# FLAT JACKS



Data sheet n°: FT En C V 8 - 01/25

- Easy to use
- Cost-effective

- High compactness: high load and long stroke with
   low space requirement
- Range of products suitable for many configurations

### Product

Flat jacks, initially invented by Freyssinet to achieve the posttensioning of structures, are thin hydraulic devices that make it possible to impose significant displacements and/or forces while requiring a particularly small space for their implementation. It is therefore a very efficient tool for example to lift existing structures.

# Description

The flat jack is in the form of a deformable capsule consisting of two half-pieces of cold-drawn steel including an o-ring chamber on its entire periphery. Two hydraulic connections (a vent and an injection point) allow the cylinder to be filled with pressurized liquid to deploy the cylinder over its entire available stroke.



Shape, stroke and colours NEW!

Considering the wide range of application cases likely to be encountered, the range of flat jack is developed to include 4 types of shapes: circular, oblong, rectangular or square.

In addition, depending on the load to be applied and the stroke required, the thickness and stroke of jacks are to be chosen on case-by-case basis within an off-the-shelf design, even if a specific design can be efficiently developed to fit any project needs. Refer to Figure 2, Figure 3 and Figure 5 for jacks geometry readily available. As described in , the jack stroke is equal to Ha – Hb =  $Ø_b$ -2\*e-2. Should the maximum stroke available for one jack be insufficient, specific measures enable to pill up several jacks.

Considering the technical compromise between the stroke, the service load and the maximum possible steel capacity, each jack has its own maximum service pressure. The colour code described in is applied in all documentation as well as on the jack painting.

Maximum service pressure	Colours
200 bar	Blue
160 bar	Green
125 bar	Yellow
100 bar	Red

Figure 1: Maximum service pressure colour code

	Circular jacks							
	Vérins Circulairs							
			Jacks					
			Vérins	3				
N°	D	Øb	e	Sutile	Pmax	F <sub>max</sub> **		
	mm	mm	mm	mm²	bar	kN		
1	70	15	1,5	1256,6	200	25		
2	220	15	1,5	28352,9	200	567		
3	650	15	1,5	301907,1	200	6 038		
4	220	18	1,5	26590,4	200	532		
5	300	18	1,5	54739,1	200	1 095		
6	70	25	2	314,2	200	6		
7	120	25	2	3848,5	200	77		
8	150	25	2	7854,0	200	157		
9	180	25	2	13273,2	200	265		
10	190	25	2	15393,8	200	308		
11	220	25	2	22698,0	200	454		
12	250	25	2	31415,9	200	628		
13	270	25	2	38013,3	200	760		
14	300	25	2	49087,4	200	982		
15	350	25	2	70685,8	200	1 4 1 4		
16	420	25	2	107521,0	200	2 150		
17	480	25	2	145220,1	200	2 904		
18	675	25	2	306796,2	200	6 136		
19	700	25	2	331830,7	200	6 6 37		
20	920	25	2	594467,9	200	11 889		
21	150	28	2	6939,8	200	139		
22	270	30	2	34636,1	160	554		
23	500	32	2	149301,0	160	2 643		
24	250	35	2	25446,9	160	407		
25	300	35	2	41547,6	160	665		
26	350	35	2	61575,2	160	985		
27	600	35	2	220618,3	160	3 530		
28	750	35	2	363168,1	160	5 811		
29	870	35	2	502654,8	160	8 042		
30	920	35	2	567450,2	160	9 079		
31	1000	35	2	679290,9	160	10 869		
32	1016	35	2	702865,4	160	11 246		
33	1050	35	2	754296,4	160	12 069		
34	1250	35	2	1093588,4	160	17 497		
35	1150	35	2	916088,4	160	14 657		
36	350	40	2	57255,5	125	716		
37	420	45	2	85529,9	125	1 069		
38	500	45	2	132025,4	125	1 650		
39	750	50	2	331830,7	100	3 318		
40	1016	55	2	644683 1	100	6 4 4 7		

Specific designs can be developed on request

\*\* Fmax : Maximum service load of the jack - A safety coefficient of 1,0 to 1,50 shall be applied on the required load capacity by the project

#### Figure 2 : Circular flat jacks available off-the-shelf

#### Fittings

The standard jacks are equipped with 6 x 8 mm steel tubes and 60 mm length (in accordance with the European standard EN 1057). These tubes are to be equipped with hydraulic connections (maximum service pressure at least equal to 250 bar). The complete range of accessories and connections can be supplied simultaneously with the jacks on request. The orientation of the nozzles, vents and supply are oriented by default at 90°, and a specific layout can be requested at the time of ordering.



