LION KING

LKD系列离心式空调风机技术手册
The LKD Series Centrifugal Fan

浙江莱恩克风机有限公司
ZHEJIANG LION KING VENTILATOR CO., LTD.

企业理念
Quallfication Certificate

诚信立足，创新发展，共赢致远……

Based on Honesty,Innovation to Promote Development,Mutual Benefits Lead to Great Future .....

诚信是莱恩克公司的立身之本。莱恩克一贯奉行全方位的诚信理念，倡导企业管理层、员工诚信经营、诚信服务，倡导同社会、客户、合作伙伴和谐发展，为铸造百年企业打下扎实根基。

创新是莱恩克公司的活力之源。公司大力倡导创新精神，积极营造尊重劳动、尊重知识、尊重人才、尊重创造的良好氛围，在实践中不断推进体制、机制、科技、产品等创新活动，为社会提供更优质的产品和服务。

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Honesty is the foundation of LION KING. We consistently pursue good faith as our principle. We advocate our managers and employees operating honestly, and we advocate to develop with society, customers and partners in harmony to make our company to exist more than one hundred years.

Innovation is the source of vitality of LION KING. We advocate innovation, and actively create good atmosphere for innovation, such as respecting talents, respecting knowledge, respecting hardworking, respecting creation. And in practice, we continue to promote innovation of our system, mechanism, technologies and products.

Mutual benefits are the way to lead us to a great future. With honest attitude, pragmatic work style and innovative thinking, we' ll try our best to achieve multi-win situation for our company, employees, customers, partners and the society, which will help us for a long-time sustainable development.

Contents 目录

浙江莱恩克风机有限公司特此证明，此处所示LKD系列离心式空调风机获得了加盖AMCA印章的授权。所示额定值系根据AMCA出版物211和AMCA出版物311，所进行测试和程序确定，并符合AMCA认证额定值计划的要求。

Zhejiang Lion King Ventilator Co Ltd certifies that the LKD Centrifugal Fan series shown herein is licensed to bear the AMCA Seal.The ratings shown are based on tests and procedures performed in accordance withAMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA CertifiedRatings Program.

命名方式 Nomenclature

LKD系列风机命名方式由风机系列代号、叶轮名义直径、结构型式组成：

The model designations signify the nominal impeller outside diameters:

LKD-355 R

- 结构型式 Construction type
  - R、L型(基本型) Type R、L (Basic model)
  - K型(加强型) Type K (Enhanced model)
- 叶轮名义直径(mm) Nominal diameter of impeller (mm)
- 前向多翼离心风机系列代号 fan series with forward curved multi-blades

产品形式 Product Features

1. 旋向

LKD系列风机可分为左旋(LG)和右旋(RD)两种旋转方式，从风机皮带轮一端正视，叶轮顺时针旋转的称为右旋风机，逆时针旋转的称为左旋风机。皮带轮可左右调向，因此不受左右方向的限制。

LKD Series ventilator can be devided into two direction of rotations, left-hand rotation(LG) and right-hand rotation (RD); Viewing from end of motor outlet line if the impeller rotates clockwise, it is called right hand ventilator ;If the impeller rotates anti-clockwise, it is called left hand ventilator. The pulley can adjust its direction, left or right, therefore there is no limitation in directionality.

2. 出风口方向

LKD系列风机可按图1所示制成0°、90°、180°、270°四种出风方向。

2. Direction of Air Outlet

According to Fig 1, LKD Series ventilator can be made in four air-outlet directions:0°,90°,180°, and 270°.

