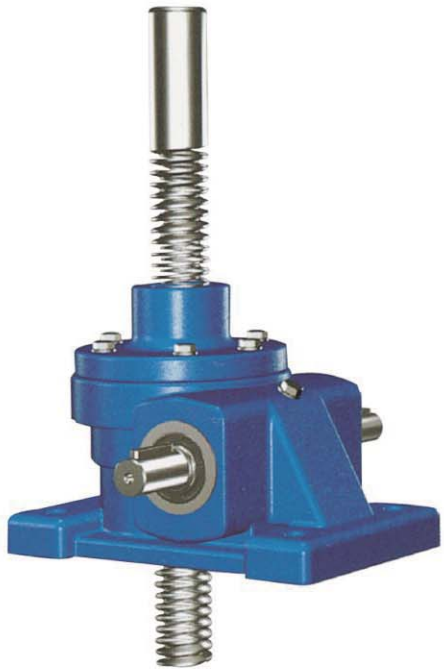
SWL蜗轮螺杆升降机



蜗轮丝杆升降机

SWL升降机，本升降机是由蜗轮副和梯形丝杆组合来完成物件的提升和下降，本机具有结构紧凑，体小轻便、灵活、可靠、寿命长、安装方便。在静止时还可自锁。

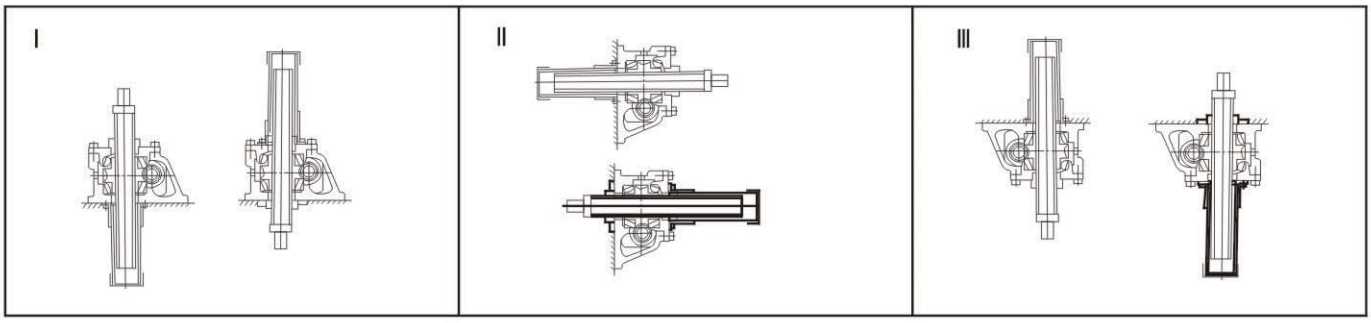
技术参数

型号	SWL1.0	SWL2.5	SWL5	SWL10	SWL15	SWL20	SWL25	SWL35	SWL50	SWL75	SWL100
最大起升力（kN）	10	25	50	100	150	200	250	350	500	750	1000
丝杆螺纹尺寸	Tr22×5	Tr30×6	Tr40×7	Tr58×12		Tr65×12	Tr90×16	Tr100×16	Tr120×16	Tr130×18	Tr150×24
最大拉力（kN）	10	25	50	99		166	250	350	500	750	1000

SWL 2.5 AS A M 500 Z S C K I

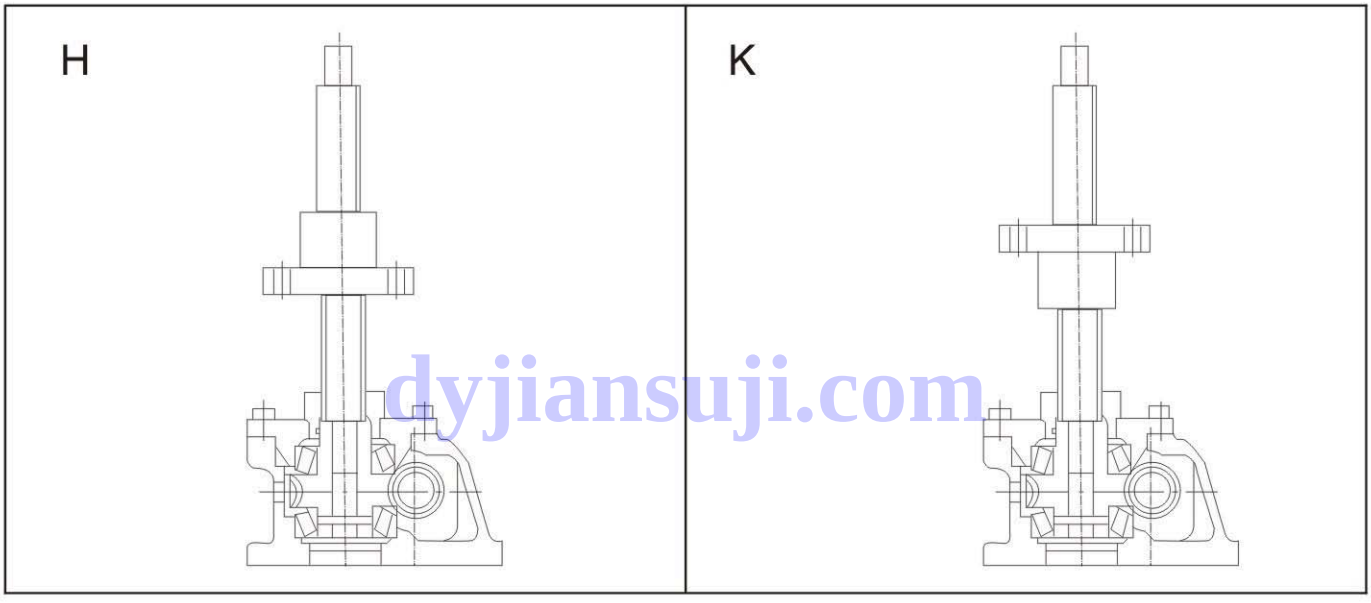
- SWL：升降机系列
- 2.5：机座号
- AS：基本形式
  - AS 丝杆转动且向上移动
  - BS 丝杆转动且向下移动
  - AM 丝杆不转动只向上移动
  - BM 丝杆不转动只向下移动
  - AR 丝杆转动螺母移动底座在下面
  - BR 丝杆转动螺母移动底座在上面
- A：输入轴方向
  - A 蜗杆一侧看为右
  - B 蜗杆一侧看为左
  - A.B为双向输入（不标）
- M：传动比
  - P 普通速比
  - M 慢速比
- 500：行程
- Z：Z 防护罩型
- S：丝杆顶端联接方式
  - S 牙口式
  - H 栓孔式
  - R 平口式
  - T 顶板式
- C：支架安装 C；普通底座式安装不标
- K：螺母放置方向 H.K
- I：安装方位 Ⅰ.Ⅱ.Ⅲ