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# FLAT JACKS



Vérins Rectangulairs           Jacks           Vérins           N°         L1         €2         Øb         e         Rmin         Suite         Pmax         Fmax         **           mm <mm<mm<mm<mm<mm<mm<mm<mm<mm<mm<mm<mm<< th=""><th colspan="10">Rectangular jacks</th></mm<mm<mm<mm<mm<mm<mm<mm<mm<mm<mm<mm<<>	Rectangular jacks									
N°         L1         C2         Øb         C         Rmin         Num         mm         m				Véri	ns Re	ectang	ulairs			
Vérins         Vérins         Pmax         Fmax	Jacks									
NºL1 $\theta_2$ $\emptyset_b$ e $P_{min}$ $N_{min}$ $P_{max}$ $F_{max}$ $F_{max}$ 1420360151.510012248820027143500200151.510013688820027144500400151.51001369882003444500400151.510021418820042846650450151.510022998820042647740350151.5100229988200477695503702021004880620037781234020025210040711200771133502502521004071120029831441022025210040711200293315450252100195171200213316500300252100195171200193318573450252100214112006233248507502521002141120063331960024025210021411200633324850750252100214112006333251550<	Vérins									
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26         420         270         28         2         100         73446         200         1469           27         420         320         28         2         100         73446         200         1469           27         420         320         28         2         100         91646         200         3533           28         600         360         28         2         100         179166         200         3531           30         540         430         28         2         100         16566         200         3531           31         720         540         28         2         100         316926         200         4333           32         920         770         28         2         100         162464         200         42249           33         650         500         30         2         100         26333         160         4052           34         350         320         35         2         100         128373         160         3322           350         470         400         35         2         100         205373         160	25	1550	280	25	2	100	340171	200	6803	
27     420     320     28     2     100     91646     200     1833       28     660     360     28     2     100     179166     200     4586       30     540     430     28     2     100     179166     200     4586       30     540     430     28     2     100     16566     200     6339       31     720     540     28     2     100     16266     200     6339       32     920     770     28     2     100     55334     160     4853       33     650     500     30     2     100     55334     160     4052       34     350     320     35     2     100     128373     160     2054       36     650     400     35     2     100     128373     160     3212       37     770     370     35     2     100     206373     160     3212       38     800     350     35     2     100     206373     160     3502       40     900     500     35     2     100     50273     160     1204       42     920	26	420	270	28	2	100	73446	200	1 469	
28         660         360         28         2         100         17916         200         3583           29         700         450         28         2         100         17916         200         3583           29         700         450         28         2         100         249286         200         4986           30         540         430         28         2         100         316926         200         4531           31         720         540         28         2         100         61246         200         4533           32         920         770         28         2         100         66373         160         4523           34         450         320         35         2         100         128273         160         2212           36         600         350         35         2         100         138273         160         3202           38         800         810         35         2         100         20373         160         3212           39         890         810         35         2         100         35273         160	27	420	320	28	2	100	91646	200	1833	
29         700         450         28         2         100         24926         200         4986           30         540         430         28         2         100         176566         200         63531           31         720         540         28         2         100         176566         200         63531           32         920         770         28         2         100         612446         200         12249           33         650         500         30         2         100         25334         160         4852           34         350         320         35         2         100         128373         160         20162           35         470         400         35         2         100         138273         160         2312           36         600         350         2         100         20373         160         302           370         770         370         35         2         100         601373         160         302           380         800         350         2         100         519273         160         502	28	660	360	28	2	100	179166	200	3 583	
30         540         430         28         2         100         176566         200         3331           31         720         540         28         2         100         176566         200         5331           31         720         540         28         2         100         516926         200         6339           32         920         770         28         2         100         612464         200         12237           34         550         300         35         2         100         66373         160         1052           35         470         400         35         2         100         128373         160         2014           36         500         300         35         2         100         138273         160         3012           37         770         370         35         2         100         138273         160         3012           38         800         350         35         2         100         50373         160         3024           39         890         810         35         2         100         50373         160 <th>29</th> <th>700</th> <th>450</th> <th>28</th> <th>2</th> <th>100</th> <th>249286</th> <th>200</th> <th>4 986</th>	29	700	450	28	2	100	249286	200	4 986	
31         720         540         28         2         100         316926         200         6339           32         920         770         28         2         100         612446         200         12249           33         650         500         30         2         100         612446         200         12249           34         350         320         35         2         100         66373         160         4553           35         470         400         35         2         100         128373         160         2513           36         500         400         35         2         100         128373         160         2512           37         707         370         35         2         100         206373         160         3512           39         890         810         35         2         100         50373         160         3512           40         900         700         35         2         100         51273         160         3524           41         900         700         35         2         100         35373         160 <th>30</th> <th>540</th> <th>430</th> <th>28</th> <th>2</th> <th>100</th> <th>176566</th> <th>200</th> <th>3 5 3 1</th>	30	540	430	28	2	100	176566	200	3 5 3 1	