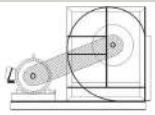
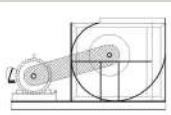
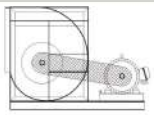
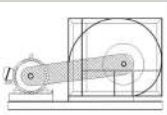
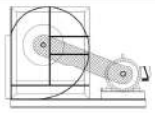
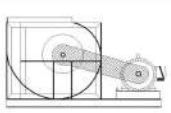
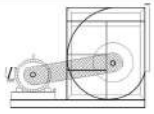
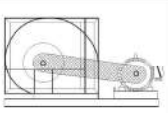
	0°	90°	180°	270°
左旋LG Left Hand				
右旋RD Right Hand				

图1(Fig1)

3．结构形式

LKD系列风机可按图2所示制成L型、LK、R型、RK型、L2型、R2型、K型、K2型。

3. Type of structure

According to Fig2,LKD series ventilators can be divided into Category L.LK.R.RK Category L2.R2、Category K.K2

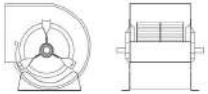
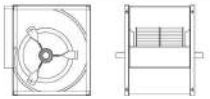
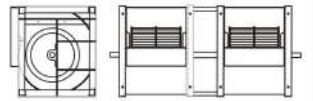
L、LK型 TYPE L.LK		L2型 TYPE L2	
R、RK型 TYPE R.RK		R2型 TYPE R2	
K型 TYPE K		K2型 TYPE K2	

图2 (Fig2)

产品结构 Constructon of Product

LKD系列风机主要由机壳、叶轮、框架、轴、出口法兰（常规配置不带法兰）构成。

1. 机壳

机壳采用热镀锌钢板制造，侧板具有符合空气动力的外形，进风口整体拉伸成型，蜗板采用点焊或咬口的方式与侧板连成一体。

2. 叶轮

前向多翼叶轮采用优质热镀锌钢板制成，叶片设计成符合空气动力的特定形状，使得效率最高、噪声最低。叶片用铆爪固定在中盘及端圈上，在最大功率连续运转时，叶轮将具备足够的刚度。后向叶轮采用优质冷轧钢板制成，按三元流理任设计的叶片焊接在经数控机床加工的中盘和端圈上，整体喷塑。叶轮出厂前按高于国家标准的内控动平衡等级全检合格。

LKD series ventilators are mainly consisted of scroll, impeller, frame bearing. shaft and outlet flange (generally is not included)

1). Scroll

The scroll is made of hot galvanizing steel sheet. Its side plate has an outline complying with aerodynamics. The scroll plat fixed to the side plates by means of “electric spot welding”. or “seam locking”

2. Impeller

Forwards curved impeller is made of high grade hot galvanizing steel sheet and is designed to a special configuration according to aerodynamics to make the efficiency highest and the noise lowest. The impeller is fixed on the middle disk plate and on the end ring with riveting grippers. The impeller has enough rigidity during continuous rotation with maximumpower. Backwards curved vadial impellers are made of high gvade cold-rolled sheet The veneev blades which are designeel in three-dimensional theory are welded between middle tray and endmost Before leaving factory, all impellers have passed all-round dynamic balance test according to the Company Standard which is higher level than National Standard.

3. 框架

R型风机框架采用热镀锌钢板剪切、折弯制成，TOX连接保证了所需的尺寸精度和应有的刚度；K型风机框架由角钢和扁钢焊接制成，表面喷塑，以保证足够的刚度和强度。

4. 轴承

LKD系列风机均采用优质滚珠轴承，并根据噪声最低来选择，该轴承设有加润滑油的孔，已预先加润滑油并自动对中；L、R型风机的轴承安装在轴承支架上，并设有防振垫圈；K型风机则采用带座向心球轴承；Z型风机采用重载荷的双列滚柱轴承的轴承箱结构。

5. 轴

风机轴采用特制钢经粗加工、调质处理及磨削加工制成，严格控制轴径尺寸公差及形位公差，每根轴均经过涂覆防锈处理。

6. 出风口法兰

法兰采用热镀锌钢板制成，法兰与蜗壳的连接采用TOX免焊工艺，外观精美，并具有足够的刚度与强度。

3. Frame

The frames for type R ventilators are made of galvanized steel angle iron bars. The cutting and bending of the frame parts, as well as the TOX connections, are formed with the use of molds to assure their high accuracy and the rigidity of the frames; The frames for type K ventilators are welded by angle steel and flat steel, and they are finished with polyestes coatings in order to assure sufficient rigidity and intesity.

