



SWF Series Mixed-Flow Fan



SWF 系列混流式通风机

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SWF 系列混流式通风机列入国家级“星火”项目,由上海交通大学、浙江上风实业股份有限公司共同研制开发,具有同机号风量较离心风机大,风压较轴流风机高,可以轴向安装等特点。北京首都宾馆、亚运工程二十三个场馆、新华社大楼、五洲大酒店、北京人民大会堂、钓鱼台国宾馆等单位,上海、深圳等大城市的高级民用建筑、工矿企业相继选用,还批量出口新加坡等东南亚地区出口日本,广大用户给予噪声低、耗电省、高效区宽、安装使用较离心风机方便、运行可靠等高度评价。

SWF series mixed-flow fan has been listed in the national "Spark" item, which is newly developed both by Shanghai Jiaotong University and Zhejiang Shangfeng Industrial Holding Co., Ltd. The pressure of SWF is higher than that of axial flow fan, and the air flow rate is larger than that of centrifugal fan, against the same impeller size, with the characteristic of in-line installation. SWF fans have been widely used in many cities, such as Shanghai, Shenzhen, Beijing, and buildings as Capital Hotel, 23 projects of Asia Game, Xinhua Publishing Building, Continent Hotel, People's Great Hall, etc., and exported to Singapore, Japan, and the other nations in South-East Asia. It is highly praised by customers for the characteristics of low noise, wide high efficiency scope, easy installation, low power consumption, reliability, etc.

SWF 系列混流式(斜流式)通风机特点

Characteristics

1. 效率高、高效区宽:本风机采用先进的 CAD 系统软件,并经多目标优化、性能预示设计研制的高科技产品,应用于斜流子午加速方法, (亦称斜流风机) 压力较同机号轴流风机高,风量较同机号离心风机大,具有效率高、高效区宽等特点。
2. 结构紧凑,安装方便,运行可靠:该风机在相同风量、风压的情况下,体积均比轴流式或离心式小,与电机直联,风机可水平安装或垂直安装,操作使用方便。
3. 噪声低:该风机的外壳经特别设计,可较大地降低气流噪声。在单位风量、单位风压的工况条件下,比 A 声级可降低 2-3 dB,同时在较低转速的情况下,可获得较高风机压力。在工矿企业和高级民用建筑的送排风系统中可替代低压离心风机或替代高压轴流风机而不需采用大量消声措施。
4. 适用范围广:本系列产品分单速和变速二种型号,可根据不同的使用场合,改变风机安装角度,改变叶片数和变换转速达到其使用要求。

本产品经上海市环保局和国家科委(委托浙江省科委)分别组织专家鉴定,荣获国家级“星火”奖、上海市科技进步奖、获国家实用新型专利,被国家科委列入这国家级重点科技成果推广项目产品。

1. High Efficiency: The fan is a hi-tech product with wide high efficiency scope developed with advanced CAD program, which is capable of multi-purposes optimisation and performance prediction. Its pressure is higher than that of axial fan, and the air flow rate is larger than that of centrifugal fan.
2. Compactness, Easy Installation and Reliability: For the same pressure and volume, SWF fan is smaller than both axial and centrifugal fan. Direct motor driving SWF in-line fan is suitable for vertical and horizontal installation, which is enable the easy installing.
3. Low Noise: With the special designed casing, the noise from the air flow has been greatly reduced, i. e., the specific A weighted sound pressure level could be reduced by 2-3dB (A). And the fan can reach higher pressure with lower speed as well. SWF fan is suitable to substitute the low pressure centrifugal fan and high pressure axial fan in industrial enterprises and civil buildings without costly acoustic solutions.
4. Applications: There are 2 types of single speed and double speed in SWF series. For various applications, SWF fan can meet with different requirements with changes of speed, blade number and pitch.

SWF fan has been appraised by Shanghai Municipal Environment Protection Bureau and China Science & Technology Committee, and won the prize of National "spark" Item, Shanghai Science & Technology Progress, held the Practical Patent. The Product has been listed in the National Expanding Project of Key Science & Technology Achievement.

