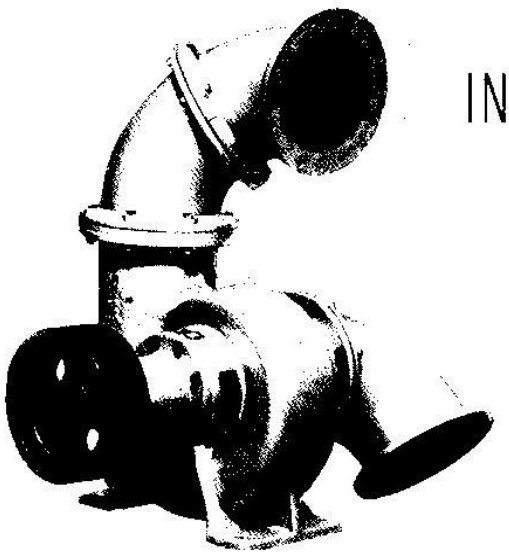
MIXED-FLOWPUMPS



INSTRUSTIONS FOR USE
AND INSTALLATION

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I. GENERAL DESCRIPTION

1. Applications

Type HBC mixed-flow pumps are horizontal, single stage, single suction, overhunging-type volute pumps. The models are 4HBC—35, 6HBC—35, 8HBC—35, 10HBC—$\frac{30}{40}$, 12HBC$_2$—40, 12HBC—50T, 14HBC—40, 16HBC—$\frac{30}{40}$, 20HBC—40, 26HBC—$\frac{30}{40}$. Main specifications: Head 3—15m, Capacity 100—5000m^3/h. The pumps are suitable for agricultural irrigation and drainage or industrial water supply and drainage.

2. Features

Small space, light weight, high efficiency simple construction, reliable operation, and easy maintenance and repair.

3. Model Notation

For example, model 12HBC$_2$—40

12—— 1/25 of pump inlet diameter in mm (i. e. the pump inlet diameter is 300mm),

H——mixed,

B——single stage, single suction, overhunging-type volute pump,

C$_2$——second improvement,

40—— 1/10 of specific speed of the pump (i. e. the specific speed of the pump is 400).

4. Driving Arrangement

There are two types of drive assembly available: one is pulley and belt device, the other is coupling. An electrical motor or a diesel engine is most commonly used to drive the pump. The model of the motor or the engine must be specified in the contract (including rated power and revolving speed), so that the manufacturer can determine the specifications of coupling or pulley.

5. Direction of Rotation

As observed from the suction side of the pump, the rotation of the impeller is counter-clockwise. However, the direction of rotation of model 26HBC—30,—40,—50 pumps is just opposite to the above statement. Please pay attention to it when install and use the pumps.

Ⅱ. Construction And Action

1. Type HBC mixed-flow pump is composed of pump casing, pump shroud, impeller, shaft and bearing case (bearing bracket), etc.

2. The pump shroud is a part which connects pump casing and inlet pipe. There should be a certain gap between the shroud and the impeller. If the gap is too small, rubbing action will occurs; and a big gap will result in too much return flow of liquid from the high pressure side to the suction side of the impeller, which would decrease the efficiency of the pump. The gap can be adjusted by changing the thickness of paper gaskets, and its optimum suitable for service is 0.3~0.7mm.

3. The shaft sealing package is made up of stuffing box, seal cage, gland and oil-filled asbestos packing. Its function is to prevent air from getting into the pump and too more water from coming out of the pump along the shaft.

4. The shaft sleeve is used to prevent the shaft from rubbing with the packing stuff. The sleeve should be replaced in time when it wears out.

5. The pump shaft is supported by ball bearings. For model 6HBC—14 HBC pumps, light lubricating oil is used, and the oil level should be kept normal; for model 16HBC, 20HBC and 26HBC pumps calcium grease of high quality is used, and 60% of the space of bearing box should be filled with that kind of grease.

6. The screwed hole on the top of pump casing is used for pouring prime water into the pump or connecting with a vacuum pump to evacuate air and draw up water.

7. The outlet of 4HBC—12HBC pumps is upward, as in figure 1; and that of 16HBC—26HBC pumps is horizontal as in figure 2. The outlet of 14HBC pump has two types, either upward or horizontal.

