOAD AT 1% ELONGATION	
						kN	kips	kN	kips
Euronorm 138-6/79 standard	1770 MPa	1/2" - T13	12.5	93	0.730	164	36.9	139	31.3
	1860 MPa	1/2" - T13	12.5	93	0.730	173	38.9	147	33.1
	1670 MPa	0.6" - T15	15.2	139	1.090	232	52.2	197	44.3
	1770 MPa	0.6" - T15	15.2	139	1.090	246	55.3	209	47.0
Euronorm 138-6/79 super	1860 MPa	1/2" - T13	12.9	100	0.785	186	41.8	158	35.5
	1770 MPa	5/8" - T16	15.7	150	1.180	265	59.6	225	50.6
A.S.T.M. A416/80	250 kpsi	1/2" - T13	12.7	92.90	0.730	160.1	36.0	144.2	32.4
	270 kpsi	1/2" - T13	12.7	98.71	0.775	183.7	41.3	165.4	37.2
	250 kpsi	0.6" - T15	15.24	139.35	1.094	240.2	54.0	216.3	48.6
	270 kpsi	0.6" - T15	15.24	140.00	1.102	260.7	58.6	234.7	52.8

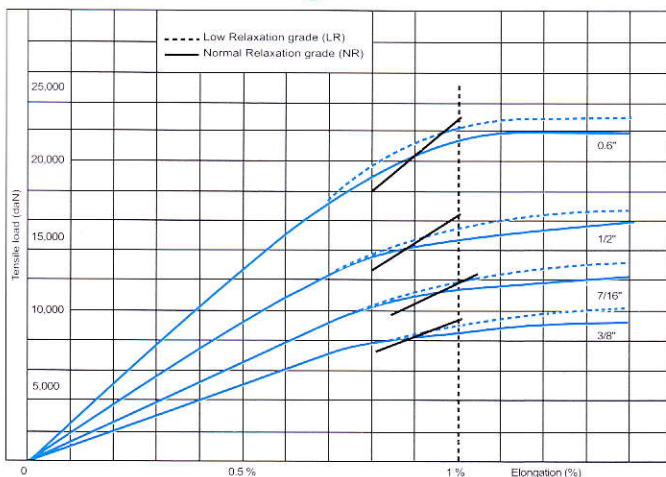
French Standard '83-14 quater fasc. 4', closely follows the Euronorm 138-6-79.

British Standard BS 5896-1980 also follows the appropriate sections of Euronorm 138-6-79.

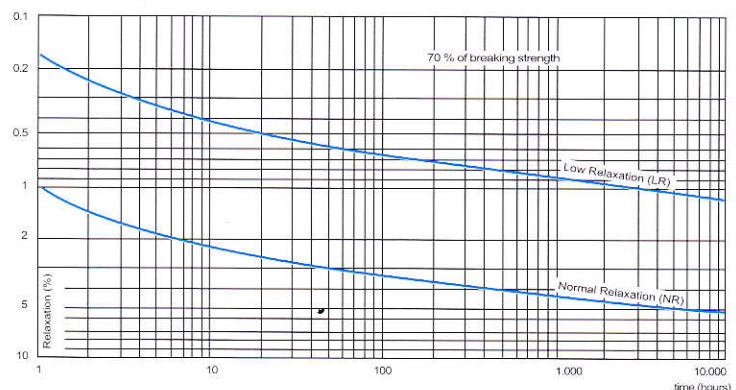
- Standard grade conforms with Euronorm Standard grade 1770 Mpa for 1/2" and Standard grade 1670 MPa for 0.6".

- Super grade conforms with Euronorm Super Grade 1860 MPa for 1/2" Super Grade 1170 MPa for 0.6".

Example of elongation curves



Example of relaxation curves



tendon forces

The K range has been designed for use with all existing grades of strand and in particular those possessing the highest performance characteristics, such as those complying with the Euronorm Super Grade.

One should of course refer to the specific manufacturer's characteristics for the type of strands specified or used for any particular structure : nominal breaking strength, cross-sectional area, relaxation, etc.

For all anchorage systems listed, individual or groups of strands may be omitted to optimise the system. However, it should be borne in mind that tendons containing the maximum number of strands possible for any particular anchorage represent the most efficient use of that anchorage.