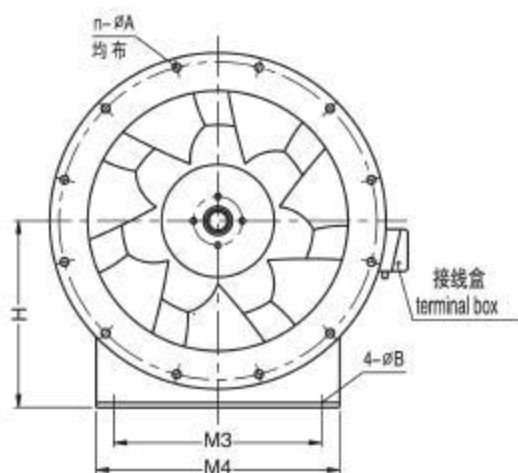
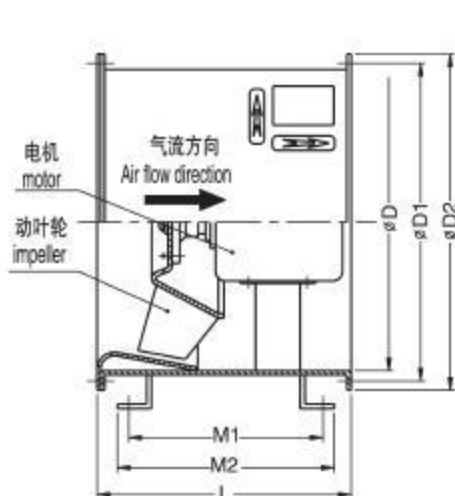
SWF-1 系列高效低噪声混流式通风机性能参数表

SWF-1 HI-Efficiency low-noise mixed-flow fan specification

型号 Model	气流进出口直径 Inlet/outlet diameter (mm)	风量 Air flow (m³/h)	全压 Total pressure (Pa)	转速 Speed (r/min)	装机容量 Rated power (kW)	A 声压级 L _{PA} dB(A)	重量 Weight (kg)
4	400	4302 3636 3053	143 175 212	1450	0.37	≤ 71	52
4.5	450	4552 4040 3392	207 216 265	1450	0.55	≤ 73	62
5	500	7433 6664 5252	220 278 326	1450	1.1	≤ 77	80
6	600	10000 8900 8121	200 262 325	1450	1.5	≤ 79	85
7	700	18800 15319 11780	329 370 470	1450	3	≤ 82	125
8	800	25467 22424 18636	193 292 382	960	4	≤ 82	182
9	900	34206 32056 27174	282 370 430	960	5.5	≤ 86	220
10	1000	44054 40598 36916	288 370 430	960	7.5	≤ 86	325
11	1100	48729 46099 43572	310 346 376	960	11	≤ 86	430
12	1200	64292 60820 57226	429 471 498	720	15	≤ 91	550
13	1300	71565 67702 63699	441 482 508	720	15	≤ 91	580

SWF- I 型系列混流通风机外型尺寸表
SWF- I series mixed-flow fan outside dimension table

型号 Model	D	D1	D2	M1	M2	M3	M4	L	H	n-ΦA	4-ΦB
4	410	450	485	260	300	200	300	350	258	8-Φ9.5	4-Φ11
4.5	460	500	535	290	330	300	400	380	290	8-Φ9.5	4-Φ11
5	510	550	590	310	350	300	400	400	316	12-Φ9.5	4-Φ11
6	610	652	690	360	400	400	500	450	378	12-Φ9.5	4-Φ15
7	710	760	810	380	420	500	600	500	428	12-Φ11.5	4-Φ15
8	810	860	910	480	520	500	600	600	488	12-Φ11.5	4-Φ15
9	910	960	1010	480	540	600	700	600	538	12-Φ11.5	4-Φ19
10	1010	1060	1110	640	700	600	700	750	600	12-Φ11.5	4-Φ19
11	1110	1168	1220	660	720	730	790	800	650	16-Φ14	4-Φ19
12	1212	1272	1330	700	770	870	930	850	700	16-Φ14	4-Φ19
13	1313	1372	1443	700	770	920	980	850	750	16-Φ14	4-Φ19



SWF-II 型 (SWF II TYPE) 高效低噪声混流式通风机性能参数表

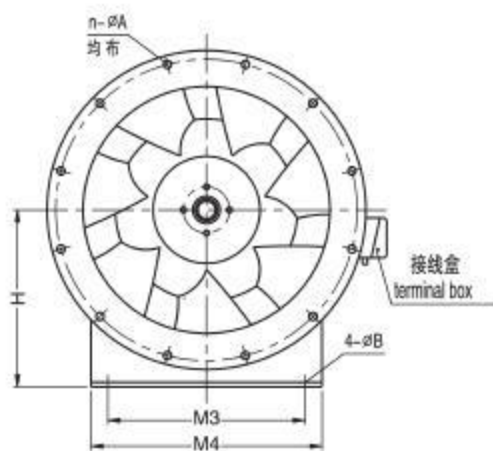
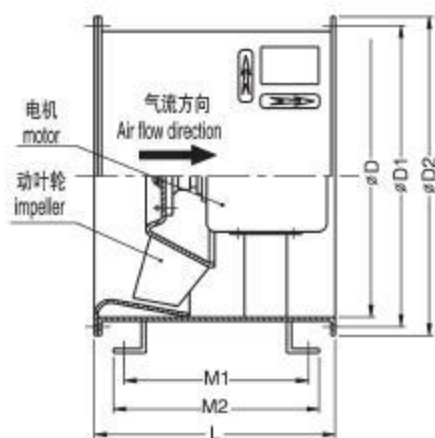
SWF-II HI-Efficiency low-noise mixed-flow fan specification