4. Bearings

Ball bearings are used in all of the LKD Series ventilators. They are high quality bearings and they are selected to minimize the ventilator noise levels. The bearings are pre-lubricated, sealed, and self-centering. For typel R ventilators, the bearings are mounted using vibration resistant washers. For type K ventilators, self-aligning pillow block ball bearings are used, Type kventilators bearings are supplied with lubrication fittings. The ventilators of type Z use the beaning housing which with heavy load double-row roller bearing.

5. Shaft

The shafts are made of Special steel bars. The shafts are rough machined and then stress relieved before final machining. The shaft diameters are machined to very accurate tolerance levels and they are fully checked to assure precision fits They are coated after assembly in order to provide corrosion resistance.

6. Outlet Flange

The outlet flange is made of galvanized steel. The connections of the flange components to each other and to the scroll are made using a TOX non-welding process. This maintains a good flange appearance while also providing sufficient strength and rigidity. The outlet flange dimensions are provided in Figure 3.

风机性能 Performance of Ventilator

1. 该样本中风机性能均指在标准状态下的性能，即风机进气状态为：

进气压力	P_a = 101.325KPa
进气温度	t = 20 ℃
进气气体密度	ρ= 1.2Kg/m³

若用户实际使用的气体进气状态或使用的风机转速改变时则可按下列关系式换算：

$$\frac{Q_0'}{Q_0}=\frac{n'}{n}$$

$$\frac{P_0'}{P_0}=\frac{n'^2}{n^2}\cdot\frac{\rho'}{\rho}\qquad \frac{P_0'}{P_0}=\frac{n'^2}{n^2}\cdot\frac{Pa'}{Pa}\cdot\frac{273+t}{273+t'}$$

$$\frac{Nin_0'}{Nin_0}=\frac{n'^3}{n^3}\cdot\frac{\rho'}{\rho}\qquad \frac{Nin_0'}{Nin_0}=\frac{n'^3}{n^3}\cdot\frac{Pa'}{Pa}\cdot\frac{273+t}{273+t'}$$

1. The ventilator performance in this catalogue denotes the performance in standard conditions. It denotes air inlet conditions of ventilator as follows:

Air inlet pressure	P_a = 101.325KPa
Air temperature	t = 20 ℃
Inlet gas density	ρ= 1.2Kg/m³

If the practical air inlet conditions of customer or the speed of the operating ventilator changes,the conversion can be carried out according to the following expression:

$$\frac{Q_0'}{Q_0}=\frac{n'}{n}$$

$$\frac{P_0'}{P_0}=\frac{n'^2}{n^2}\cdot\frac{\rho'}{\rho}\qquad \frac{P_0'}{P_0}=\frac{n'^2}{n^2}\cdot\frac{Pa'}{Pa}\cdot\frac{273+t}{273+t'}$$

$$\frac{Nin_0'}{Nin_0}=\frac{n'^3}{n^3}\cdot\frac{\rho'}{\rho}\qquad \frac{Nin_0'}{Nin_0}=\frac{n'^3}{n^3}\cdot\frac{Pa'}{Pa}\cdot\frac{273+t}{273+t'}$$

上述式中

- 流量Q_0(m^3/h)、全压P_0(Pa)、转速n(r/min)、内功率Nin_0(Kw)由性能曲线图上查得。
- 右上角加符号“*”的则为用户实际使用气体进气状态下所需的性能参数。
- 上式中略去了相对湿度的差别。

2. 性能曲线图上的功率Nin_0是指风机的内功率。

- 风机轴功率：$Ns = Nin_0/\eta m$

式中：Ns- 风机轴功率

ηm- 风机机械效率

风机机械效率的取值方法可参照表1。

where:

- Volume Q_0(m^3/h), total pressure P_0(Pa), speed n(r/min) can be obtained from Performance chart.
- Asterisk (*) on the upper right corner denotes the performance parameter needed by the customers in practical gas inlet conditions.
- The difference in relative humidity is omitted from the above-mentioned formulas.