11.3.1.3 安装方位

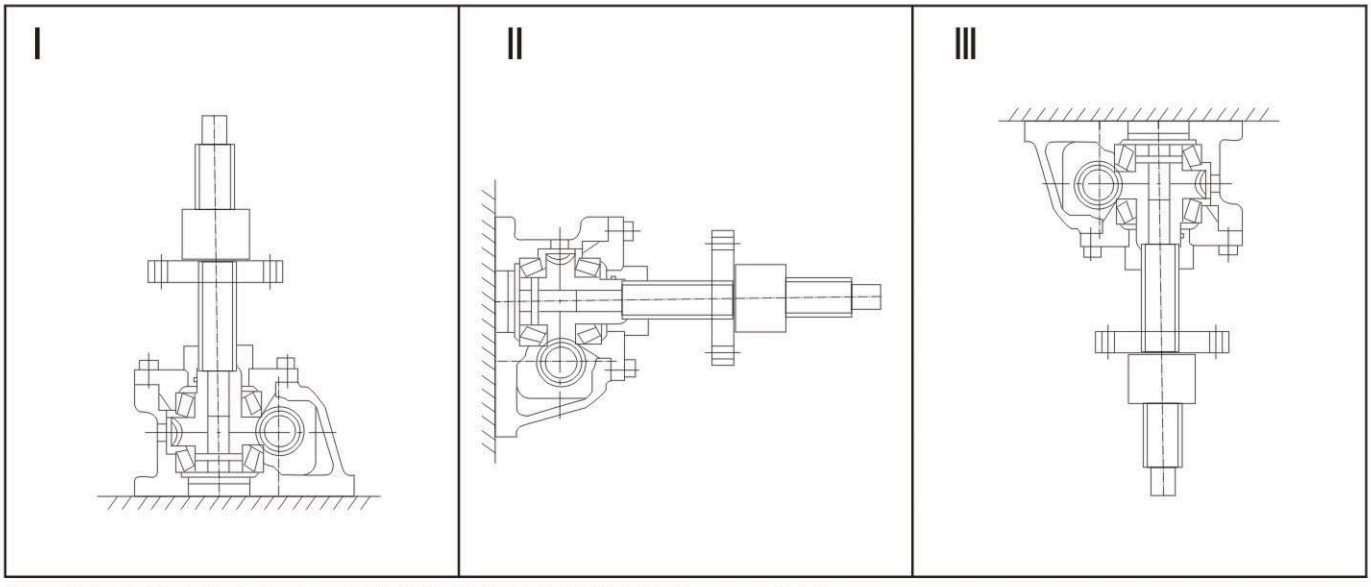


11.3.2.2 活动螺母的安装方向（H，K）

选 型和型号表示方法中，还需注明螺母的放置方向（如下图）。



11.3.2.3 安装方位（Ⅰ、Ⅱ、Ⅲ）



注：采用Ⅲ型安装方位时，底脚安装螺栓的性能等级须为10.9级以上。

升降机主要性能参数表

型号		SWL1	SWL25	SWL5	SWL10	SWL15	SWL20	SWL25	SWL35	SWL50	SWL75	SWL100
最大起升力 KN		10	25	50	100	150	200	250	350	500	750	1000
丝杆螺纹尺寸		Tr22x5	Tr30x8	T42x7	T58x12	T58x12	T65x12	T90x16	T110x16	T120x16	T130x18	T150x24
丝杆底径 d3		16.5	21	34	45	45	52	72	92	102	110	124
丝杆螺矩 L1		5	8	7	12	12	12	16	16	16	18	24
最大拉力 KN		10	25	50	100	150	200	25	350	500	750	1000
蜗轮副传动比 i	P	3/11	1/8	1.6.4	1/8.3	1/8.3	1/8	3/31	3/32	3/32	3/38	3/46
	M	1/22	1/25	1/25	1/24	1/24	1/24	1/27	1/29	1/38	1/33	1/40
蜗杆每转行程	P	1.36	1	1.25	1.44	1.44	1.56	1.55	1.5	1.5	1.421	1.565
	M	0.227	0.32	0.32	0.5	0.5	0.5	0.59	0.55	0.474	0.485	0.5
满载时蜗杆扭矩 N.m	P	6.5	18	39.5	119	179	240	366	464	856	1380.5	2040.9
	M	2.9	8.86	19.8	60	90	122	217	253	453.3	761.3	1278.3
效率%	P	21	22	23	20.5	20.5	19.5	16	18	15	13	13
	M	12	11	11.5	13	13	12.8	9	11	10	8	8
空载扭矩 To(N·m)		0.29	0.02	1.4	2.0	2.6	3.9	6.8	123	19.6	29.4	39.2
行程的重量 kg		5.5	7.7	1.8	27	33	42	75	92.2	248	370	748
功率 kW		P=Txn/9550[T:扭矩(N.m) n:转速(r/min)]										
润滑剂		合成钙纳基润滑脂 ZGN-1或 ZGN-2（-20℃~100℃）										
最大行程		300	400	770	1000	800	980	1500	1500	2000	2000	2000
拉力负荷行程可加大												

注意事项:

1）选择升降机时不论静载、动载、冲击载荷均不得超过其允许承受的最大载荷，根据安全系数、使用行程、校对丝杆的稳定性选择具有充分容量的升降机；

2）一定要注意丝杆轴转速与承受的载荷进行搭配，对于升降 机的容许最大载荷、容许外加负载、容许丝杆轴的旋转速等项目进行校验，如果超过产品的数据将会造成升降机设备整体的重大损伤；

3）升降机在工作时其减速部表面温度应控制在—15℃~80℃的范围以内，确保活动螺母表面温度也在上述范围以内；

4）输入轴容许转速为1500r/min，输入轴不得超过此转速；

5）SWL不可连续运转：单台升降机的负荷时间率（%ED）以30分为单位计算，SWL（梯形丝杆类型）的负荷时间内不得超过20%ED。

$$\text{负荷时间率\%ED}=\frac{\text{1动作周期的工作时间}}{\text{1动作周期的工作时间+1动作周期的停歇时间}}\times 100\%$$

6）对于在同一轴线上联接数台升降机时，请务必对输入轴强度进行校核，使每台升降机所承担的扭矩都应在其容许输入轴扭矩以内；

7）驱动源的起动扭矩应确保在使用扭矩的200%以上；

8）在零摄氏度以下工作时因受润滑油粘性变化的影响使得整机效率下降，所以必须选有充足的驱动源；

9）SWL型理论上具有自锁功能，但工作在振动冲击较大的场合时会导致自锁功能失灵，因此须外加一制动装置或 选择带有制动的驱动源。

10）升降机使用的环境如下：

使用场所	室内无雨水侵入的场所
周围空气	灰尘为一般工厂状态
环境温度	—15℃~10℃
相对湿度	85%以下

11）当升降机工作在多灰尘的场所中时请务必选择防尘罩伸缩套附件来保护丝杆，在室外使用时请务必考虑使用罩壳等装置，使机器不直接受到风吹雨打；

12）在升降机工作时，不得进行人为的强行停机，否则将使升降机受到严重破损；

选型方法:

升降机型号的确定：

计算总机的当量载荷Ws（N）

Ws=最大载荷Wmax× 使用系数f1（N）

被驱动设备系数（f1）表：

载荷性质	使用举例	被驱动设备系数(f1)
无冲击载荷，负荷惯性小	开关、阀门传送带切换装置	1.0~1.3
轻微冲击载荷，负荷惯性中等	各种移动装置；升降用各种升降机	1.3~1.5
大冲击振动载荷，负荷惯性大	用台车搬运东西；保持压延滚轮的位置	1.5~3.0

计算单台升降机的当量载荷W $W=\frac{WS}{\text{联动台数}\times\text{联动系数fd}}$

联动系数

联动台数	1	2	3	4	5~8
联动系数	1	0.95	0.9	0.85	0.8

确定升降机型号：

充分考虑载重，速度，行程，效率，驱动源后暂时选定型号根据使用行程、环境条件、输出顶端的联接方式，确定升降机的整体型号。

输入功率校核：

负载所需输入功率与许容量最大输入功率相比较如果超过请提高型号或降低丝杆轴转速再计算。

负载所需输入功率计算

所需输入轴转速 N1（r/min）	$n_1=\frac{V}{L1}\times i$
所需输入轴扭矩 T1（N·m）	$T_1=\frac{W\times L1}{2\pi\times i\times\eta}+T_0$
所需输入功率 P1（kW）	$P_1=\frac{T1\times n1}{9550}$

V：升降机丝杆轴(活动螺母)升降速度mm/min
L1：丝杆螺距(mm) i：减速比
W：单台升降机当量无荷（N）π：圆周率
η：升降机的综合效率 T0：空载扭矩（N.m）
(L1、i、η、TO参照性能参数表)

丝杆稳定性校核

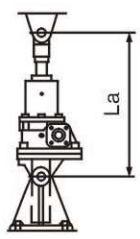
当丝杆承受轴向压缩载荷时，请对其进行稳定性校验，如超过其临界载荷值请提高型号后再计算。

升降机丝杆临界稳定载荷通过以下公式计算：

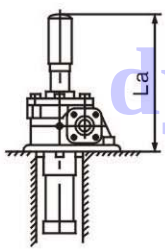
$$P_{CR}=fm\times\left(\frac{d^2\ ^2}{La^3}\right)$$ 确保 $$P_{CR}>W\times SF(SF=4)$$

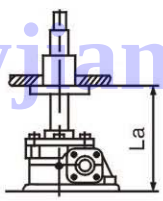
PCR：临界载荷（N） d3：丝杆底径mm(参照性能惨数表) fm：支撑系数 La：作用点间距离，mm
W：单台升降机当量载荷（N） SF：安全系数（一般SF=4）

丝杆轴稳定性校验时，La（La值计算根据各型号尺寸）与fm（支撑系数）选取如下：

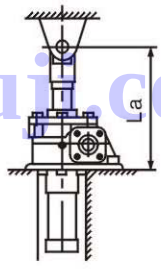


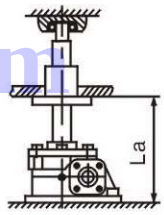
两端支撑$fm=10\times10^4$

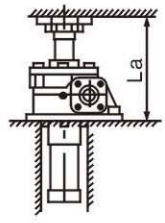




底座固定轴端自由 $fm=2.5\times10^4$







底座固定轴端支撑或固定 $fm=2.5\times10^4$

临界转速校核

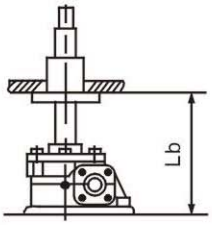
如为活动螺母选型时，请务必将丝杆轴转速控制在临界转数以下，若超出临界转速，请提高型号再计算。

$$n_c=\frac{96\times fn\times d_3\times10^6}{L_b^2}$$ $$n_s=\frac{n1}{i}$$

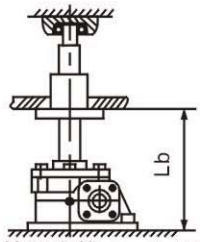
nc:临界转速 r/min
d:丝杆底径 mm(参照性能参数表)
fn:长度系数
Lb:支撑间距离 mm

ns:丝杆转速r/min
n1:输入速度r/min
i:减速比

丝杆轴转速样难时，Lb（Lb值计算根据各型号尺寸）与fn（长度系数）选取如下：



轴端自由 fn=0.36



轴端支撑 fn=1.56

请确保：nc>ns

计算举例：SWL200在输入转速为1200r/min，轴端支撑下运转，根据外形尺寸与传动能力表查得：

d3=72　　Lb=1437

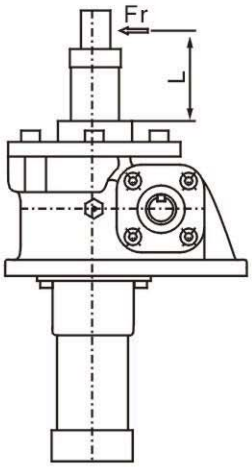
$$ns=\frac{n_1}{i}=\frac{1200}{8}=150r/min$$

$$nc=\frac{96\times fn\times d_3\times 10^6}{L_b^2}=\frac{96\times 1.56\times 72\times 10^6}{(1437)^2}=5222r/min$$