32         920         770         28         2         100         61246         200         12249           33         650         500         30         2         100         61246         200         12249           33         650         500         30         2         100         255394         160         4622           34         350         320         35         2         100         128373         160         2013           36         500         400         35         2         100         138273         160         2212           37         770         370         35         2         100         138273         160         3212           38         800         350         35         2         100         200773         160         3212           39         890         810         35         2         100         35373         160         5652           41         900         700         35         2         100         35373         160         572           42         920         420         35         2         100         36373         160	31	720	540	28	2	100	316926	200	6 3 3 9	
33         650         500         30         2         100         25534         160         4852           34         350         320         35         2         100         66373         160         4852           34         350         320         35         2         100         168373         160         2452           36         470         400         35         2         100         128373         160         2012           37         770         370         35         2         100         208373         160         302           39         890         810         35         2         100         603173         160         302           41         900         700         35         2         100         51273         160         8308           42         920         420         35         2         100         293873         160         5422           43         1100         700         35         2         100         364373         160         5702           44         1070         420         35         2         100         364373         160	32	920	770	28	2	100	612446	200	12 249	
34         350         320         35         2         100         663/3         160         1062           35         470         400         35         2         100         663/3         160         1062           36         500         400         35         2         100         128373         160         2054           36         500         400         35         2         100         208373         160         23212           37         770         370         35         2         100         200773         160         33212           39         810         35         2         100         200773         160         5621           40         900         500         35         2         100         532373         160         563           41         900         700         35         2         100         54273         160         338           42         920         420         35         2         100         645373         160         3324           43         1107         700         35         2         100         365373         160         324 <th>33</th> <th>650</th> <th>500</th> <th>30</th> <th>2</th> <th>100</th> <th>255394</th> <th>160</th> <th>4 852</th>	33	650	500	30	2	100	255394	160	4 852	
35         4/0         4/0         35         2         100         1283/3         160         2054           36         5/0         4/0         35         2         100         138273         160         2054           36         5/0         4/0         35         2         100         138273         160         2054           37         770         370         35         2         100         206373         160         3212           39         890         810         35         2         100         603173         160         5652           40         900         500         35         2         100         512373         160         8308           41         900         700         35         2         100         512373         160         8308           42         920         420         35         2         100         293873         160         1324           43         1100         700         35         2         100         366373         160         1324           45         1270         370         35         2         100         365373         160	34	350	320	35	2	100	66373	160	1062	
36         500         400         35         2         100         1882/3         100         2212           37         770         370         35         2         100         206373         160         3212           38         800         350         35         2         100         206373         160         3212           39         890         810         35         2         100         603173         160         5652           40         900         500         35         2         100         53273         160         5652           41         900         700         35         2         100         35273         160         5652           42         920         420         35         2         100         35373         160         572           43         1100         700         35         2         100         34573         160         1324           44         1070         420         35         2         100         345373         160         1524           45         1270         700         35         2 <th100< th=""> <th345373< th="">         160</th345373<></th100<>	35	470	400	35	2	100	1283/3	160	2054	
37         770         370         350         35         2         100         206373         160         3302           38         800         350         35         2         100         206373         160         3302           39         890         810         35         2         2         100         600173         160         5652           40         900         700         35         2         100         51273         160         5652           41         900         700         35         2         100         51273         160         4708           42         920         420         35         2         100         519273         160         4708           43         1100         700         35         2         100         519273         160         4704           44         1070         420         35         2         100         248373         160         5702           45         1270         370         35         2         100         356373         160         1702           46         1500         600         35         2         100	36	500	400	35	2	100	138273	160	2212	
38         800         30         35         2         100         20077         100         9212           39         800         810         35         2         100         600173         160         9512           39         800         810         35         2         100         600173         160         9512           41         900         700         35         2         100         53273         160         4702           43         1100         700         35         2         100         293873         160         54242           44         1070         700         35         2         100         246373         160         542444           4107         740         35         2         100         346373         160         5702           46         1500         600         35         2         100         346373         160         5702           47         670         650         37         2         100         33889         125         4249           48         350         350         15         150         100         102688         200 <th< th=""><th>37</th><th>200</th><th>370</th><th>35</th><th>2</th><th>100</th><th>206373</th><th>160</th><th>3 302</th></th<>	37	200	370	35	2	100	206373	160	3 302	