2. The power (Nin_0) on the performance chart the internal power of the ventilator.

- Shaft power of ventilator: $Ns = Nin_0/\eta m$

where: Ns-Shaft power of ventilator

ηm-Mechanical efficiency of ventilator

The value of mechanical efficiency of ventilator can be obtained from Table 1.

风机传动方式Way of ventilator driving	η_m
电机直联传动electric motor directly driven	1
联轴器直联传动Coupling directly driven	0.98
三角皮带传动V-belt driven	0.95

表1 (Table1)

(2)配套电机的功率: N = Ns . K

式中: N-配套电机的功率

K-电机容量安全系数

电机容量安全系数的取值方法可参照表2。

(2)The rated power of the drive motor equals the total required shaft input power multiplied by the safety factor:

N = Ns . K

where: N = rated power of drive motor

K = required safety factor

The required safety factor is provided in Table 2.

电机功率Power of electric motor(Kw)	K值Value k
≤2.2Kw	1.2
≤7.5Kw	1.15
≥11Kw	1.1

表2 (Table2)

3. 噪声：噪声等级显示在每个性能表上。LwiA为总声功率级的A计权声级。计算所得的总声功率级用表3中倍频谱的A计权衰减值换算至A声功率级。

3. Noise: The noise levels shown on each performance chart,LwiA,refer to the overall sound power “A-Weighted” levels. The computed sound power levels were converted into A-Weighted levels using adjustments to the octave band spectrum as follows:

中心频率 Center Frequency Hz	63	125	250	500	1000	2000	4000	8000
调整为A-Weighted Adjustment dB(A)	-25.5	-12.5	-8.5	-3	0	+1	+1	-1

表3 (Table3)

总声压级LpiA能利用总声能等级按如下公式计算：

无边界状态：$LpiA = Lwia - (20\log_{10} d) - 11$

室内状态：$LpiA = Lwia - (20\log_{10} d) - 7$

式中：d = 离风机距离(m)

The overall sound pressure levels, LpiA, can be computed from the overall sound power levels as follows:

Free Field Conditions: $LpiA = Lwia - (20\log_{10} d) - 11$

Room Conditions: $LpiA = Lwia - (20\log_{10} d) - 7$

Where: d = distance from fan in meters.

4. L2 型、R2型、K2型双联风机性能与 L型 、R型、K型风机曲线上所示性能比较，在压力相同情况下，双联风机性能如下：

风量	x 2
转速	x 1.05
内功率	x 2.15
噪声	+3

双联风机的性能未获AMCA International 授权。

4. Comparing the performance of the twin ventilator of Category L2 Category R2 and Category K2 with the performance of Category L Category R and K in the chart in the same condition of pressure,the twin ventilators' performance is as the following.

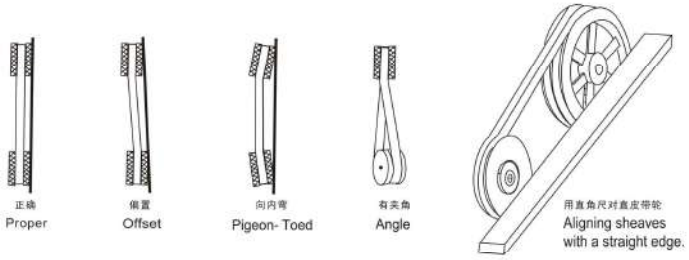
Volume	x 2
Speed	x 1.05
Inner Power	x 2.15
Noise	+3

Performance of twin ventilators are not licensed by AMCA International.

皮带转动安装 V-BELT DRIVE INSTALLATION

1. 拆除风机轴端的保护并检查有无缺口和毛刺；
2. 检查风机和电机轴之间的平行度；
3. 中心距应控制在0.7(d1+d2)<a<2(d1+d2)，前向风机皮带速度应控制在10~15m/s；后向风机皮带速度应控制在25~35m/s；
4. 将皮带轮套在轴上滑进去，不要敲击，以免损伤轴承；
5. 用一根直尺把风机和电机上的带轮对齐并紧固；
6. 把皮带套进皮带轮，不要撬、挤压，以免损伤皮带；
7. 调整张紧度直至皮带看起来松紧适度，风机运行几分钟后，再调整皮带至合适的张紧度；
8. 关掉风机，移动电机座以调整张紧度，当风机工作时，皮带紧的一边应是两个皮带轮连成的一直线，松的一边有轻微弧形。