Cable forces (kN)

STANDARD	EURONORM 138-6/79						A.S.T.M. A 416/80			
	Grade 1770		Grade 1860		Super grade 1860		Grade 250 K		Grade 270 K	
Units	100%	80%	100%	80%	100%	80%	100%	80%	100%	80%
7 K 13	1 148	918	1 211	969	1 302	1 042	1 121	897	1 286	1 029
12 K 13	1 968	1 574	2 076	1 661	2 232	1 786	1 921	1 537	2 204	1 764
19 K 13	3 116	2 493	3 287	2 630	3 534	2 827	3 042	2 434	3 490	2 792
27 K 13	4 428	3 542	4 671	3 737	5 022	4 018	4 323	3 458	4 960	3 968
37 K 13	6 068	4 854	6 401	5 121	6 882	5 506	5 924	4 739	6 797	5 438
55 K 13	9 020	7 216	9 515	7 612	10 230	8 184	8 806	7 045	10 104	8 083
	Grade 1670		Grade 1770		Super grade 1770		Grade 250 K		Grade 270 K	
4 K 15	928	742	984	787	1 060	848	865	692	1 043	834
7 K 15	1 624	1 299	1 722	1 378	1 855	1 484	1 514	1 211	1 825	1 460
12 K 15	2 784	2 227	2 952	2 362	3 180	2 544	2 596	2 077	3 128	2 502
19 K 15	4 408	3 526	4 674	3 739	5 035	4 028	4 110	3 288	4 953	3 962
27 K 15	6 264	5 011	6 642	5 314	7 155	5 724	5 840	4 672	7 039	5 631
37 K 15	8 584	6 867	9 102	7 282	9 805	7 844	8 003	6 402	9 646	7 717

Choice of jacks

UNITS	K 100	K 200	K 350	K 500	K 700	K 1000
7 K 13	**	*				
12 K 13		**	*			
19 K 13			**	*		
27 K 13				**	*	
37 K 13					**	*
55 K 13						**
4 K 15	**	*				
7 K 15		**	*			
12 K 15			**	*		
19 K 15				**	*	
27 K 15					**	*
37 K 15						**