39         300         500         300         300         300         500         300	38	900	000 010	30 25	2	100	2007/3	160	3 212	
au         sub         sub         sub         sub         sub         sub         sub           41         900         700         35         2         100         sub         sub         sub           42         920         420         35         2         100         sub         sub         sub           43         1100         700         35         2         100         sub         sub         sub           43         1100         700         35         2         100         sub         sub         160         8308           44         1070         420         35         2         100         346373         160         5542           45         1270         370         35         2         100         356373         160         1208           46         1500         370         25         100         33889         125         4249           48         350         350         15         15         100         90398         125         4249           49         360         890         15         15         100         703398         200         1468	39	000	010	30 25	2	100	0031/3	160	9 051	
2         550         750         750         2         100         51327         100         6308           42         920         420         35         2         100         635273         160         4700           44         1100         700         35         2         100         645273         160         4701           44         1070         420         35         2         100         346373         160         5542           45         1270         370         35         2         100         366373         160         5702           46         1500         600         35         2         100         39889         126         4249           48         350         350         15         1.5         100         75028         200         1924           49         360         360         15         1.5         100         733388         200         16454           50         890         15         1.5         100         733388         200         16456           51         750         25         2         100         318247         200         46656 </th <th>40 11</th> <th>900</th> <th>700</th> <th>35</th> <th>2</th> <th>100</th> <th>519772</th> <th>160</th> <th>0 002 g 200</th>	40 11	900	700	35	2	100	519772	160	0 002 g 200	
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44         1070         420         35         2         100         6452/3         160         10/324           44         1070         420         35         2         100         346373         160         55702           46         1270         370         35         2         100         346373         160         5702           46         1500         600         35         2         100         346373         160         5702           46         1500         600         35         2         100         346373         160         1208           47         670         650         37         2         100         339889         125         4249           48         350         350         15         15         100         96198         200         1924           49         360         360         15         1.5         100         73398         200         14668           51         750         750         25         2         100         228966         200         29703           52         540         540         28         2         100         228906	42	1100	700	35	2	100	2000/0	160	4702	
4.10         7.20 <th< th=""><th>43</th><th>1070</th><th>420</th><th>35</th><th>2</th><th>100</th><th>346373</th><th>160</th><th>5 542</th></th<>	43	1070	420	35	2	100	346373	160	5 542	
1         1	45	1270	370	35	2	100	356373	160	5 702	
47         670         650         37         2         100         33989         125         4240           48         350         350         15         1.5         100         33989         200         1924           49         360         360         15         1.5         100         102698         200         2924           50         890         890         15         1.5         100         73398         200         14668           51         750         750         25         2         100         485171         200         9703           52         540         540         28         2         100         229806         200         4569           53         250         250         2         100         31894         160         510           54         370         370         35         2         100         86373         160         1382           55         500         500         35         2         100         181273         160         2900	46	1500	600	35	2	100	754273	160	12.068	
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49         360         360         15         1.0         102698         200         2.054           50         890         890         15         1.5         100         733398         200         14668           51         750         750         25         2         100         485171         200         9703           52         540         540         28         2         100         28804         200         4596           53         250         250         30         2         100         31894         160         510           54         370         370         35         2         100         86373         160         1328           55         500         500         35         2         100         181273         160         2900	48	350	350	15	1.5	100	96198	200	1924	
50         B20         B20         B2         B20	49	360	360	15	1.5	100	102698	200	2 0 5 4	
51         750         750         25         2         100         485171         200         9703           52         540         540         28         2         100         28507         200         4566           53         250         250         30         2         100         31894         160         510           54         370         370         35         2         100         86373         160         1382           55         500         500         35         2         100         181273         160         2900	50	890	890	15	1.5	100	733398	200	14 668	
52         540         540         28         2         100         229806         200         4 596           53         250         250         30         2         100         31894         160         510           54         370         370         35         2         100         86373         160         1382           55         500         500         35         2         100         181273         160         2900	51	750	750	25	2	100	485171	200	9 703	
53         250         250         30         2         100         31894         160         510           54         370         370         35         2         100         86373         160         1382           55         500         500         35         2         100         181273         160         2900	52	540	540	28	2	100	229806	200	4 596	
54         370         370         35         2         100         86373         160         1 382           55         500         500         35         2         100         181273         160         2 900	53	250	250	30	2	100	31894	160	510	
<b>55</b> 500 500 35 2 100 181273 <b>160</b> 2 900	54	370	370	35	2	100	86373	160	1 382	
	55	500	500	35	2	100	181273	160	2 900	
56 550 550 35 2 100 226773 160 3 628	56	550	550	35	2	100	226773	160	3 628	
<b>57</b> 500 500 50 2 100 157854 100 1579	57	500	500	50	2	100	157854	100	1 579	
<b>58</b> 650 650 50 2 100 300354 <b>100</b> 3 004	58	650	650	50	2	100	300354	100	3 004	