$$nc=5222r/min>ns=150r/min\cdots\cdots OK.$$

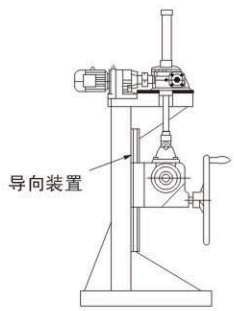
当有横向载荷时，请外加导向器。

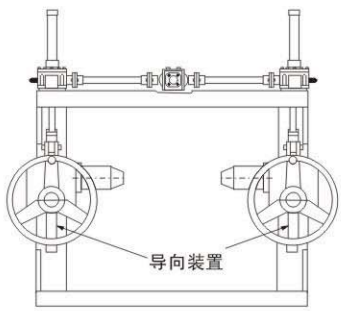
SWL许用横向载荷

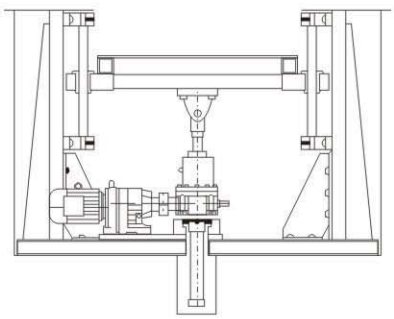


Fr(N) / L(mm) \ Type	010	025	050	100	150	200	300	500	750	1000
100	318	570	2500	4010	4610	8210	38200	85300	73500	186200
200	159	290	1250	2010	2300	4110	23000	50400	56800	145000
300	106	190	830	1340	1540	2740	15300	33600	46100	104700
400	76	140	620	1000	1150	2050	11400	25200	39300	78500
500	64	110	500	800	920	1640	9100	20200	33900	62800
600	53	100	420	670	770	1370	7600	16800	29900	62300
700	51	90	360	570	660	1170	6500	14400	26700	44800
800	48	90	310	500	580	1030	5700	12600	24100	39200
900	45	90	280	450	510	910	5000	11200	22000	34800
1000	42	90	250	400	460	820	4500	10100	20200	31300

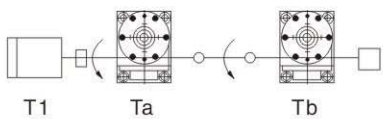
SWL超过许用横向载荷时，请外加导向装置，举例如下：







当升降机传动配置为串联时（即同一轴线配置了两个或以上数量的升降机）如图须对各升降机输入轴端进行强度校核；



Ta：为升降机a的所需输入扭矩

Tb：为升降机b的所需输入扭矩

电机必需的扭矩T1=Ta+Tb<升降机a的容许输入轴扭矩

升降机选择举例：

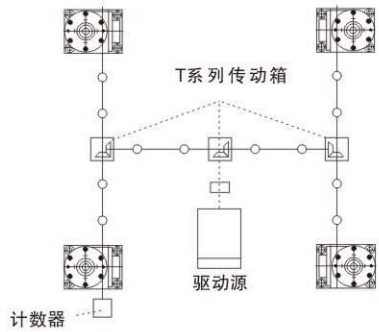
例题：4台联动机，结构如下图所示的4台联动模式，工厂内保持常温，有少许灰尘，有横向负荷在升降机侧面设置了导向器，安装状态采用底座固定，轴端采用一固定一支撑，电源为三相380V/50HZ，使用频

率为2次/小时 ×8小时

1、最大轴向载荷：88.2KN/4台

2、升降速度：10mm/s（600mm/min）

3、使用行程：260mm



升降机型号确定：

1>.计算总机当量载荷Ws（取被驱动设备系数为1.3）

$Ws=Wnax\cdot f1=88200\times1.3=114660N$

2》.计算单台当量载荷W

$$W=\frac{114660}{4\times0.85}=33724N$$

3>.暂定型号：

考虑速度、效率、驱动源、载重后暂定选择SWL10（参照性能参数表）

4>.行程校核：

使用行程为260mm，充分考虑余量后选定行程为300mm（参照SWL10尺寸表）

5>.输入功率校核：

（1）所需输入功率计算：

① $n1=\frac{V}{L1}\times i=\frac{0.60}{0.012}\times8.3=415r.min$

② $T_1=\frac{W\times L_1}{2\pi\times i\times\eta}+T_0=\frac{33724\times0.012}{2\times3.14\times8.3\times0.205}+1.34=39.2Nm$

③ $P_1=\frac{T1\times n_1}{9550}=\frac{39.2\times415}{9550}=1.7kW$

（2）参照性能参数表，P1max=2.2kW>P……OK

Pmax=119×(1500/8.3)/9550=2.2kW

6>.丝杆稳定性校核：

因为施加压缩载荷，根据传动能力表及外尺寸

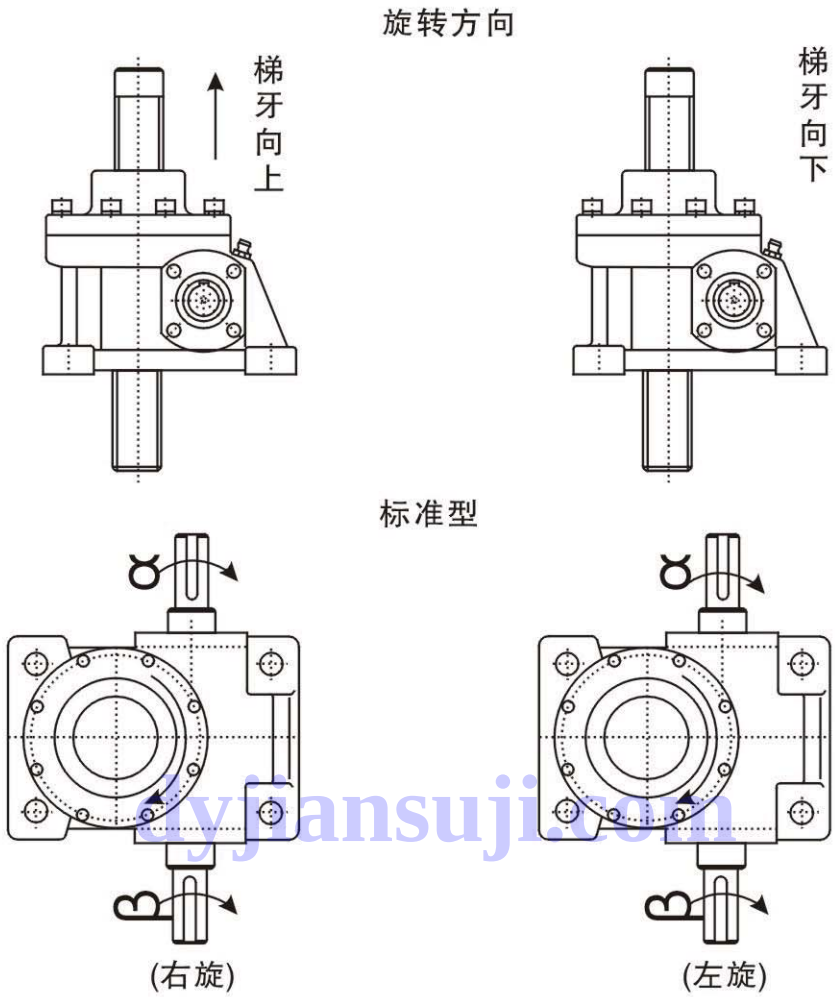
图得出：

$d_3=45\quad La=604+33=637\quad fm=20\times10^4\quad SF=4$

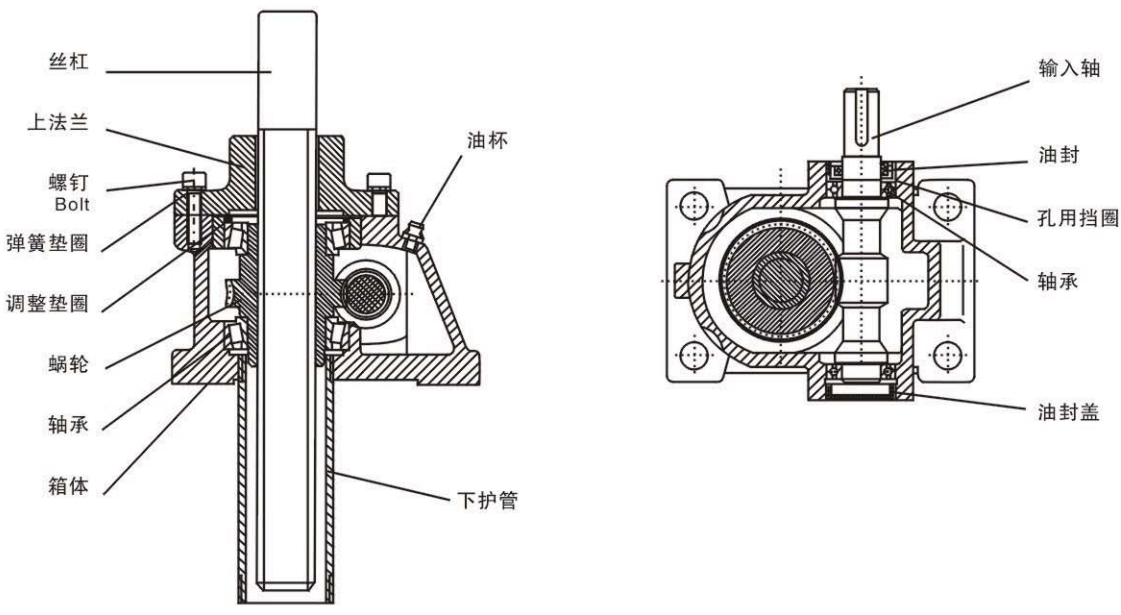
$$P_{CR}=fm\times\left(\frac{d_3^2}{La}^2\right)=20\times10^4\times\left(\frac{45^2}{637}^2\right)=2021162N$$