型号 Model	气流进出口 直径 Inlet/outlet diameter (mm)	风量 Air flow (m³/h)	全压 Total pressure (Pa)	转速 Speed (r/min)	装机容量 Rated power (kW)	实耗功率 Actual power consumption (kW)	A 声压级 L _{PA} dB(A)	重量 Weight (kg)
7	700	18800 15319 11780	329 370 470	1450	4/3	2.2/0.6	≤82	211
		12050 10140 7799	124 162 206	960			≤73	
8	800	41256 35380 28148	560 667 872	1450	11/9	10/3	≤91	294
		25467 22424 18636	193 292 382	960			≤82	
9	900	56666 51590 48044	644 845 981	1450	17/8	16.3/4.7	≤92	420
		34206 32056 27174	282 370 430	960			≤86	
10	1000	66541 60321 55758	704 751 804	1450	24/8	18.8/5.5	≤93	600
		44054 40598 36916	228 329 371	960			≤86	
11	1100	73601 68629 63812	709 789 843	1450	24/8	21/6	≤94	630
		48729 46099 43572	310 346 370	960			≤86	
12	1200	85723 81093 76031	763 837 886	960	25/12	23/9.7	≤95	700
		64292 60820 57226	429 471 498	720			≤91	
13	1300	95420 90270 84933	785 857 904	960	30/15	25/10.5	≤95	730
		71565 67702 63699	441 482 508	720			≤91	

SWF-II 系列混流通风机外形尺寸表

SWF II series mixed-flow fan outside dimension table

型号 Model	D	D1	D2	M1	M2	M3	M4	L	H	n-ΦA	4-ΦB
7	710	760	810	460	500	500	600	550	428	12-Φ11.5	4-Φ15
8	810	860	910	620	660	500	600	750	488	12-Φ11.5	4-Φ15
9	910	960	1010	660	720	600	700	800	538	12-Φ11.5	4-Φ19
10	1010	1060	1110	700	760	600	700	850	600	12-Φ11.5	4-Φ19
11	1110	1168	1220	700	770	730	790	850	650	16-Φ14	4-Φ19
12	1212	1272	1330	750	820	870	930	900	700	16-Φ14	4-Φ19
13	1313	1372	1443	800	870	920	980	950	750	16-Φ14	4-Φ19



SWF-III 系列高效低噪声混流式通风机性能参数表

SWF-III HI-Efficiency low-noise mixed-flow fan specification

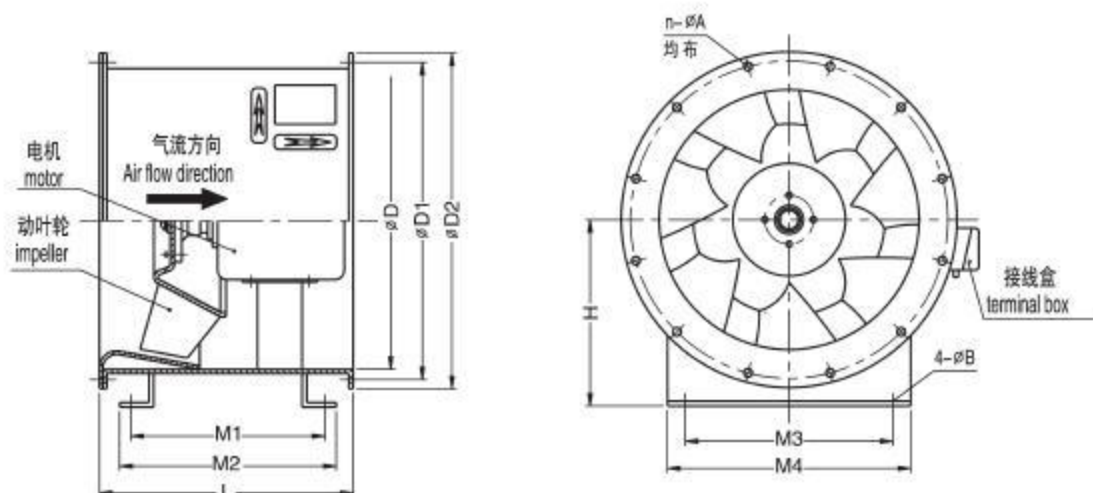
型号 Model	气流进出口 直径 Inlet/outlet diameter (mm)	风量 Air flow (m³/h)	全压 Total pressure (Pa)	转速 Speed (r/min)	装机容量 Rated power (kW)	A 声压级 L _{PA} dB(A)	重量 Weight (kg)
4	400	6801 6221 5688	710 880 950	2850	4.0	78	101
4.5	450	8731 8159 7561	720 840 960	2850	4.0	80	111
5	500	13110 12410 11342	750 850 960	2850	5.5	83	121
6	600	19230 18220 17210	780 850 960	2850	7.5	85	156
7	700	31380 29880 27330	600 810 980	1450	11	89	240
8	800	37350 35380 32210	800 820 1000	1450	15	91	322
9	900	46138 41590 37310	780 950 1000	1450	18.5	92	397
10	1000	51821 48152 45032	780 980 1000	1450	18.5	93	460
11	1100	59521 56659 53530	800 980 1100	1450	22	94	544
12	1200	68358 65158 62058	800 980 1100	960	22	95	635
13	1300	84386 80386 76280	880 990 1120	960	30	95	736