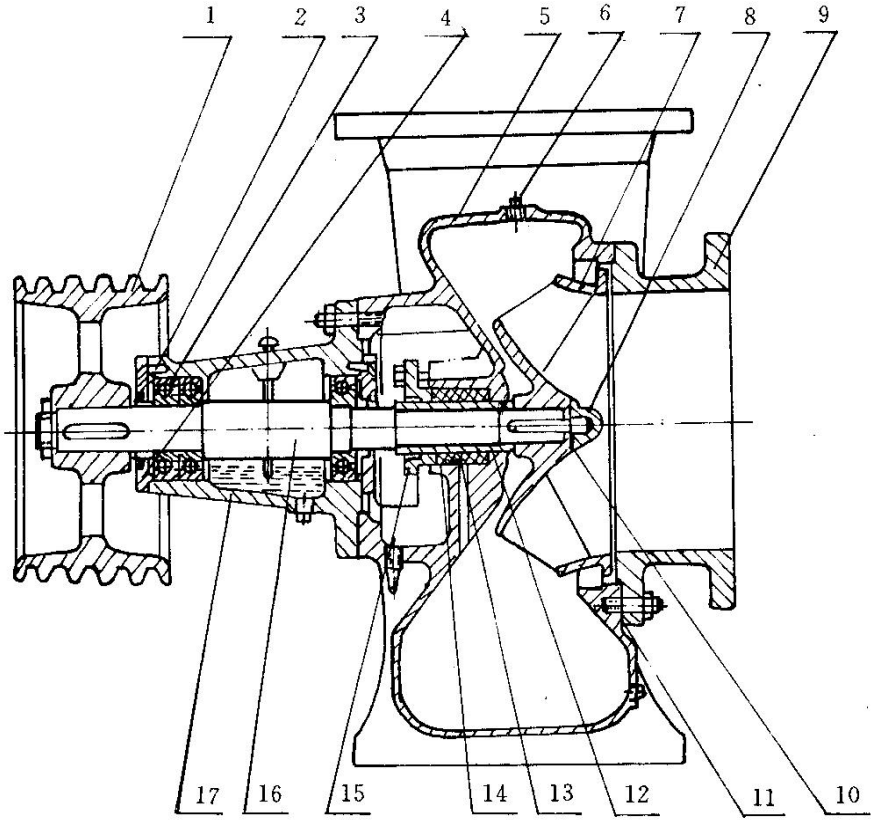


Fig 1. Upward outlet type

1	Pulley	7	Impeller	13	Seal cage
2	Thrust sleeve	8	Impeller nut	14	Packing stuff
3	Bearing	9	Pump shroud	15	Gland
4	Bearing end cover	10	Washer	16	Shaft
5	Pump casing	11	Paper gasket	17	Bearing case
6	Screwed plug	12	Shaft sleeve		

Pump Model	Bearing Model	Packing Specification	Pump Model	Bearing Model	Packing Specification
4HBC－35	306	8×8×141	10HBC－$\frac{30}{40}$	311	13×13×229
6HBC－35	307	10×10×157	12HBC$_2$－40	311	13×13×229
8HBC－35	308	10×10×189	12HBC－50T	311	12×12×226