1. Remove the protective coating from the ends of the fan shaft and assure that the shaft ends are free of nicks and burrs.
2. Check fan and motor shafts for parallel and angular alignment.
3. The center distance must be controlled as 0.7(d1+d2)<2(d1+d2); the belt speed of forward fan should be more than10m/s,but less than 15m/s, (10<v<15m/s); the belt speed of backward fan should be more than 25m/s,but less than 35m/s, (25<v<35m/s);
4. Slide sheaves on to the shafts–do not drive the sheaves on to the shafts as this may result in bearing damage.
5. Align fan and motor sheaves with a straight–edge or string, and tighten.
6. Place belts over the sheaves with carefull, otherwise the belts will be damaged.
7. Adjust the belt tension until the belts appear snug. Run the unit for a few minutes and allow the belts to set properly.
8. Switch off the fan, adjust the belt tension by moving the motor base. When in operation, the tight side of the belts should be in a straight line from sheave to sheave and there should be a slight bow on the slack side.



皮带松紧度 Belt tenstion

合适的皮带松紧度对使用寿命来说很重要太紧会给皮带和轴承带来额外的负载，降低它们的使用寿命，太松会出现皮带打滑现象而产生热能并降低使用寿命。
皮带松紧度量具可用来判断皮带是否松紧合适。量具本身带有一个尺表，根据皮带轮中心距和皮带横截面确定皮带张紧力的大小,如图4和表3。
如没有皮带张紧度量具，应调节皮带松紧至风机启动时皮带不发出尖叫声为止，如发出短促的叫声是允许的。
拉紧皮带后、开动风机之前，重新检查皮带轮的对齐情况，如有必要则重新调整对齐。新皮带在开始使用时可能有点拉伸，则应在运行几天后重新检查皮带张紧度。

A proper level of belt tension is required in order to obtain a satisfactory belt life. If the belt tension level is too high, then excessive loads will be imposed on the belts and the bearings, and this will reduce the lives of both of these components. If the belt tension level is too low, then the belt will slip. Belt slippage generates a large amount of heat, and this heat will drastically reduce the life of a belt.
Belt-tensioning gauges can be used to determine whether the belts are tensioned properly. A chart is normally supplied with the gauge which indicates the ranges of forces required to deflect the belts by a given amount to obtain the proper belt tension level. The required forces are based p u on the center distance of the sheaves and the belt cross-section. the belts are properly tensioned when the forces required to deflect the belt are within the specified range, see Fig4 and Table3.
If a belt-tensioning gauge is not available, then the belt should be tightened just enough so that the belt does not squeal when the ventilator is started. A very short period of noise during the starting of a ventilator is allowable, but a squeal lasting several seconds or longer is not acceptable. After tensioning the belts and before starting the ventilator,check to make sure that the sheaves are properly aligned.
Realign the sheaves if necessary. note that new belts may stretch alittle during inital use,so the belt tension level should be checked after afew days of operation.

与中心距有关的皮带张紧度指示
Belt tension indicator applied to mid centre distance.

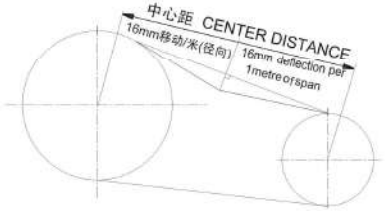


图4 (Fig4)

皮带截面 Belt Section	使皮带向下移动16mm径向距离1米所需的力 Force required to deflect belt 16mm per metre of span		
	张紧力（小皮带轮直径） Small Pulle/Diamter (mm)	牛顿	千克力 Kilogram force (Kgf)
SPZ	56-95	13-20	1.3-2.0
	100-140	20-25	2.0-2.5
SPA	80-132	25-35	2.5-3.6
	140-200	35-45	3.6-4.6
SPB	112-224	45-65	4.6-6.6
	236-315	65-85	6.6-8.7
SPC	224-335	85-115	8.7-11.7
	375-560	115-150	11.7-15.3
A	80 140	10 15	1.1 1.5
B	125-200	20-30	2.0-3.1