说明:表中参数是为空调工程中替代低压离心风机所用的混流式通风机,具有比离心机体积小、重量轻、安装方便等优点。

Note: Data in table are for mixed-flow fan which is a substitute of low-pressure centrifugal fan in air-conditioning project, it is compact, light and easy installation.

SWF-III 型系列混流通风机外型尺寸表
SWF-III series mixed-flow fan outside dimension table

型号 Model	D	D1	D2	M1	M2	M3	M4	L	H	n-ΦA	4-ΦB
4	410	450	485	400	440	200	300	500	258	8-Φ9.5	4-Φ11
4.5	460	500	535	420	460	300	400	520	290	8-Φ9.5	4-Φ11
5	510	550	590	420	460	300	400	520	316	12-Φ9.5	4-Φ11
6	610	652	690	460	500	400	500	550	378	12-Φ9.5	4-Φ15
7	710	760	810	580	620	500	600	700	428	12-Φ11.5	4-Φ15
8	810	860	910	620	660	500	600	750	488	12-Φ11.5	4-Φ15
9	910	960	1010	620	680	600	700	750	538	12-Φ11.5	4-Φ19
10	1010	1060	1110	620	680	600	700	750	600	12-Φ11.5	4-Φ19
11	1110	1168	1220	700	770	730	790	850	650	16-Φ14	4-Φ19
12	1212	1272	1330	750	820	870	930	900	700	16-Φ14	4-Φ19
13	1313	1372	1443	800	870	920	980	950	750	16-Φ14	4-Φ19



SWF-IV 型系列混流通风机性能参数表

SWF-IV series mixed-flow fan specification

机号 No	转速 Speed r/min	全压 Total pressure Pa	风量 Air flow m³/h	功率 Power kW
7A	1450	787	24726	11
		887	22379	
		1044	18612	
		1061	16419	
		1086	14710	
	960	345	16370	3
		288	14816	
		457	12322	
		465	10871	
		476	9340	
	720	194	12278	1.1
		219	11112	
		257	9242	
		262	8153	
		268	7305	
7.5A	1450	904	30411	15
		1018	27525	
		1198	22892	
		1219	20195	
		1247	18094	
	960	396	20135	4
		446	18233	
		525	15156	
		534	13370	
		547	11979	
	720	233	15101	1.5
		251	13668	
		295	11367	
		301	10027	
		308	8984	
8A	1450	1028	36908	18.5
		1159	33405	
		1363	22782	
		1487	24509	
		1419	21959	
	960	451	24436	5.5
		508	22117	
		597	18394	
		608	16227	
		622	14538	
	720	253	18327	2.2
		286	16587	
		336	13795	
		342	12170	
		350	10904	
8.5A	1450	1161	44270	22
		1308	40068	
		1539	33323	
		1566	29398	
		1602	26339	
	960	509	29310	7.5
		573	26528	
		674	22062	
		686	19463	
		702	11438	
	720	286	21983	3
		322	19896	
		379	16547	
		386	14597	
		395	13097	
机号 No	转速 Speed r/min	全压 Total pressure Pa	风量 Air flow m³/h	功率 Power kW
9A	1450	1301	52551	30
		146	47463	
		1726	39557	
		1755	34897	
		1796	31226	
	960	570	34793	11
		643	34190	
		756	26189	
		769	23104	
		787	20700	
	720	320	26094	4
		362	23618	
		425	19642	
		433	15525	
		443	14789	
9.5A	1450	1368	63980	37
		1765	52690	
		1908	47040	
		1979	41400	
		2006	35750	
	960	600	42360	11
		774	34880	
		836	31145	
		867	27410	
		879	23670	
	720	337	31770	5.5
		435	26260	
		470	23360	
		488	20555	
		495	17750	
10A	1450	1606	72087	55
		1810	65245	
		2130	54262	
		2166	47859	
		2217	42888	
	960	704	47726	15
		794	43196	
		934	35925	
		950	31692	
		972	28395	
	720	396	35795	7.5
		446	32392	
		525	26944	
		534	23770	
		547	21296	
10.5A	1450	1671	86385	75
		2156	71140	
		2330	63520	
		2417	55895	
		2450	48270	
	960	733	57190	18.5
		945	47100	
		1021	42050	
		1060	37010	
		1074	31960	
	720	412	42900	7.5
		632	35325	
		574	31540	
		596	27755	
		604	23970	
机号 No	转速 Speed r/min	全压 Total pressure Pa	风量 Air flow m³/h	功率 Power kW
11A	960	807	65730	22
		1040	54040	
		1123	48350	
		1165	42500	
		1177	36821	
	720	454	49300	11
		585	40530	
		632	36260	
		655	31880	
		662	17610	
11.5A	960	882	75105	30
		1136	61750	
		1228	55140	
		1274	48570	
		1287	42060	
	720	496	56330	11
		639	46315	
		691	41430	
		717	36425	
		724	31540	
12A	960	960	85330	30
		1237	70160	
		1337	62770	
		1387	55180	
		1401	47790	
	720	540	64000	15
		696	52620	
		752	47075	
		780	41390	
		788	35840	
12.5A	960	1100	93215	37
		1240	84367	
		1459	70166	
		1484	61898	
		1518	55458	
	720	619	69912	15
		697	63057	
		820	52625	
		834	46425	
		855	41593	

