RESOURCE PAGES

VANKOS HYD®

BASIC HYDRAULIC CALCULATIONS

Pressure exerted anywhere in a confined liquid is transmitted equally & undiminished in all directions throughout the liquid.

FORCE / LOAD

Force (F) = Pressure (P) x Jack / Cylinder effective area (A)

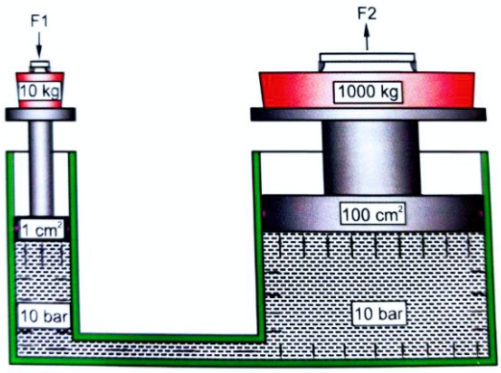
F - Force acting on jack / cylinder in kg

P - Operating pressure in bar

A - The jack / cylinder effective are ėm 2/4 d

Cylinder bore diameter

D - Cylinder bore diameter



Application of Pascal's Law in Force Multiplication

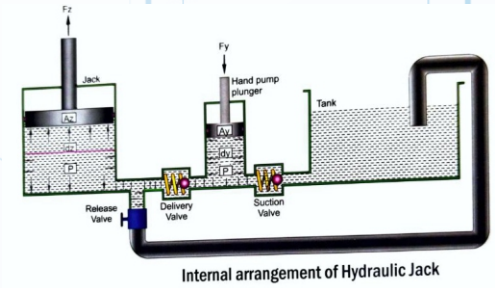
Example:

A **RC-EXP-100/50** Jack is required to lift a load of (F_z) 80t What operating pressure required?

Az	= π/4 x(dz)²
Bore dia. Dz	= 14 cm
Az	=153.94 cm²
P (bar)	= Fz (kg) / Az (cm²)
Fz = 80t	= 80,000 kg
P	= 80,000 / 153.94
	= 520 bar

Hand pump plunger load (Fy) at pressure 520 bar

Ay	= π/4 x (dy)²
Plunger dia. Dy	= 1.2 cm
Fy	= P (bar) x Ay (cm²)
	= 520 x 1.13
	= 588 kg



Internal arrangement of Hydraulic Jack

- Suction valve: prevents back flow from pump plunger to tank
- Delivery valve: prevents back flow from jack to pump plunger
- Release valve: stops / allows oil from jack to flow back to tank

By applying 588 kg load on hand pump plunger (Fy), Jack can lift 80t load (Fz)

Conclusion: By applying smaller force we can lift / move bigger load

- Suction valve: prevents back flow from pump plunger to tank
- Delivery valve: prevents back flow from jack to pump plunger
- Release valve: stops / allows oil from jack to flow back to tank

If 'n' no.of jacks are used to lift, assuming all jacks are equally loaded. Total lifting load = p x A x n Similarly, if value of any two variables are given, the third factor can be calculated with the formula.

Hand pump – Calculate no. of handle strokes needed to lift jack, given effective are over a specified stroke.

$$\text{No. of actuations of hand pump for 1 cm of ram lift} = \frac{\text{Jack Effective are}}{\text{Pump discharge per actuation}}$$

Example:

Hand pump Model HP-1/P

Effective are of cylinder (RC-EXP- 10t)	: 15.9 cm2
Discharge / actuation of 1 P4 pump	: 2.8 cc
No. of actuation of hand pump	: 15.9 / 2.8 = 5.7 (approx. 6)

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System oil capacity

System oil capacity
Total Volume of oil = Oil capacity of one jack / cylinder (cc) x No. of jack / cylinder
Example – 6 Nos. of RC-EXP- 20/150 operating in tandem
Total volume of oil = 468 x 6 = 2808 cc

Jack / Cylinder oil capacity

Oil capacity (cc) = Effective area (cm2) x Stroke (cm)
Example – RC-EXP- 20/150 (for effective area refer catalogue)
Oil capacity = 31.2 x 15 = 468 cc

Selection of Pump based on Jack Speed

Pump type	Force in tons												
	Pressure stage	5	10	15	20	25	30	50	60	75	100	150	200
HP-1/P	Single	3.5	1.8	1.2	0.9	0.7	0.6	0.4	0.3	0.2	-	-	-
HP 3012	1st stage	18.8	9.4	6.3	4.8	3.9	3.4	1.9	1.7	1.3	1.0	0.7	0.5
HP 3012	2nd stage	3.5	1.8	1.2	0.9	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.1
HP-2A/P-7	1st stage	92.5	46.5	31.1	23.7	19.2	16.7	9.4	8.6	6.5	4.8	3.3	2.4
HP-2A/P-7	2nd stage	5.4	2.7	1.8	1.4	1.1	1.0	0.5	0.5	0.4	0.3	0.2	0.1
HP-2A/P-13	1st stage	182.5	91.8	61.3	46.8	37.9	33.0	18.6	16.9	12.9	9.5	6.4	4.6
HP-2A/P-13	2nd stage	5.4	2.7	1.8	1.4	1.1	1.0	0.5	0.5	0.4	0.3	0.2	0.1

Power Pack Unit - Jack speed in mm per second

Pump type	Force in tons															
	Pressure stage	50	60	75	100	150	200	250	300	400	500	600	800	1000	1500	2000
VPU-2-HS	Single	2.1	1.9	1.5	1.1	0.7	0.5	0.4	0.4	0.3	0.2	0.2	-	-	-	-
VPU-3-HS	Single	3.2	2.9	2.2	1.6	1.1	0.8	0.7	0.6	0.4	0.4	0.3	-	-	-	-
VPU-5-HS	Single	5.5	5.0	3.8	2.8	1.9	1.4	1.1	1.0	0.8	0.6	0.5	-	-	-	-
VPU-2-HD	1st Stage	10.2	9.3	7.1	5.2	3.5	2.5	2.1	1.8	1.4	1.1	0.9	-	-	-	-
VPU-2-HD	2nd Stage	2.1	1.9	1.5	1.1	0.7	0.5	0.4	0.4	0.3	0.2	0.2	-	-	-	-
VPU-3-HD	1st Stage	15.5	14.1	10.8	7.9	5.4	3.9	3.2	2.7	2.1	1.7	1.4	1.1	0.9	-	-
VPU-3-HD	2nd Stage	3.2	2.9	2.2	1.6	1.1	0.8	0.7	0.6	0.4	0.4	0.3	0.2	0.2	-	-
VPU-5-HD	1st Stage	-	-	18.1	13.3	9.0	6.5	5.4	4.5	3.6	2.9	2.4	1.8	1.4	0.9	0.7
VPU-5-HD	2nd Stage	-	-	3.7	2.7	1.8	1.3	1.1	0.9	0.7	0.6	0.5	0.4	0.3	0.2	0.1
VPU-7.5-HD	1st Stage	-	-	-	18.7	12.7	9.2	7.6	6.4	5.0	4.1	3.4	2.5	2.0	1.3	1.0
VPU-7.5-HD	2nd Stage	-	-	-	4.0	2.7	2.0	1.6	1.4	1.1	0.9	0.7	0.5	0.4	0.3	0.2

- Higher capacity & customized solutions on request. • Specifications are subject to change due to continual improvement.
- Capacity & Stroke specified are maximum safe limits. As safe practice, use at 80% of rating.