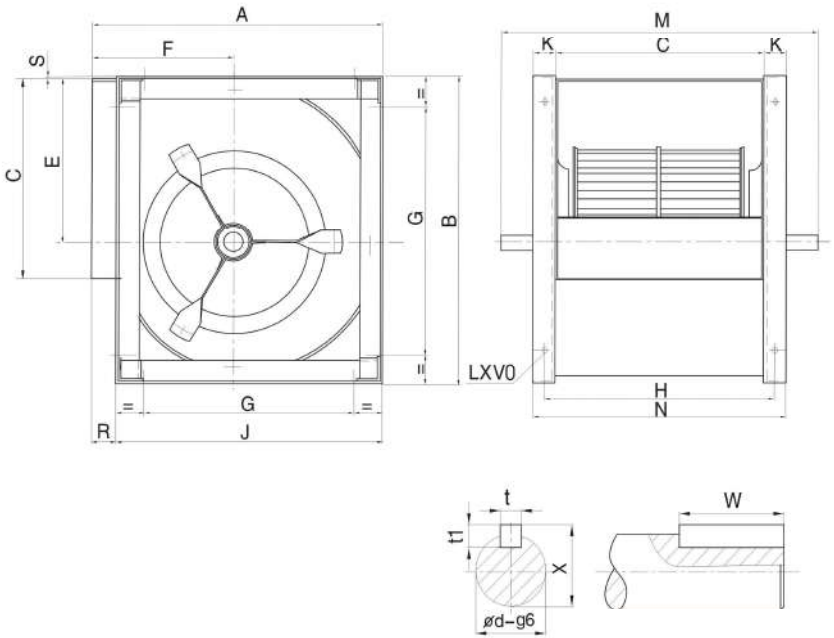
表3(Table3)

轴承润滑 Bearing Lubrication

风机使用带座轴承，可通过加油嘴注入润滑油。润滑油有效期取决于油脂类型、轴承的转速和工作温度。判断是否加油的最好办法是当加新油时观察清除下来的旧油脂，如果清除下来的油脂看起来还象是新的，可延长换油脂的间隔，如果清除下来的油脂比新的黑得多表明油脂已氧化，应缩短换油脂的间隔。

The ventilator bearings are filled with lubricant when they come from the factory, so the bearings do not require any additional grease to be supplied before starting the ventilator.
The ventilator that are equipped with pillow block bearings are provided with lubrication fittings,and these fittings allow for additional lubrication to be supplied to the bearings at regular intervals.The allowable period of time between lubrication of these bearings depends upon the operating speeds and temperatures of the bearing as well as on the type of grease used. The best way to determine the required frequency of lubrication is to inspect the condition of the grease that is discharged from the seals when new grease is added.If the discharged grease looks similar to the new grease,then a longer period of time between lubrications is possible.If the discharged grease is much darker than the new grease, then this indicates that the grease is being oxidized and more frequent lubrications of the bearings are required.