(电压 380V)

说明:

表内数值是系列数值,如
用户要求特殊数据需另行
设计制作。

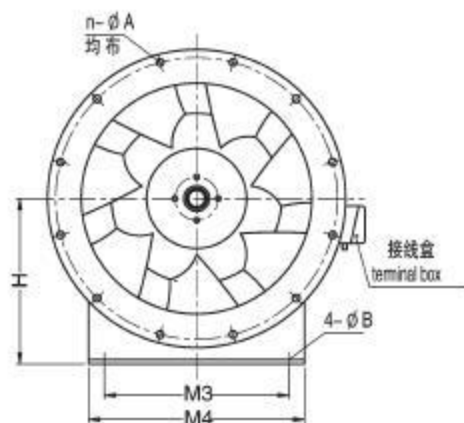
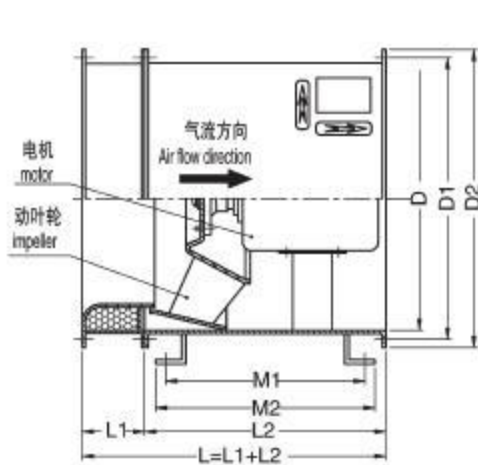
Note:

The individual requirements
beyond the table would be
available with design.

SWF-IV 型系列混流通风机外型尺寸表

SWF-IV series mixed-flow fan outside dimension table

型号 Model	D	D1	D2	M1			M2			M3	M4	L1	L2			n-ΦA	4-ΦB	H
				4P	6P	8P	4P	6P	8P				4P	6P	8P			
7	810	860	910	540	460	360	580	500	400	500	600	420	660	550	460	12-Φ11.5	4-Φ15	488
7.5	840	890	940	580	480	380	620	520	420	600	700	450	700	600	500	12-Φ11.5	4-Φ15	522
8	910	960	1010	620	480	420	680	540	480	600	700	480	720	600	560	12-Φ11.5	4-Φ19	538
8.5	950	1000	1050	620	520	460	680	580	520	600	700	510	760	660	600	12-Φ11.5	4-Φ19	570
9	1010	1060	1110	720	620	600	780	680	660	600	700	540	860	750	720	12-Φ11.5	4-Φ19	600
9.5	1070	1126	1176	760	630	590	830	700	660	730	790	570	890	760	720	16-Φ14	4-Φ19	630
10	1110	1168	1220	880	680	630	950	750	700	730	790	600	1050	820	780	16-Φ14	4-Φ19	650
10.5	1180	1236	1286	1230	830	700	1300	900	770	870	930	630	1400	1000	840	16-Φ14	4-Φ19	690
11	1238	1294	1344		810	760		880	830	870	930	660		950	900	16-Φ14	4-Φ19	720
11.5	1294	1350	1400		830	760		900	830	920	980	690		1000	900	16-Φ14	4-Φ21	747
12	1350	1406	1456		880	830		950	900	920	980	720		1050	980	20-Φ18	4-Φ21	775
12.5	1400	1465	1516		930	810		1000	880	1000	1060	750		1100	950	20-Φ18	4-Φ21	780