$$P_F=\frac{P_{CR}}{SF}=\frac{2021162}{4}=505290>W=33724\quad\cdots\cdots OK$$

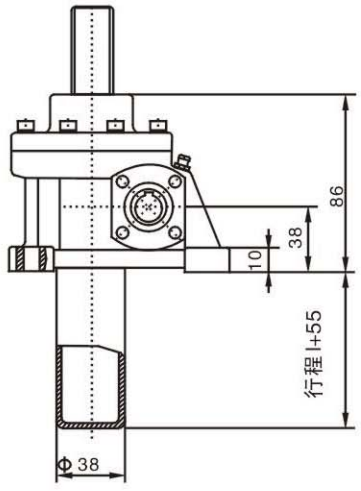
输入转向与丝杆上下运动关系如下：



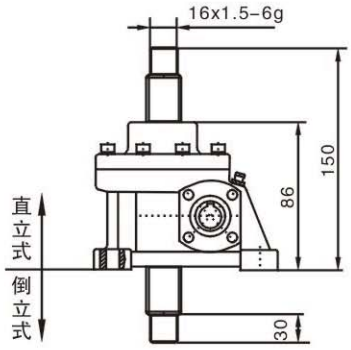
SWL系列蜗杆升降机结构示意图



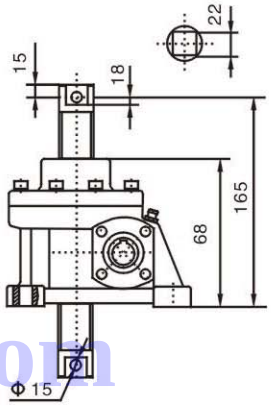
SWL1.0



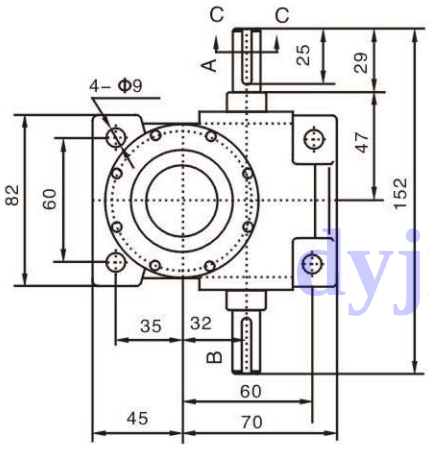
S型(牙口式)



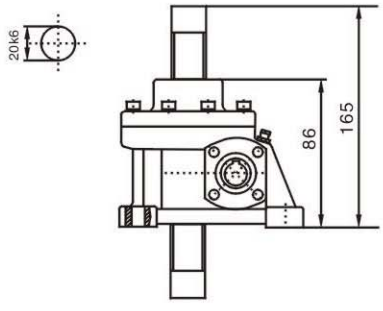
H型(栓孔式)



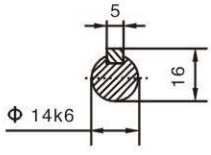
双输入

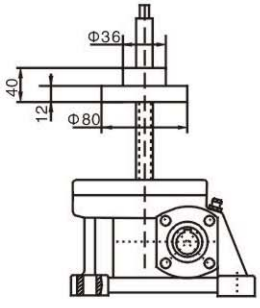


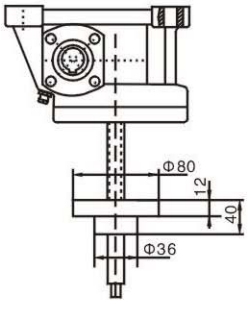
R型(平口式)

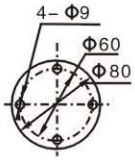


C-C

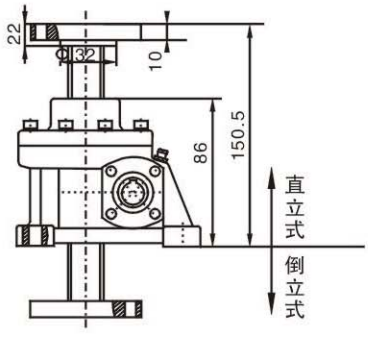




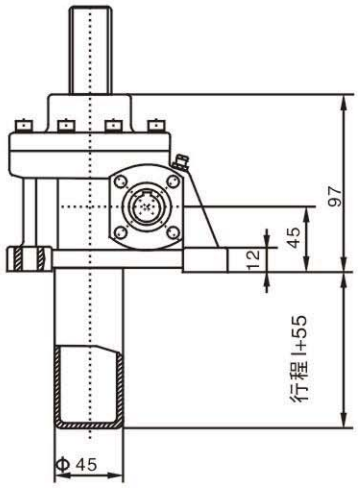




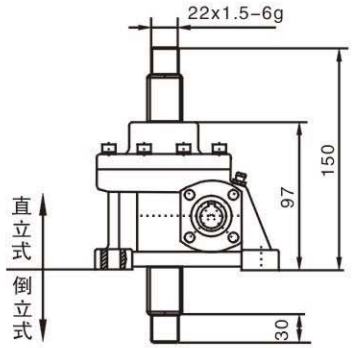
T型(顶板式)



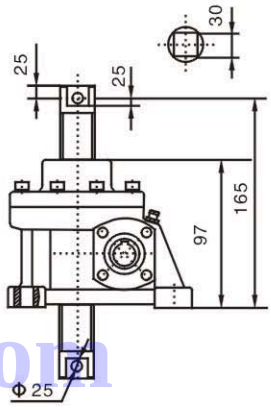
SWL2.5



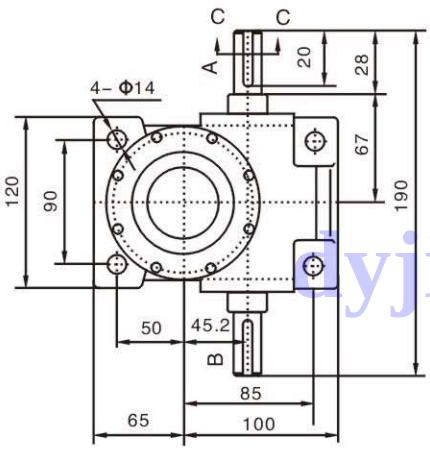
S型(牙口式)



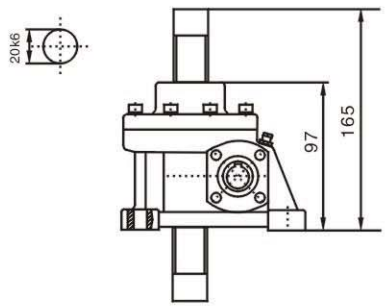
H型(栓孔式)



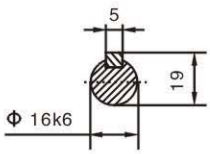
双输入

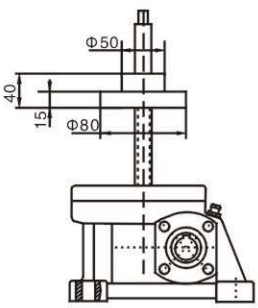


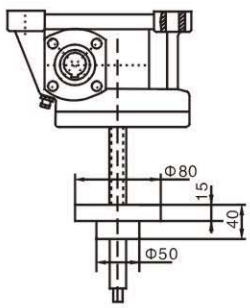
R型(平口式)

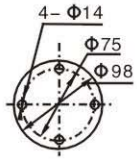


C-C

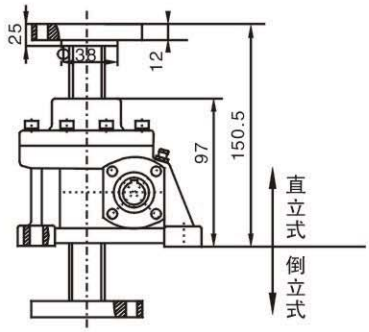




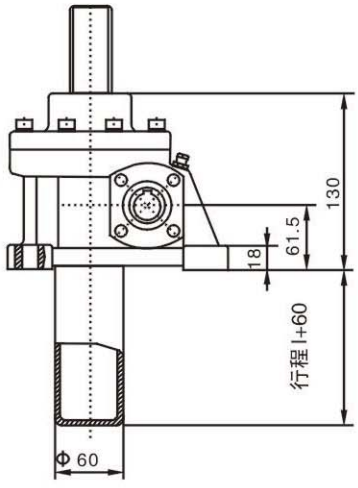




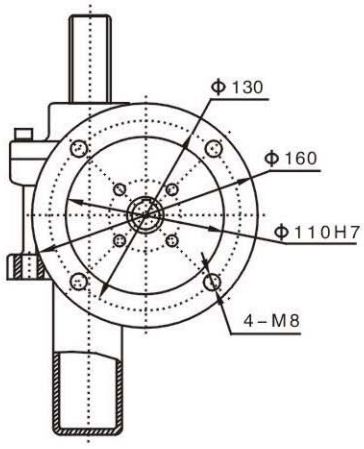
T型(顶板式)