Specific designs can be developed on request \*\* Fmax : Maximum service load of the jack - A safety coefficient of 1,0 to 1,50 shall be applied on the

required load capacity by the project

Figure 3: Rectangular flat jacks available off-the-shelf



Figure 4: Filling the central volume using a resin mortar

Vérins oblongs Sutil P<sub>max</sub> F<sub>max</sub> Ø, R<sub>mir</sub> L €2 е N mm mm mm mm mm mm<sup>2</sup> kN bar 1.5 54873.2 1 0 9 7 1.5 74046.9 1 481 1.5 86448.0 1 729 1.5 60013.3 1 200 22854.0 42854.0 29309.7 29393.8 47671.5 66613.3 1 332 79921.5 1 598 67854.0 1 357 170013.3 3 400 140909.7 2 818 105558.7 2 111 187.5 211806.1 3 389

Specific designs can be developed on reques

\*\* Fmax : Maximum service load of the jack - A safety coefficient of 1,0 to 1,50 shall be applied on the required load capacity by the project

Figure 5: Oblong-shaped jacks

### Performances

The force exerted by the flat cylinder varies according to: the maximum stroke, the service pressure, as well as the useful section of the jack (which decreases when the jack opens). The maximum force values mentioned in the dimensional tables above are specific to each jack design. Jacks are to be selected while considering a safety factors applied on the expected load during the project (value between 1.2 and 1.5, as per NF EN 1993-4-2 – Eurocode 3 table 2.1).

The conversion pressure to load in the data above are to be considered with an uncertainty of around +/-5%. If a lower uncertainty is required, a calibration (sacrificial operation to be performed on a jack dedicated to this purpose) on a cylinder in the batch) can be carried out in the laboratory.

Although these jacks can be used on a permanent or long-term basis when injected with a curable product (such as resin or cement grout), no transverse force can be taken up by the flat jack before complete setting of the filler.



Figure 6: building lifting & displacement monitoring



Figure 7: Nuclear reactor - Cadarache





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# — TECHNICAL DATA SHEETS **FLAT JACKS**

## Application cases

Areas of use Flat cylinders can be used for many applications

- Lifting,
  - Weighing,
  - Pushing,
- Formwork unloading,
- Bearings load transfer.

For the jacks to be operational after delivery to the site, they must be equipped with the required hydraulic connections that are compatible with the supply circuit (following the recommendation of the product use procedure) and the gap between the bulges must be filled. To flatten the support surface of the cylinders, several options are available:

- A wedge using a steel plate specific to the flat jack (dimensions provided on request),
- Filling the volume between the bulges with a resin mortar (see Figure 4),
- Pouring of the flat cylinder into a specifically designed concrete block (to be sized for each project).

Whether the jack is injected using a curable product (resin or cement grout) or a hydraulic fluid, the use of a high-pressure cylinder is necessary to precisely control the opening speed of the flat jack. This device is inserted in the supply circuit between the hydraulic pump and the flat jack.

Should the jack be injected with a curable product and is foreseen to be removed from the structure at a later stage, the unloading of the jack is possible using sand bearing box.

To ensure safety of the jacking operation shimming is required all along the operation to mitigate the risk of hydraulic failure during or after the jacking operation.







Figure 8: Jack stroke and fittings orientation