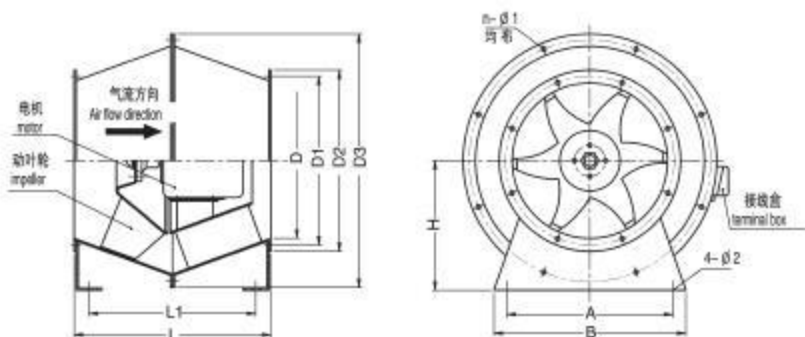
SWF-V 型系列混流通风机性能参数表

SWF-V series mixed-flow fan specification

机号 No	风量 Air flow m³/h	全压 Total pressure Pa	转速 Speed r/min	功率 Power kW	壳体 噪声 Noise dB(A)	重量 Weight kg
2	520 760 1040	352 280 220	2900	0.25	≤65	15
	260 380 520	88 70 55	1450	0.04	≤56	
2.5	894 1220 2180	660 600 440	2900	0.75	≤75	22
	447 610 1090	165 150 110	1450	0.09	≤60	
3	1489 3020 4360	960 680 520	2900	1.1	≤77	25
	749 1510 2180	240 170 130	1450	0.18	≤60	
3.5	3974 5920 6220	800 760 440	2900	2.2	≤82	40
	1516 2240 3118	278 265 250	1450	0.37	≤68	48
	1000 1480 2064	120 116 108	960	0.18	≤60	
4	2530 4170 5180	390 280 220	1450	0.75	≤72	66
	1675 2761 3430	171 122 96	960	0.18	≤60	60
4.5	4050 6120 7060	480 350 250	1450	1.1	≤73	75
4.5	2910 3890 4980	275 180 100	960	0.37	≤65	78
5	7062 8076 8648	370 360 350	1450	2.2	≤78	100
	3510 4680 6050	210 200 170	960	0.75	≤70	85
6	8200 12400 17900	870 690 380	1450	5.5	≤82	220
	6040 8100 8640	360 260 240	960	1.5	≤72	185
7	8110 15040 18120	400 350 260	960	3	≤78	210
8	10110 15070 25120	500 450 400	960	5.5	≤82	315

SWF-V 型系列混流通风机外型尺寸表

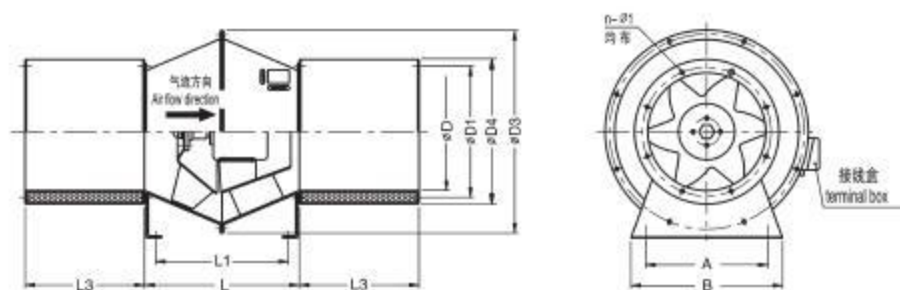
SWF-V series mixed-flow fan outside dimension table



型号 Model	D	D1	D2	D3	L1	L	A	B	n-Φ1	4-Φ2	H
2	200	240	264	347	256	320	110	160	6-Φ7	4-Φ11	180
2.5	250	290	314	425	324	390	150	200	8-Φ7	4-Φ11	215
3	300	340	364	523	284	350	190	240	8-Φ9.5	4-Φ11	270
3.5	350	390	414	559	465	530	230	280	8-Φ9.5	4-Φ11	285
4	400	450	485	650	524	610	270	320	8-Φ9.5	4-Φ11	335
4.5	450	500	535	721	594	680	300	360	8-Φ9.5	4-Φ11	370
5	500	540	570	750	464	554	380	460	12-Φ9.5	4-Φ11	384
6	600	652	700	976	810	900	420	500	12-Φ9.5	4-Φ15	495
7	700	760	800	903	550	640	500	600	12-Φ11.5	4-Φ15	470
8	800	860	900	1085	630	720	600	700	12-Φ11.5	4-Φ15	565