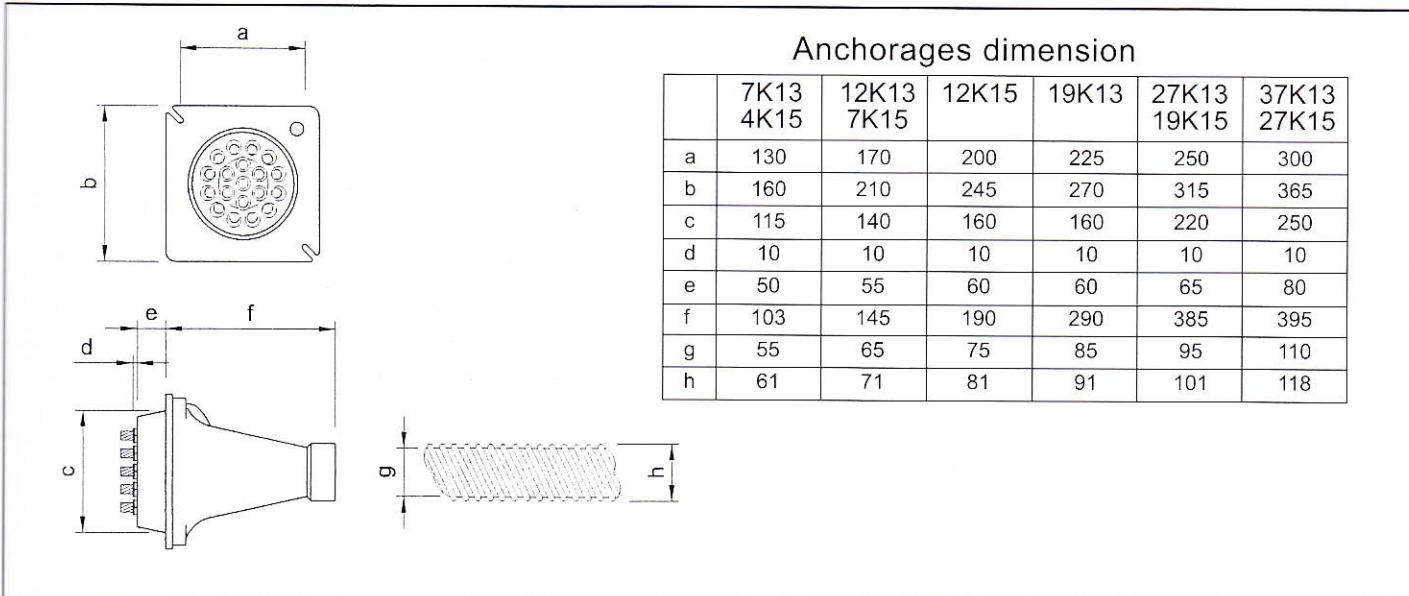
** Optimal choice

* Optional choice

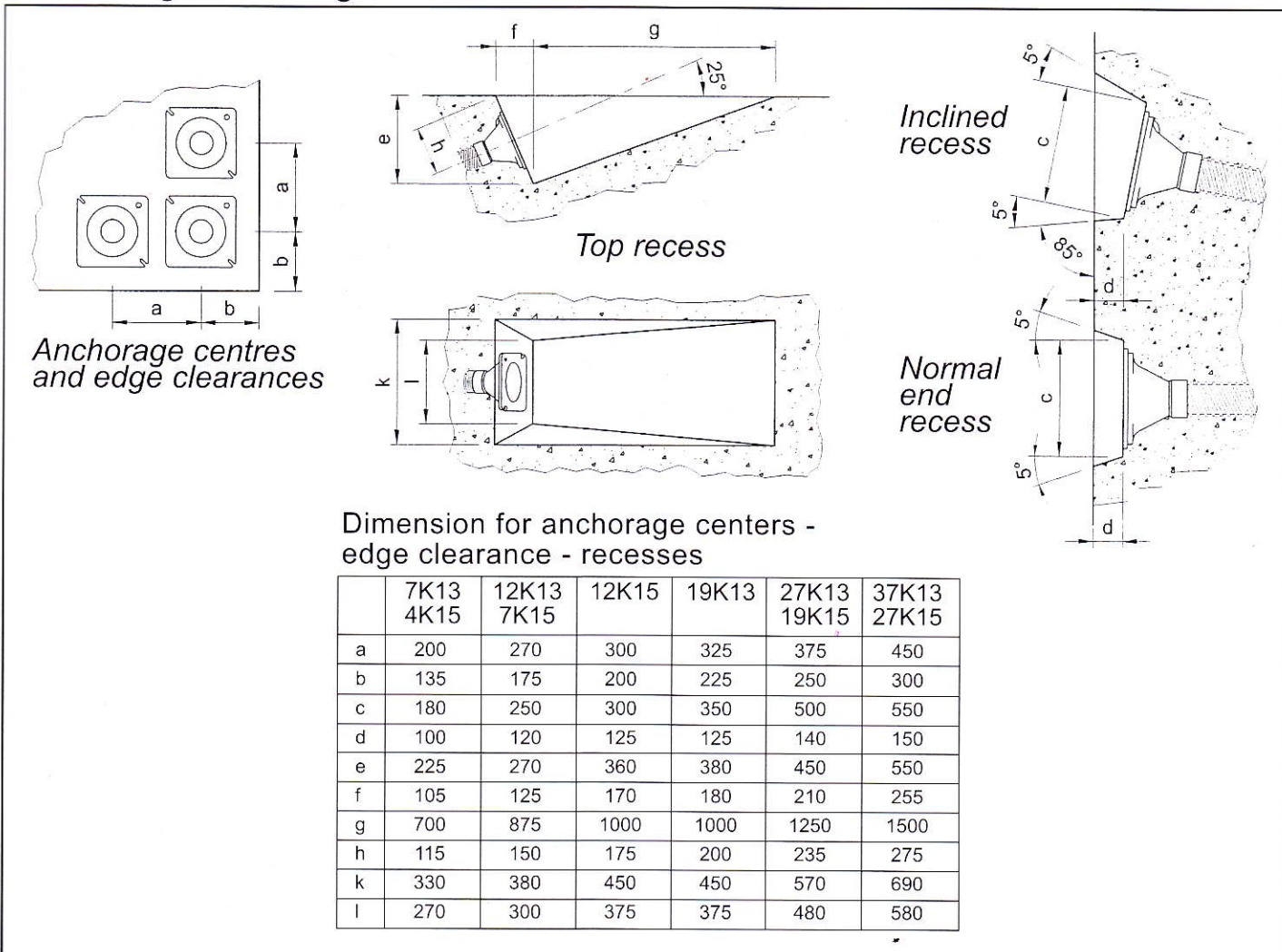
The jacks marked** are suitable for the optimum use with the anchorage units shown in the table. Furthermore each jack can be equipped to fit the anchorage units of smaller size marked*. In that case it is necessary to design the anchorage recesses according to the size of the larger jack in use.