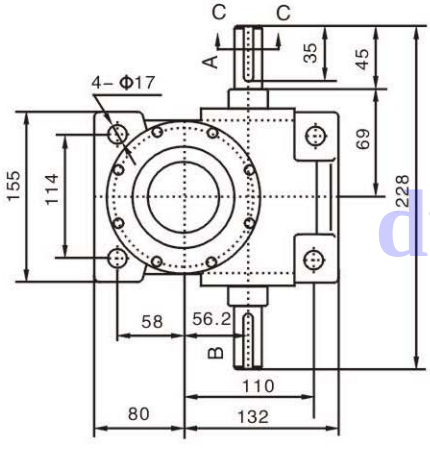
SWL5

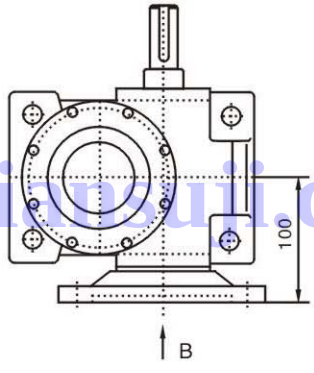


双输入



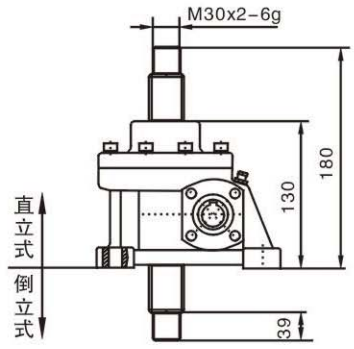
直联双输入



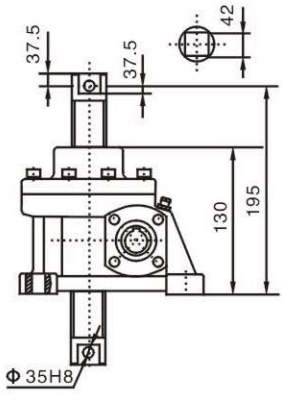


直联单输入

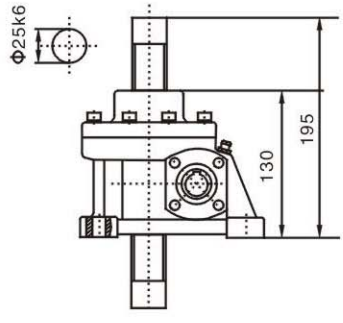
S 型(牙口式)



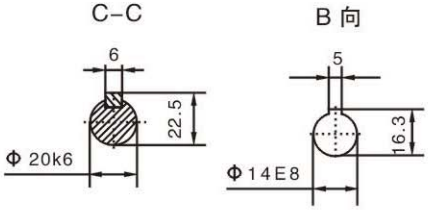
H型(栓孔式)

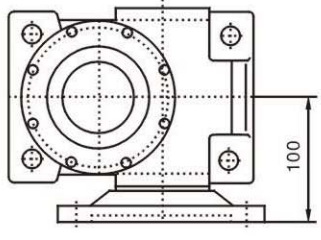


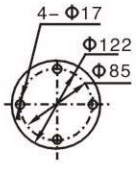
R型(平口式)

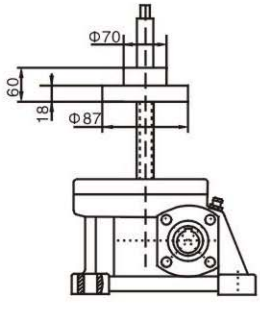


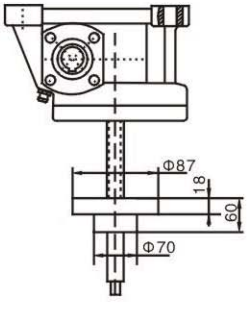
T型(顶板式)

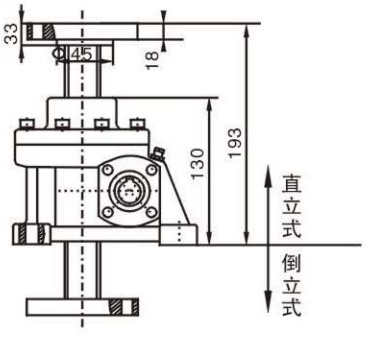




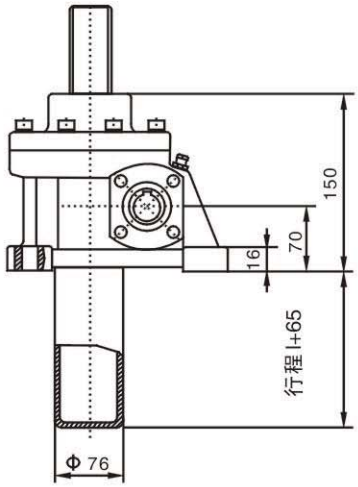




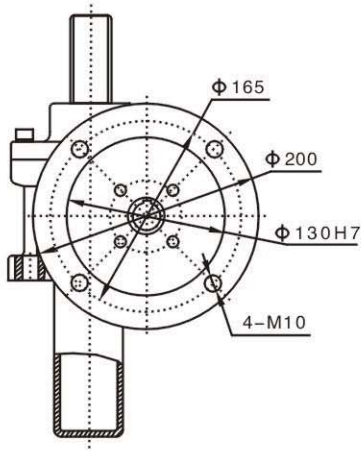




SWL10
SWL15

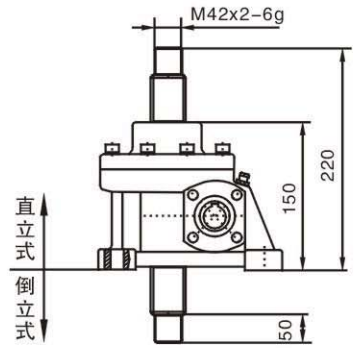


双输入

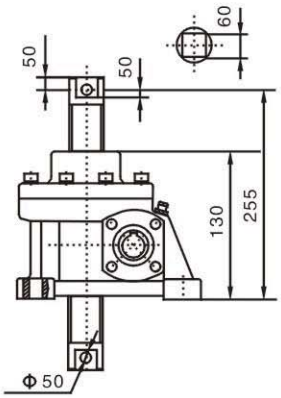


直联双输入

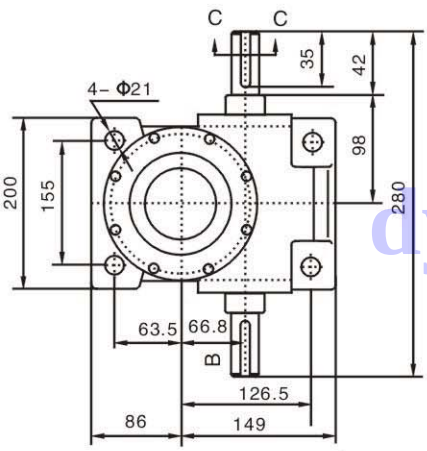
S 型(牙口式)

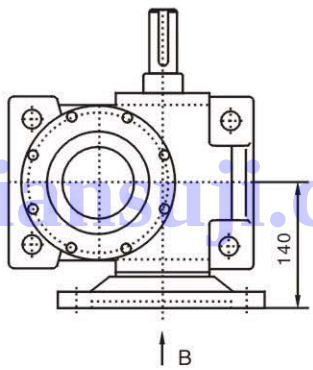


H型(栓孔式)

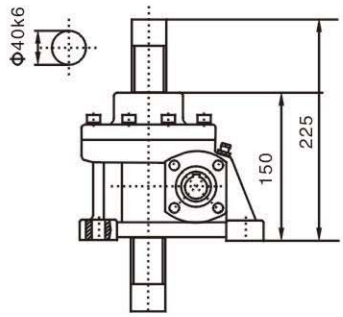


R型(平口式)



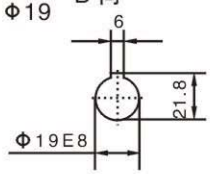


直联单输入

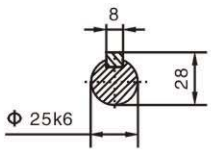


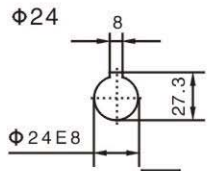
T型(顶板式)