SWF-V-X 型消声型混流式通风机安装及外形尺寸

SWF-V-X silencer Fan Outside Dimension table

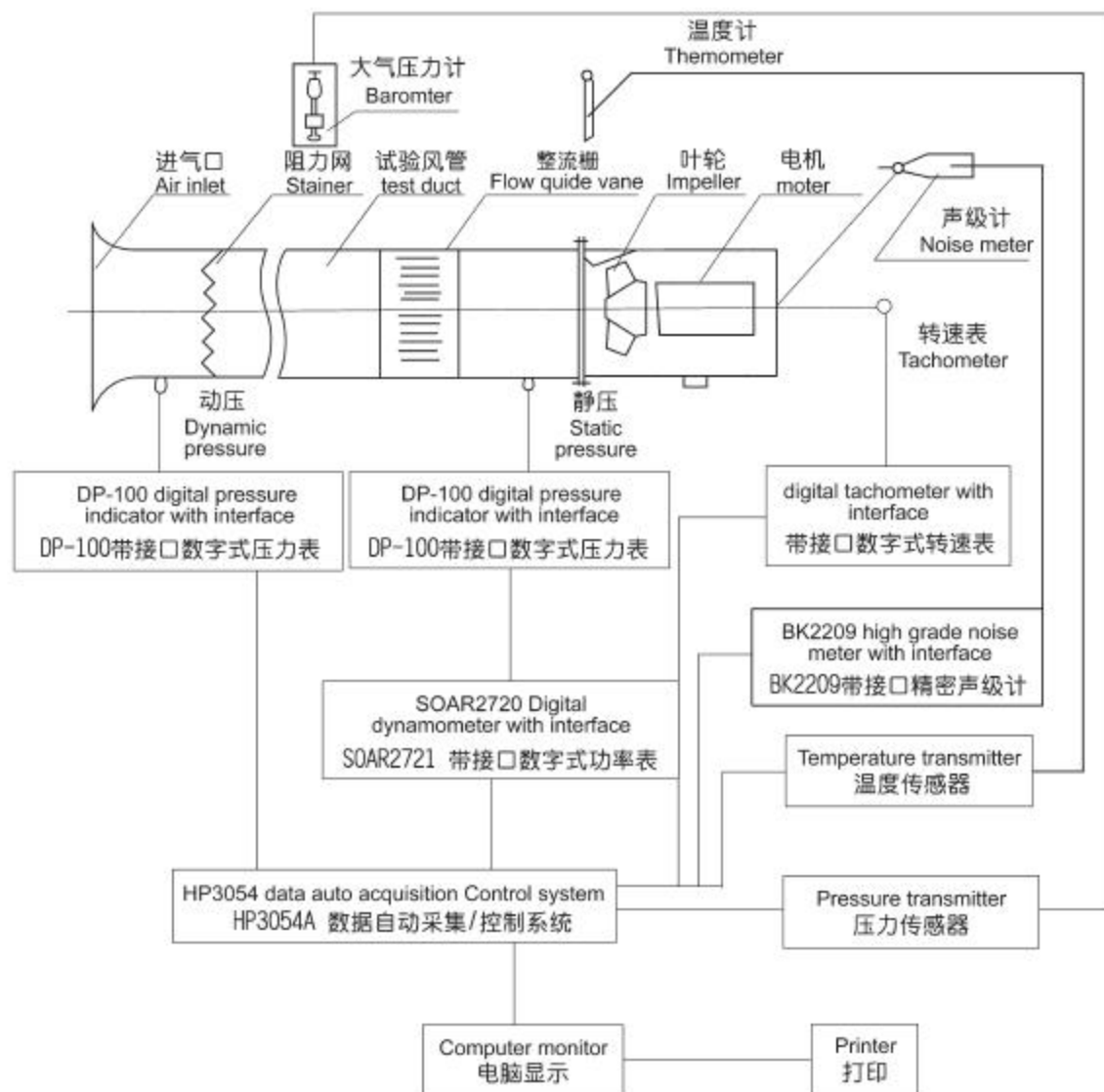


型号 Model	D	D1	D4	L3	n-Φ1	4-Φ2
2	200	240	400	200	6-Φ7	4-Φ11
2.5	250	290	450	250	8-Φ7	4-Φ11
3	300	340	500	300	8-Φ9.5	4-Φ11
3.5	350	390	550	350	8-Φ9.5	4-Φ11
4	400	450	600	400	8-Φ9.5	4-Φ11