anchorage and recess detailing

Jacking anchorages (local castings used)

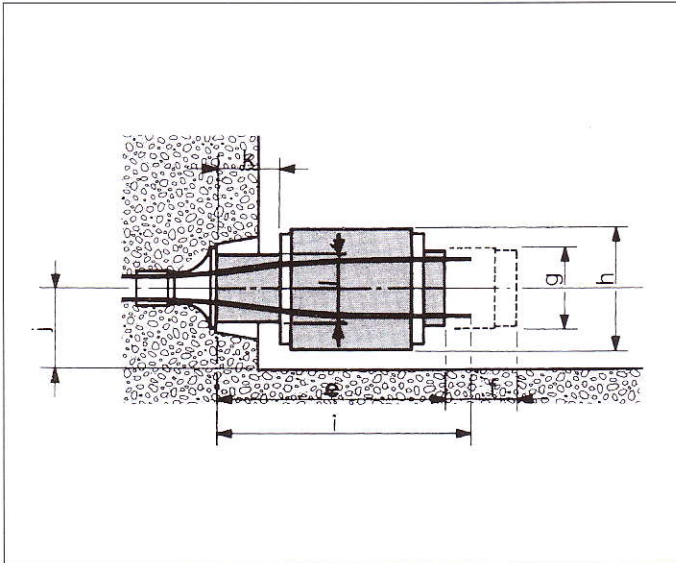


Anchorage detailing (for local castings used)



stressing

Overall dimensions of jacks

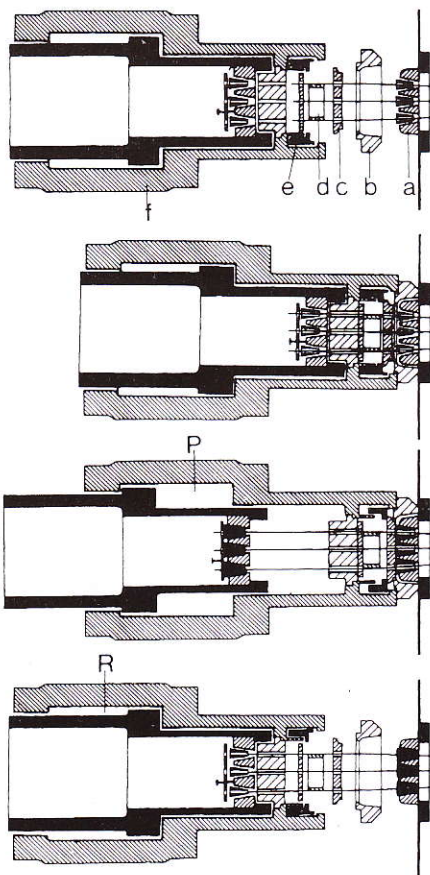


JACK TYPE	UNIT TYPE		e	f	g	h	i	j	k	l
K 100	7 K 13	—	522	200	—	290	700	200	122	195
	—	4 K 15	532	200	—	290	700	200	122	195
K 200	7 K 13	4 K 15	638	200	230	350	800	230	175	190
	12 K 13	—	637	200	230	350	800	230	175	200
K 350	—	7 K 15	642	200	230	350	800	230	175	200
	12 K 13	7 K 15	742	250	270	440	900	270	175	200
K 500	19 K 13	12 K 15	747	250	270	440	900	270	175	250
	27 K 13	19 K 15	928	250	318	515	1090	310	160	250
K 700	27 K 13	19 K 15	940	250	318	515	1090	310	160	320
	37 K 13	27 K 15	896	250	382	620	1050	360	85	370
K 1000	37 K 13	27 K 15	847	250	382	620	1000	360	—	—
	55 K 13	37 K 15	1012	250	500	720	1165	410	124	438
KF 500	—	—	888	250	500	720	1040	410	—	—
	27 K 13	19 K 15	1081	250	360	565	410	340	485	364

All dimensions in millimeters

Tensioning sequence

Front-pull jack



1 - Placing
Order in which jack and accessories are placed:

1.1 Front-pull jacks
a) anchor block with jaws
b) bearing ring
c) blocking plate
d) friction ring
e) strand positioning plate
f) jack

1.2 Rear-pull jacks
a) anchor block with jaws
b) rubber springs (if used)
c) pressure plate
d) jack
e) rear anchor block with re-usable jaws

2 - Preparation for stressing
Fixing of strands to the temporary anchor block by means of re-usable jaws.