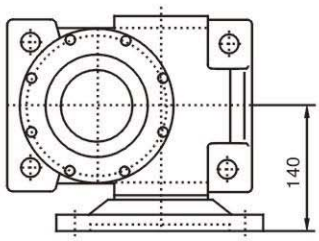
B 向

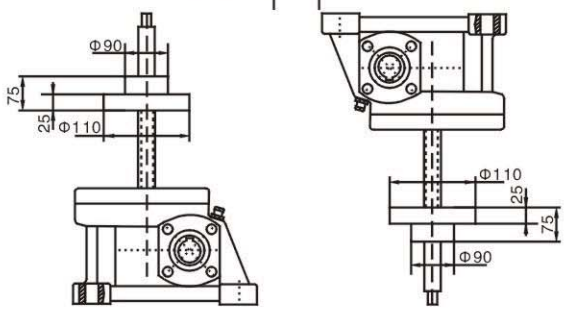


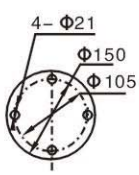
C–C

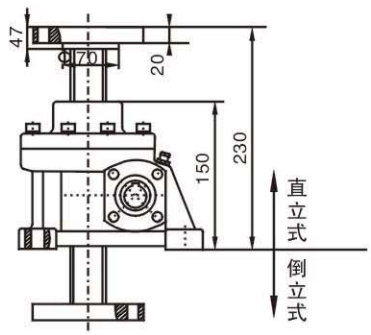




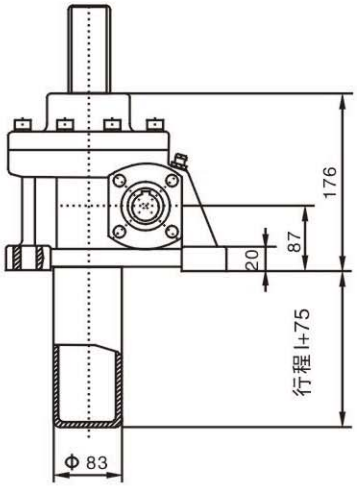




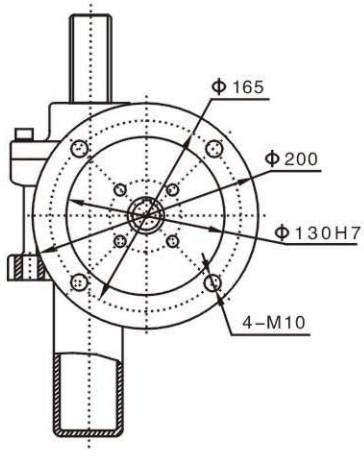




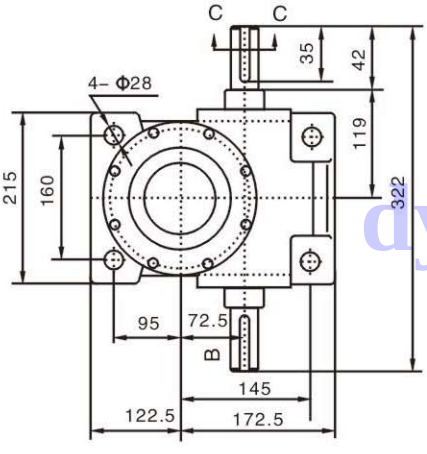
SWL20

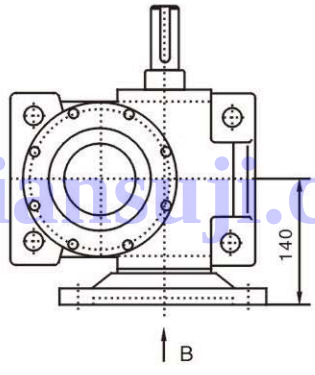


双输入



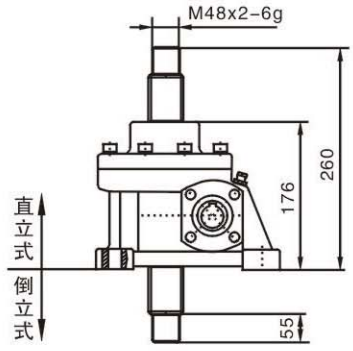
直联双输入



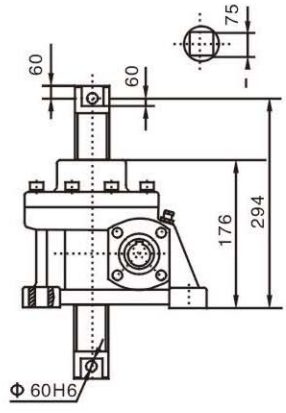


直联单输入

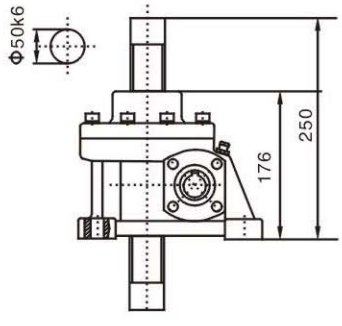
S 型(牙口式)



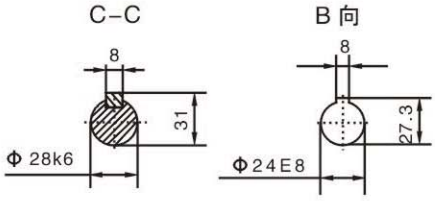
H型(栓孔式)

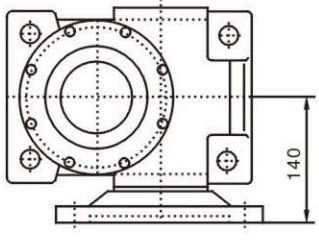


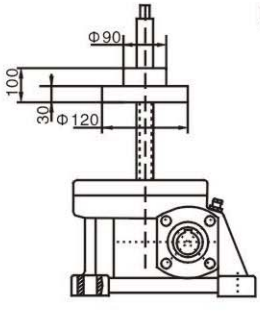
R型(平口式)

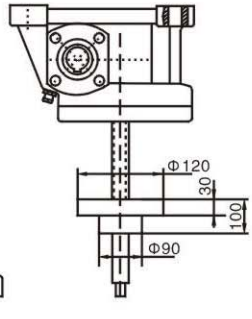


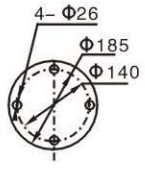
T型(顶板式)

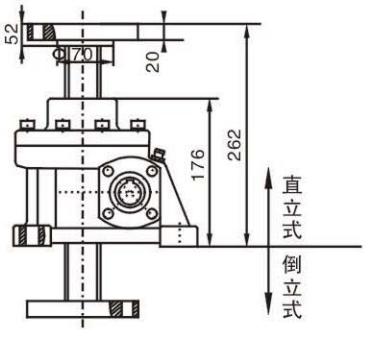




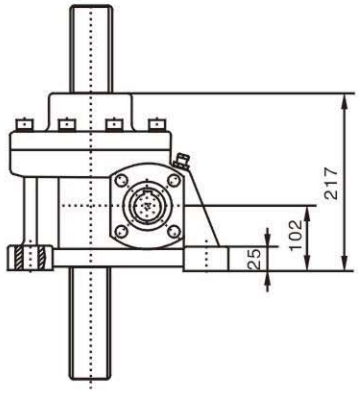


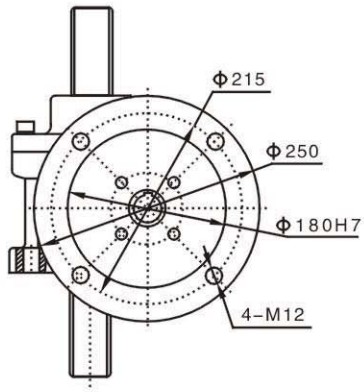




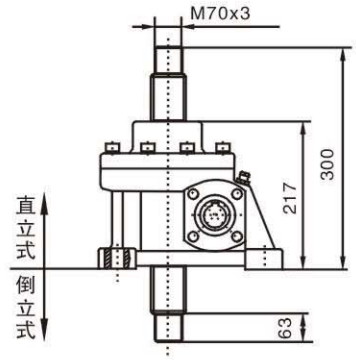


SWL25



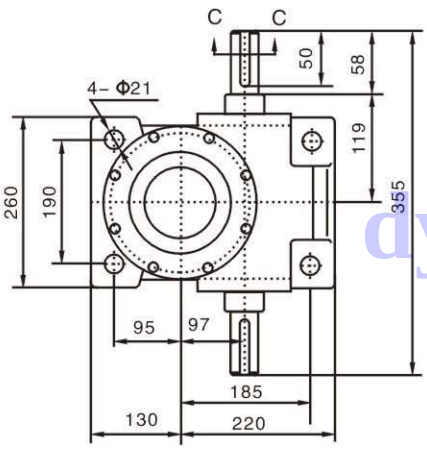


S 型(牙口式)

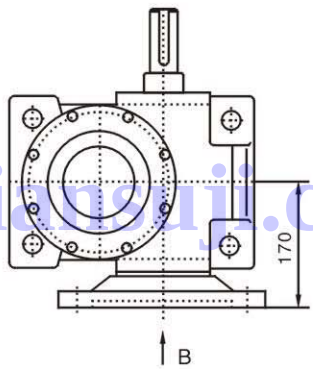


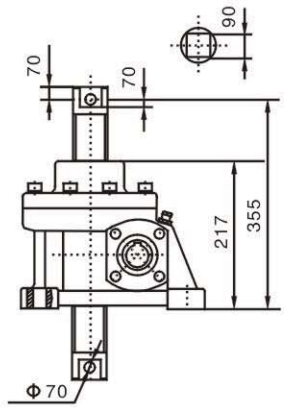
H型(栓孔式)

双输入

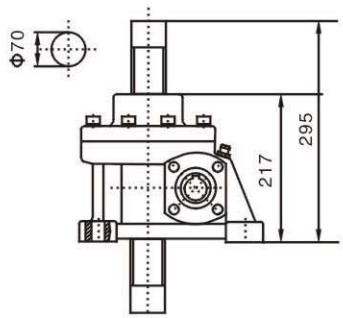


直联双输入



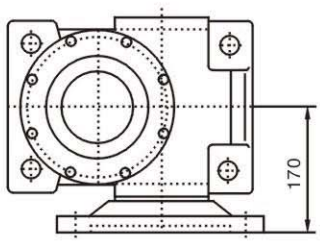


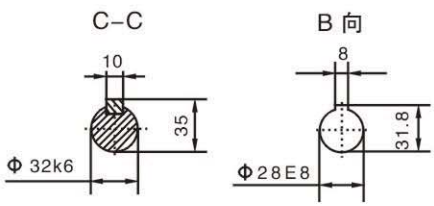
R型(平口式)

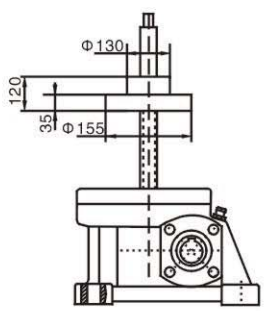


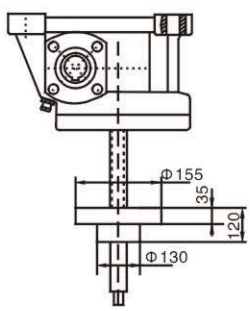
T型(顶板式)