型号 Model	D	D1	D4	L3	n-Φ1	4-Φ2
4.5	450	500	650	450	8-Φ9.5	4-Φ11
5	500	540	700	500	12-Φ9.5	4-Φ11
6	600	652	800	600	12-Φ9.5	4-Φ11
7	700	760	900	700	12-Φ11.5	4-Φ15
8	800	860	1000	800	12-Φ11.5	4-Φ15

SWF 系列高效低噪声混流式通风机气动性能试验示意图

SWF HI-efficiency low-noise mixed-flow fan aerodynamic performance test diagram



计算公式 (Calculation formular):

空气密度 (Air density)

$$\rho = P_a / R T_a (\text{Kg/m}^3)$$

风机风量 (Air flow)

$$Q = 63.977 (\Delta P_n / P_a)^{-2} (\text{m}^3/\text{min})$$

风机全压 (Total pressure)

$$P = [(A_1/A_2)^2 \times 0.96^2 - 0.8525] \Delta P_n + P_{\text{est},1} (\text{Pa})$$

风机功率 (Power)

$$N = W \times E_{\text{motor}} / 100 (\text{kW})$$

双速风机电机引出接线法 CONNECTION METHODS OF THE OUTLET TERMINATION

2 速 2-speed	低速(Δ) Low speed			高速(YY) High speed		
	1U 	1V 	1W 	1U 	1V 	1W 
	2U 	2V 	2W 	2U 	2V 	2W 

注: 配用双速电机的风机由用户提出, 可带电控箱。

REMARKS: The electrical control panel ordered by user is available for the fan applied with 2 speed motor.

SWF 型高效低噪声混流式风机使用、维护保养

1. 维护保养

- 安装前应认真检查风叶及机壳有否因运输损坏或变形, 否则应待修复后方可安装;
- 检查叶片与内筒有否因连接螺钉松动而碰壳, 如叶片风筒间隙不均匀, 则应先调整后方可安装;
- 风机起动前, 首先要检查风机及管道内有无妨碍转动的物品;
- 检查电机绝缘性能是否良好, 接通电源后查看有无摩擦碰撞及异常振动;
- 在正常运行中, 如遇下列故障应立即停机检查:
 - 电机温升超过 70°C ;
 - 电机冒白烟;
 - 发生强烈振动或有较大碰撞声。

2. 风机常见故障分析

风机振动产生的原因很多, 可从下述方面进行检查:

- 叶轮与风筒相摩擦, 并出了异常的声音及振动;
- 支架底脚螺栓未紧固, 亦会出现较大的振动;
- 叶轮因运输中受压变形, 或螺栓松动而产生振动;
- 叶轮轴连接螺钉松动或主轴弯曲变形;
- 支加与电机连接螺钉松动导致叶轮不平衡, 轴承损坏而造成激烈振动。

3. 电机发热

在常温下运行一段时间后, 发现电机温升过高, 则可能有下列原因造成:

- 电机超负荷运行; 配合间隙小, 不符合要求;
- 轴与轴承安装歪斜, 两个轴承不同轴度;
- 阻力过大, 电机超负荷运行;
- 电源电压过低或三相电机缺相运行。

Operation, maintenance instruction for SWF series hi-efficiency low-noise mixed flow fan

(1). Maintenance

a. Check for any damage of impeller and casing during transportation prior to installation, and repair (if necessary) before installation; b. Check blades for any touch with casing caused by loose connecting bolts, adjust the clearance between blade and casing if required before installation; c. Make sure there is no foreign body in the fan or duct before running. Inspect motor for good insulation, check for any rubbing of abnormal vibration after power input. Trip the fan immediately at any of following cases: ①. Motor temperature goes up exceeding 70°C ; ②. Motor smoking out; ③. Excessive vibration or abnormal noise.

(2). The analysis for normal break down of fan

a. Impeller rubs against casing causing abnormal noise and vibration; b. Mounting bolt untightened causing excessive vibration; c. Impeller deformed during transportation, or loosening bolt causing vibration; d. Loosening connecting bolt of impeller and bushing or bending shaft; e. Loose bolts for connecting motor and support causing unbalance of impeller and excessive vibration.

(3). Heating

Motor temperature excessively rising after a period of operation could be caused by following reasons: a. Motor bearing damage due to too small tolerance. b. Unalignment of bearing and shaft. c. Motor overloading. d. Supply low voltage or one phase out phase out in 3-phase power supply.