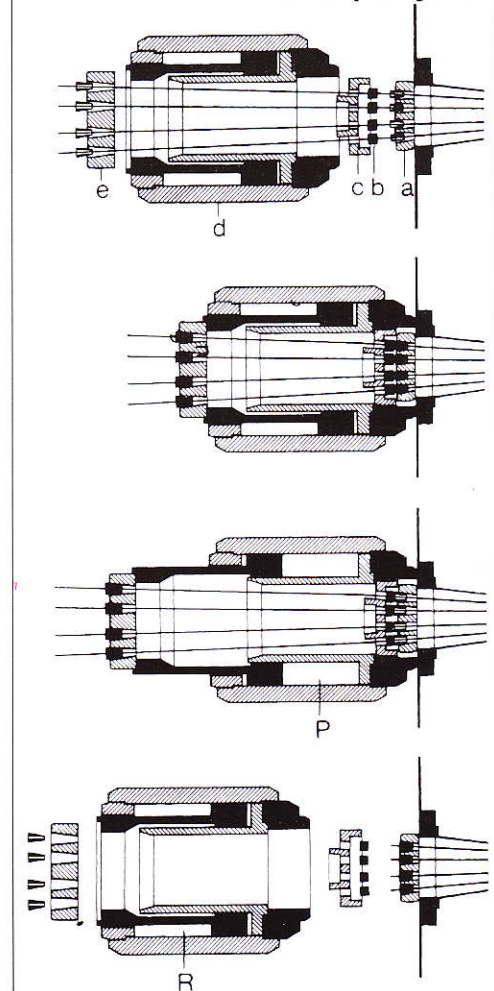
3 - Stressing
Pumping into the tension chamber (P) to the pressure corresponding to the required force in the cable.

3.1 Front-pull jacks
Hydraulic blocking of anchorage jaws.

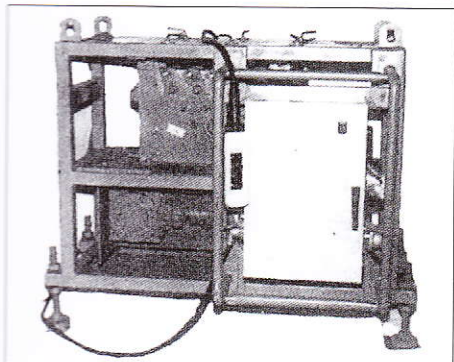
3.2 Rear-pull jacks
The rubber springs ensure that jaws block uniformly.

4 - Draining and removal of jack
Opening the tension circuit. Pumping into the blocking/return circuit (R) to drain oil from the tension chamber. Removal of jack and accessories.

Rear-pull jack

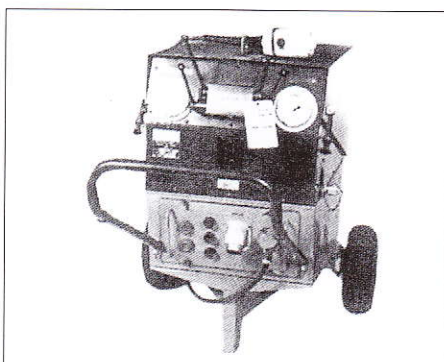


Stressing equipment



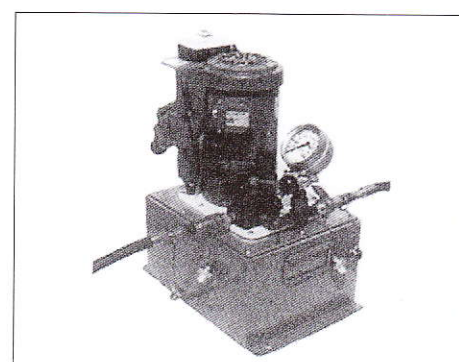
MAP 2V standard strand pusher

- Two speed electric strand pusher
- 0.60 and 2.40 m/s
- Electrical motor 750/3 000 rpm
- Equipped for 13 or 15 mm strands
- Remote control
- Flexible strang guide
- Weight 600 kg



Hydraulic tensioning pumps

- Electrical motor driven hydraulic pumps
- Two hydraulic circuits controlled by manual distributor
 - tensioning circuit
 - blocking and return circuit