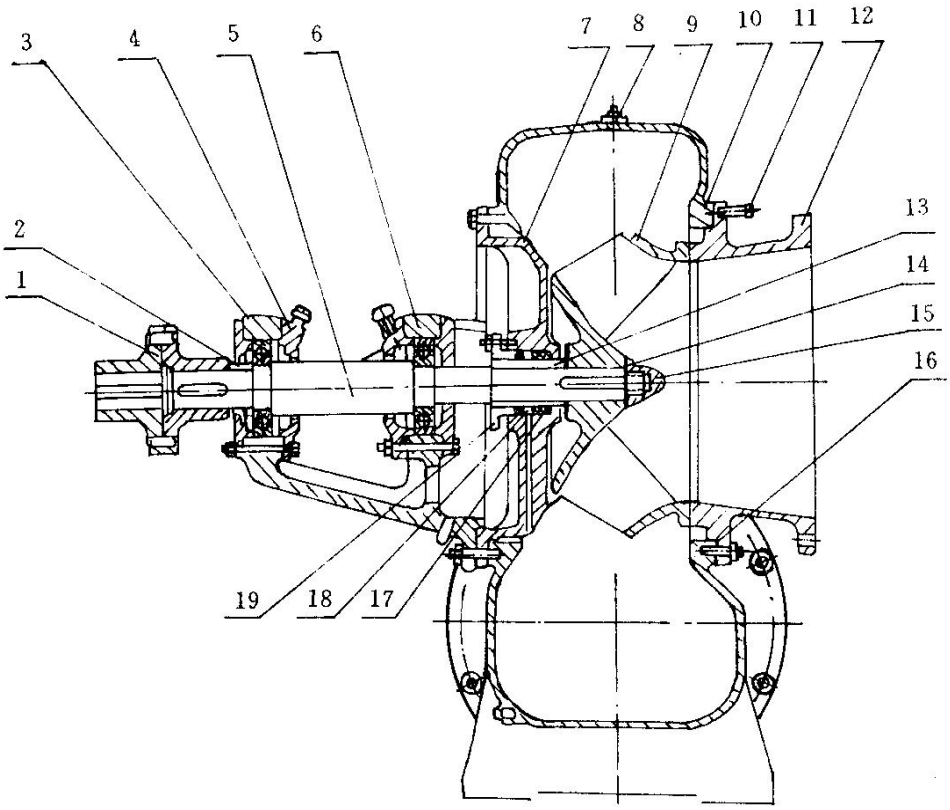


Fig 2. Horizontal outlet type

1	Coupling	8	Screwed plug	15	Impeller nut
2	Thrust sleeve	9	Impeller	16	Paper gasket
3	Bearing case	10	Pump casing	17	Packing stuff
4	Bearing end cover	11	Screw	18	Seal cage
5	Shaft	12	Pump shroud	19	Gland
6	Bearing	13	Shaft sleeve		
7	Tail cover	14	Washer		

Pump Model	Bearing Model	Packing Specification	Pump Model	Bearing Model	Packing Specification
14HBC—40	311	13×13×229	20HBC—40	314	15×15×298.5
16HBC—30,—40	312	13×13×261	26HBC—30,—40,—50	46322	20×20×420

Ⅲ. CHARACTERISTICS

1. Plrformance curves

The performance curves are shown later.

2. Changing of revolving speed

(a) The revolving speed of the pump can be altered so as to adjust the head and capacity suitable for various requirements.

(b) Method to change the speed: to change the pulley of the pump, or to change the gears of a gear drive equipment, or to select motive power of different speeds.

(c) After the speed n is changed, the capacity Q, head H and brake power N are also changed. They are linked by three following relationships:

$$Q_1=Q\frac{n_1}{n},\qquad H_1=H(\frac{n_1}{n})^2,\qquad N_1=N(\frac{n_1}{n})^3$$

where Q_1, H_1, N_1 denote capacity, head and brake power respectively after varying the speed, and Q, H, N are capacity, head and brake power at defined pump speed.

(d) When the speed of pump is increased, the brake power is increased by cubic form, the suction head is decreased, and the life of pump is shortened. To increase pump speed too much will probably cause abnormal events. Therefore, it should be very carefullv considered to increase the speed.

(e) When the speed is decreased by a large amount, the pump utilization will be decreased. So it should be avoided as possible to run the pump at a too low speed.

The following performance curves are derived from typical testing reports. The parameters listed in the performance tables are the specifications for ex-work testing.