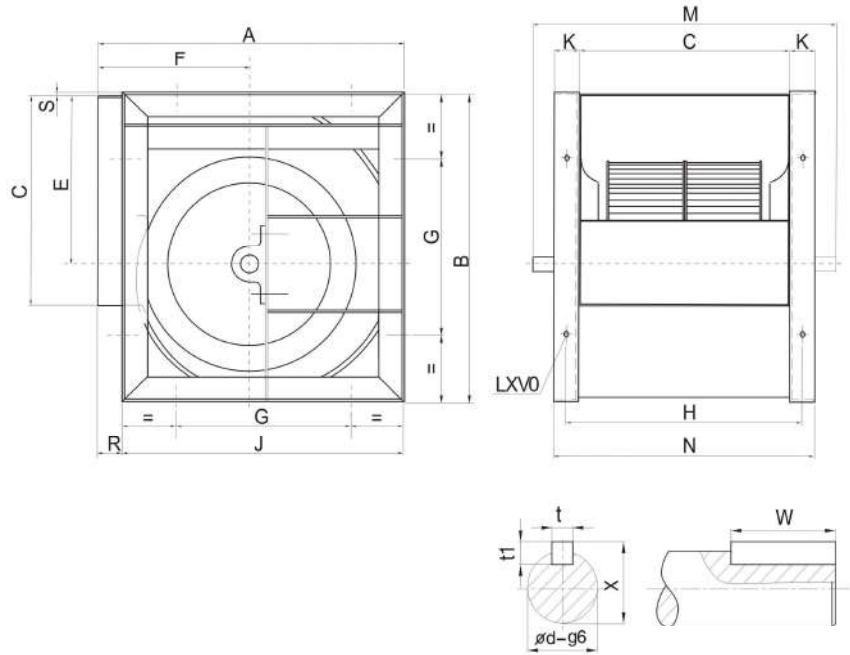
LKD-R



Model	A	B	C	E	F	G	H	J	K	M	N	R	S	t	t1	W	X	ϕd	LxV
200	343	370	256	215	164	224	281	306	25	420	306	37	4	6	6	40	22.5	20	11x16
225	383	415	288	243	180	224	313	348	25	460	338	35	3	6	6	50	22.5	20	11x16
250	419	461	322	270	195	224	347	384	25	490	372	35	4	6	6	50	22.5	20	11x16
280	466	518	361	302	215	280	391	432	30	555	421	34	5	8	7	40	28	25	13x18
315	518	578	404	340	236	280	434	480	30	600	464	38	3	8	7	40	28	25	13x18
355	578	655	453	383	261	355	493	548	40	675	533	30	6	8	7	65	33	30	13x18
400	651	736	507	431.5	290	355	547	613	40	725	587	38	4.5	8	7	65	33	30	13x18
450	726	827	569	486	322	530	609	681	40	815	649	45	5	10	8	70	38	35	13x18
500	800	914	638	538	352	530	678	750	40	885	718	50	5	10	8	50	38	35	13x18
560	893	1030	715	602	390	530	765	845	50	1000	815	48	8	12	8	70	43	40	13x18
630	999	1157	801	678.5	434	530	851	946	50	1090	901	53	7	14	9	70	48.5	45	13x18
710	1121	1303	898	765	485	630	948	1058	50	1255	998	63	7	14	9	90	53.5	50	17x22

注：表格中尺寸的单位为mm
Note：the size unitin the form is mm

LKD-K



Model	A	B	C	E	F	G	H	J	K	M	N	R	S	t	t1	W	X	ϕd	LxV
280	466	518	361	302	215	280	391	432	30	580	421	34	5	8	7	40	33	30	13x18
315	518	578	404	340	236	280	434	480	30	625	464	38	3	8	7	40	33	30	13x18
355	578	655	453	383	261	355	493	548	40	685	533	30	6	10	8	50	38	35	13x18
400	651	736	507	431.5	290	355	547	613	40	790	587	38	4.5	10	8	70	38	35	13x18
450	726	827	569	486	322	530	609	681	40	850	649	45	5	12	8	70	43	40	13x18
500	800	918	638	538	352	530	678	750	40	920	718	50	5	12	8	70	43	40	13x18
560	893	1030	715	602	390	530	765	845	50	1070	815	48	8	14	9	90	53.5	50	13x18
630	999	1157	801	678.5	434	530	851	946	50	1155	901	53	7	14	9	90	53.5	50	13x18
710	1121	1303	898	765	485	630	948	1058	50	1290	998	63	7	18	11	90	64	60	17x22
800	1250	1468	1007	862	535	710	1057	1181	50	1450	1107	69	7	18	11	90	64	60	17x22
900	1408	1648	1130	971	604	800	1180	1319	60	1570	1250	89	9	18	11	100	64	60	17x22
1000	1541	1810	1267	1066	657	900	1317	1462	60	1700	1387	79	9	18	11	100	64	60	17x22

注：表格中尺寸的单位为mm
Note：the size unitin the form is mm