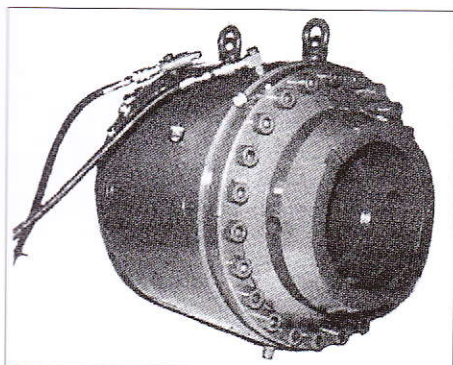


P6M pump

- Output 2.5 - 4 l/min
- Maximum pressure 630 bars
- Weight 240 kg

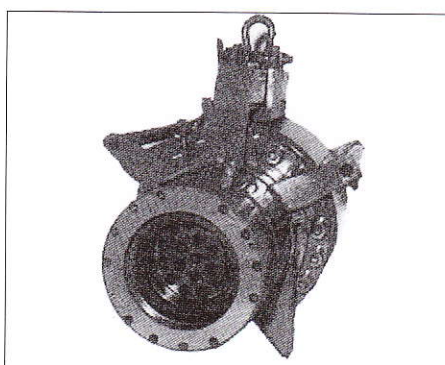
P7M pump

- Output 0.9 l/min
- Maximum pressure 680 bars
- Tank capacity 23 l
- Weight 65 kg



Hydraulic tensioning jacks

- Hydraulic double-action centre-hole jacks
- Strands individually anchored



K range jacks

- rear-end temporary anchor block
- optional hydraulic blocking nosepiece

KF range jacks

- front-end temporary anchor block
- hydraulic blocking device in the nosepiece



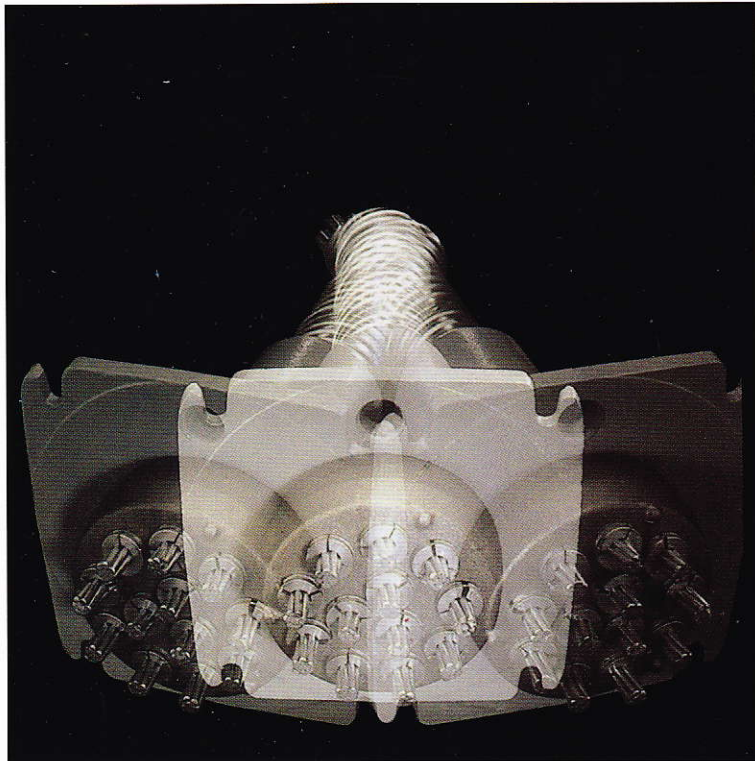
Swaging jack

- Hydraulic swaging jack
- Extruded sleeves for 13 and 15 mm strands
- Maximum pressure 700 bars
- Extruding force 520 kN
- Weight 47 kg

Jacks characteristics

JACK TYPE		K 100	K 200	K 350	K 500	K 700	K 1000	KF 500
Maximum force	kN	1120	2065	3065	4595	6125	8945	5000
Tension cyl. area	cm ²	203.4	318	490	765.8	980	1431	769
Return cyl. area	cm ²	65.9	157	232	452.3	589	724	367
Maximum pressure	bar	550	650	625	600	625	625	650
Stroke	mm	200	200	250	250	250	250	250
Maximum diameter	mm	270	350	440	508	609	720	565
Length closed	mm	365	402	502	718	767	783	1016
Total weight	kg	112	208	328	740	1060	1450	970

All dimensions in millimeters



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