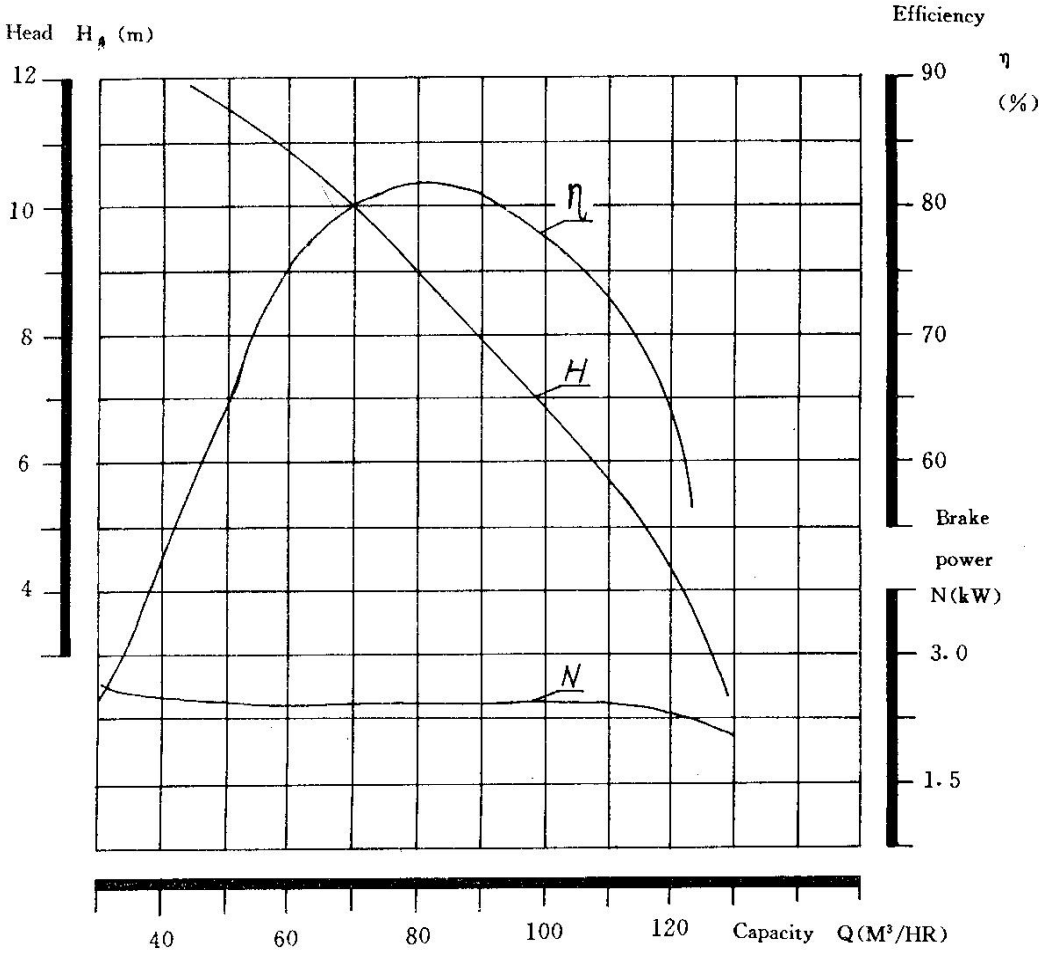
3. Allowable suction head [Hs], required net positive suction head (NPSH) r and critical net positive suction head (NPSH) c can be approximately related by following two relationships:

$$[HS]\approx 10-(NPSH)\ r$$

$$(NPSH)\ r\approx(NPSH)\ c+0.3$$

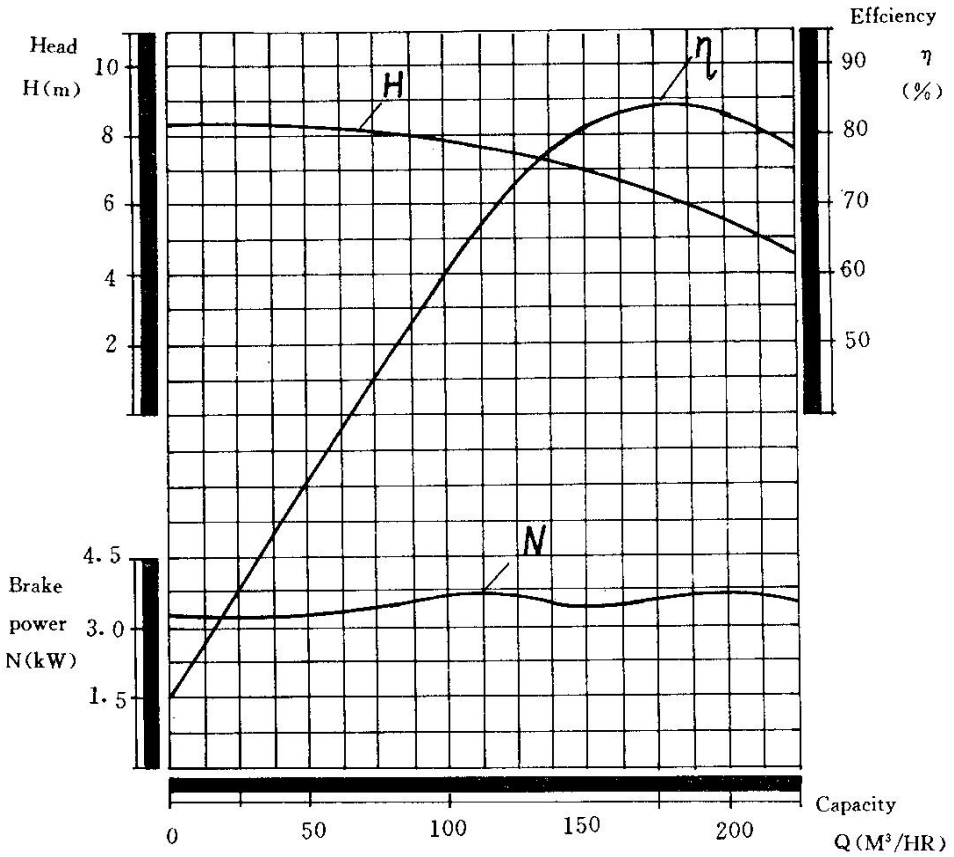
where measuring units of all quantity are shown in meter.