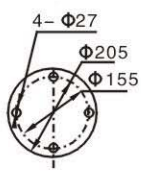
直联单输入

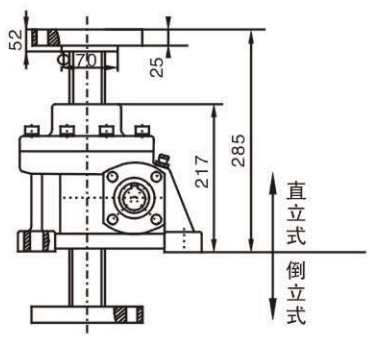




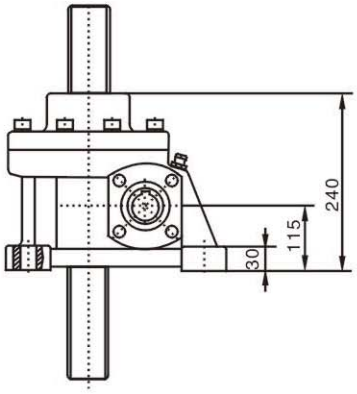


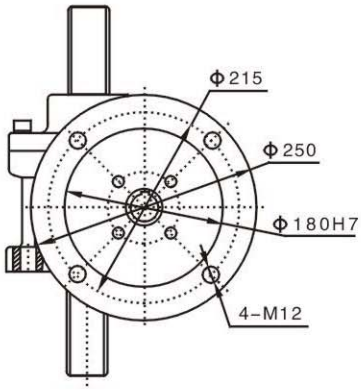




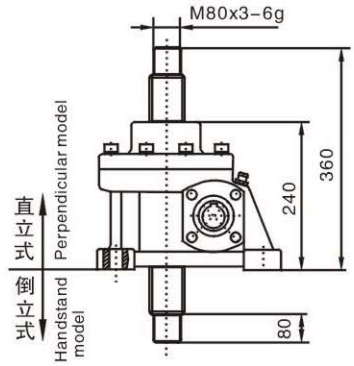


SWL35



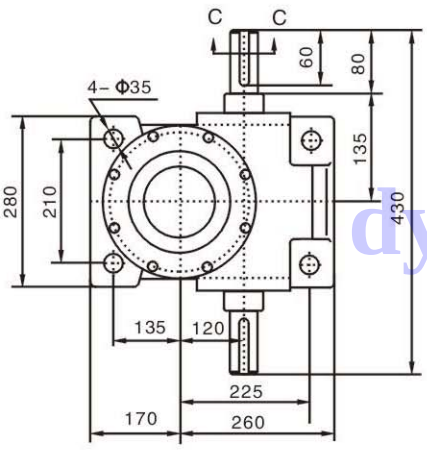


S 型(牙口式)

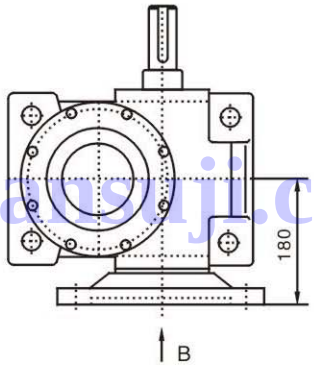


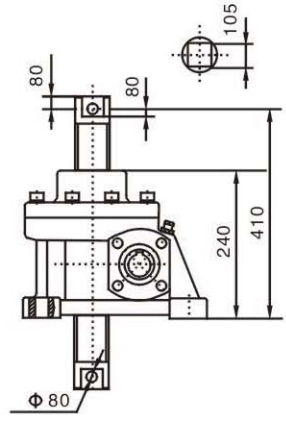
H型(栓孔式)

双输入

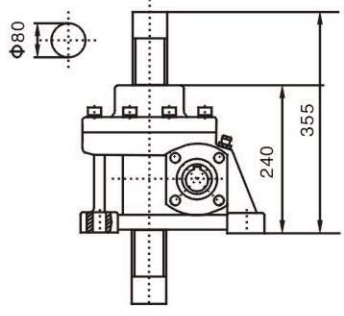


直联双输入



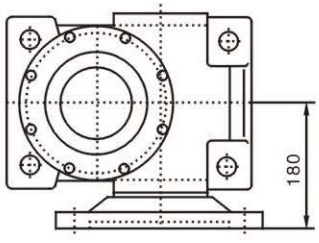


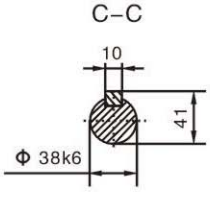
R型(平口式)

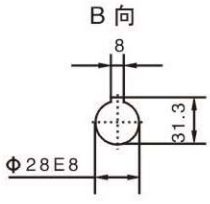


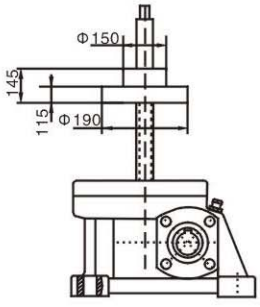
T型(顶板式)

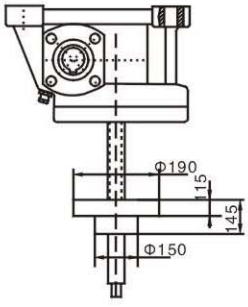
直联单输入

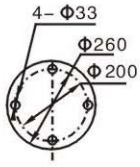


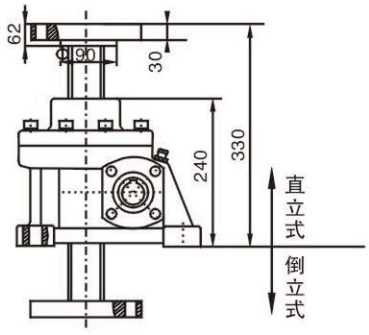




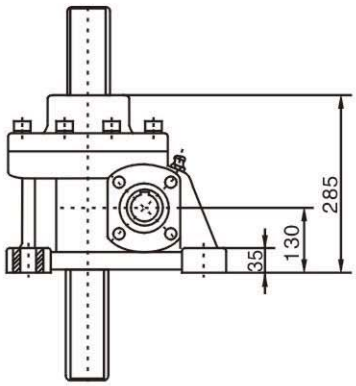


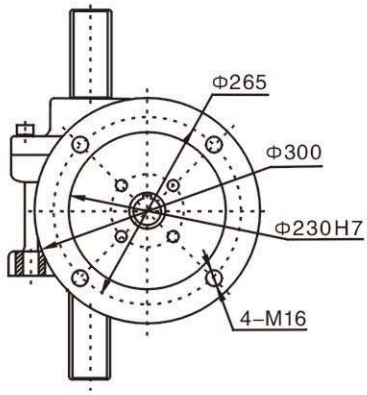




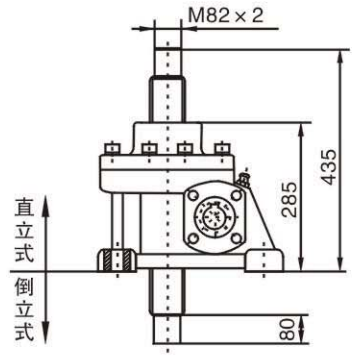


SWL50



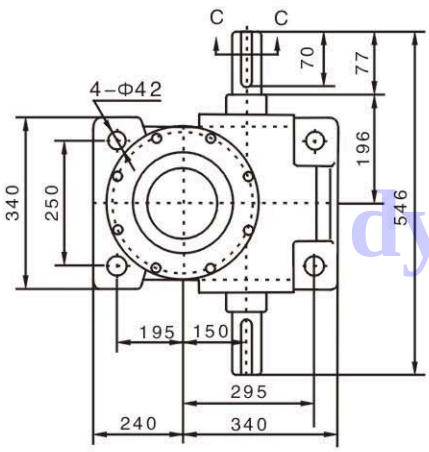


S 型(牙口式)

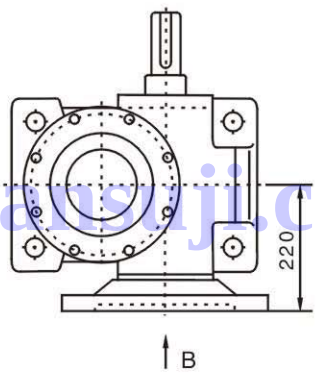


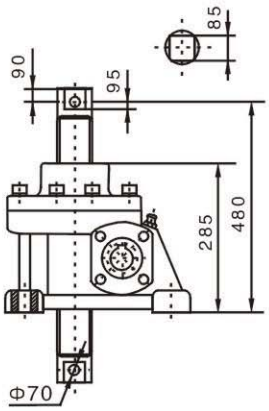
H型(栓孔式)

双输入

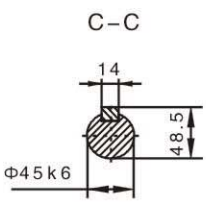


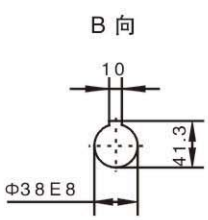
直联双 输入



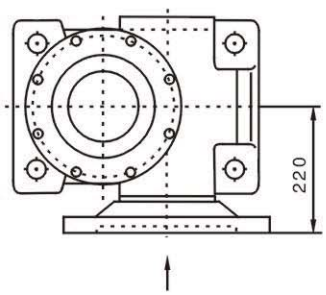


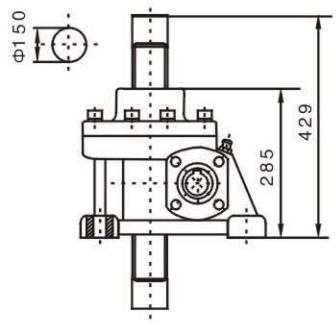
R型(平口式)



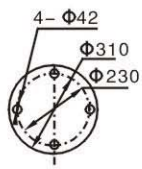


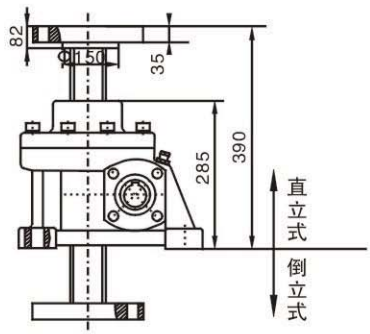
直联单 输入



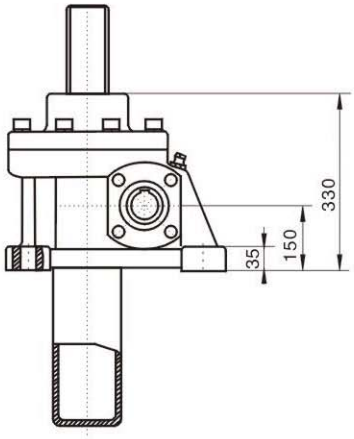


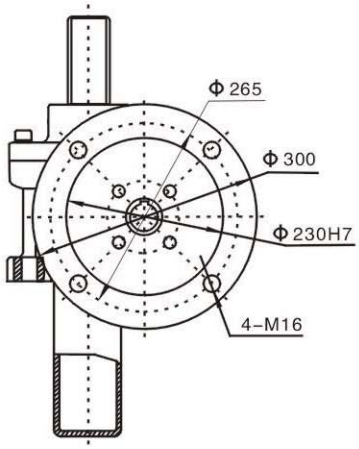
T型(顶板式)



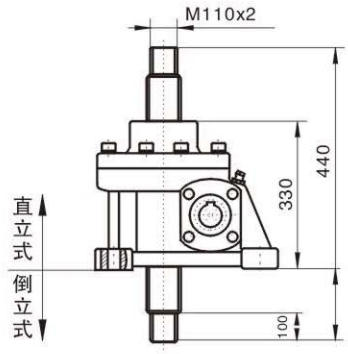


SWL75



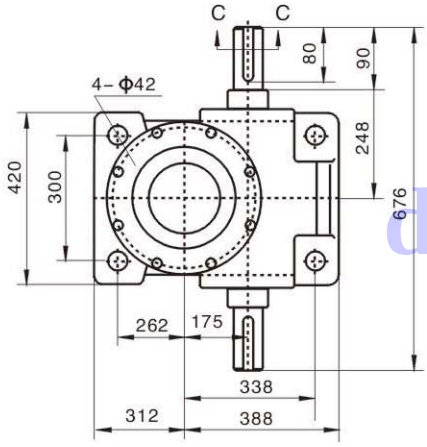


S 型(牙口式)

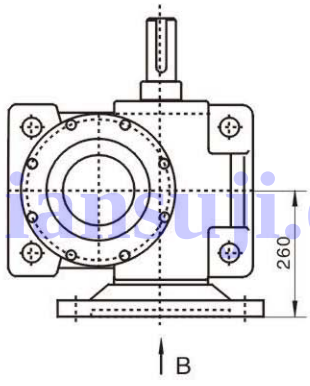


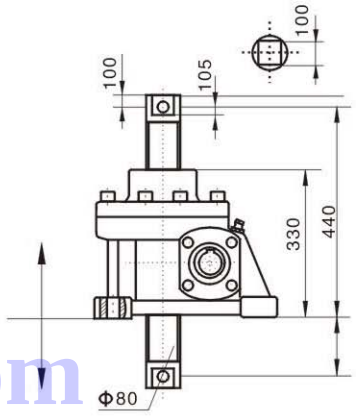
H型(栓孔式)

双输入

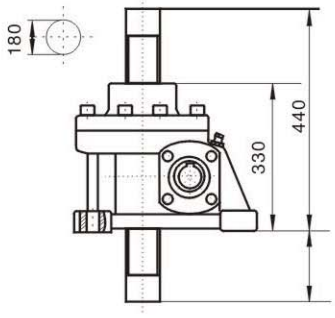


直联双输入

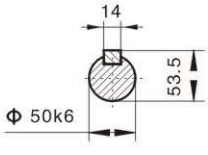




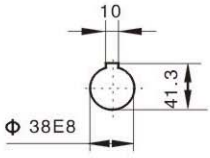
R型(平口式)



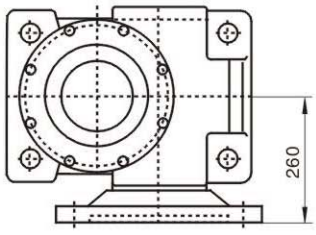
C-C

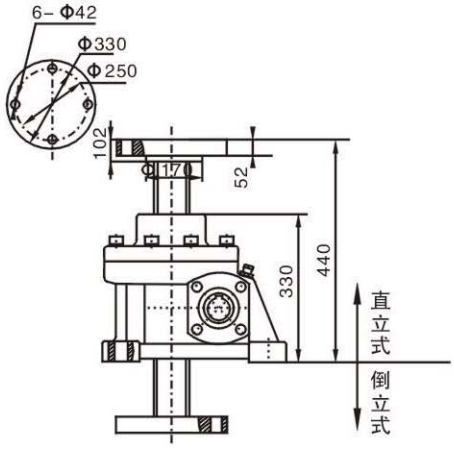


B 向

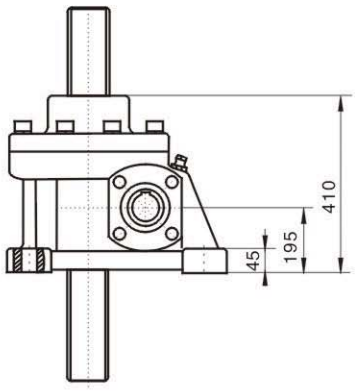


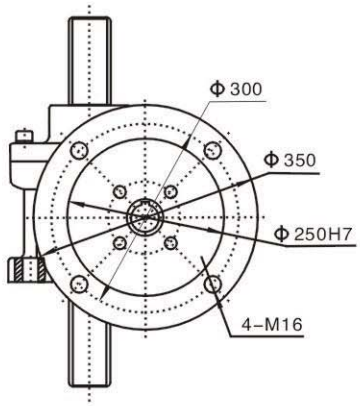
直联单输入



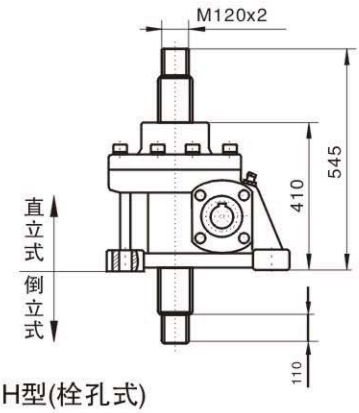


SWL100



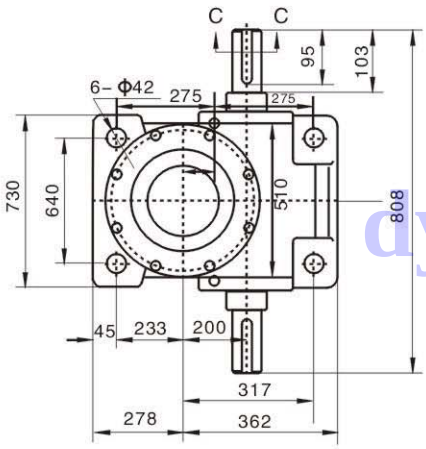


S 型(牙口式)

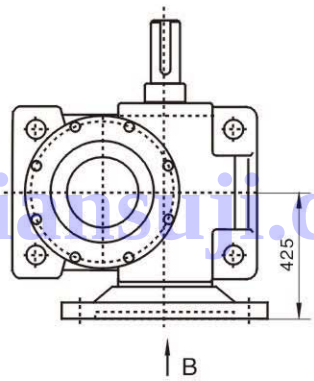


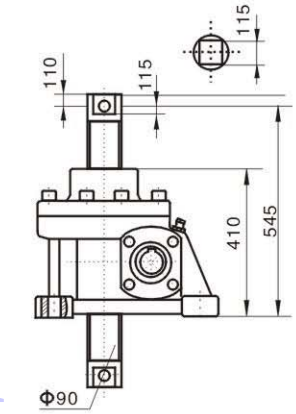
H型(栓孔式)

双输入

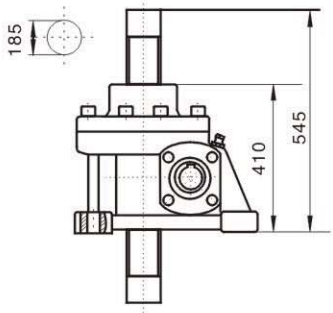


直联双输入

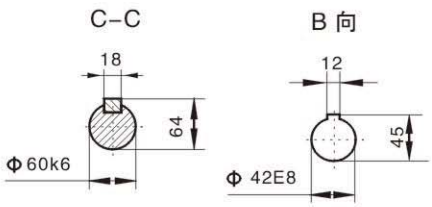




R型(平口式)



T型(顶板式)



直联单输入