4HBC－35 Mixed-flow pump performance curves
(n＝2900r/min)



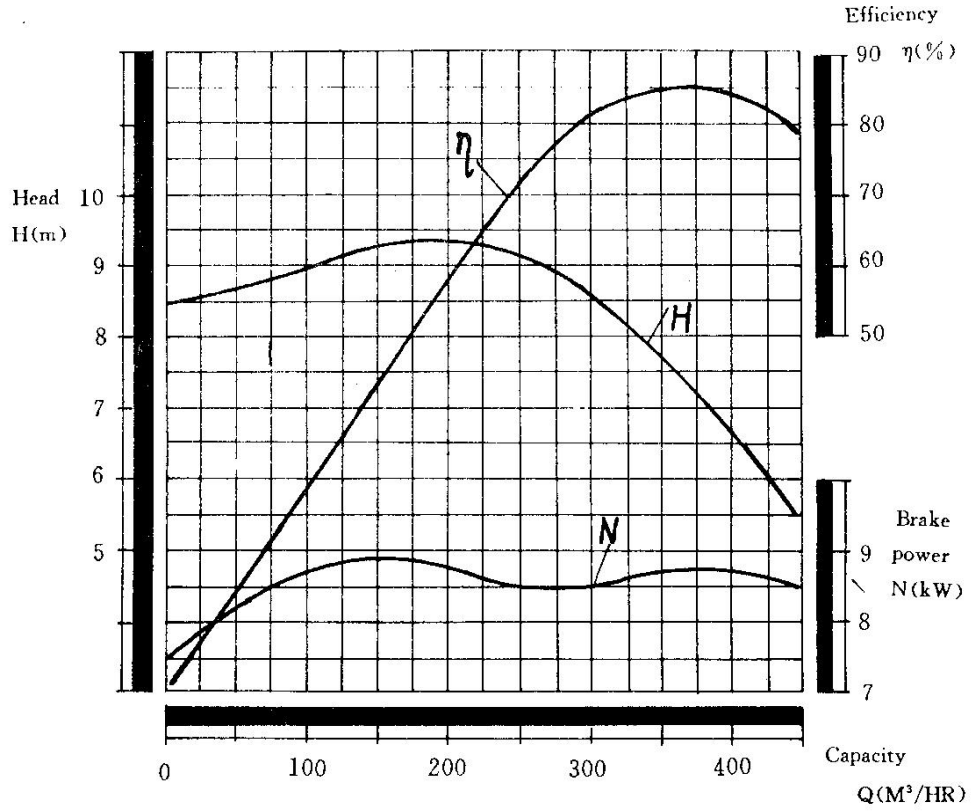
Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
98	27	7	2900	2.40	2.5	78	3.6	100	117	29
89	25	8		2.40		81				
70	19	10		2.38		80				

6HBC—35 Mixed-flow pump performance curves
(n=1450r/min)



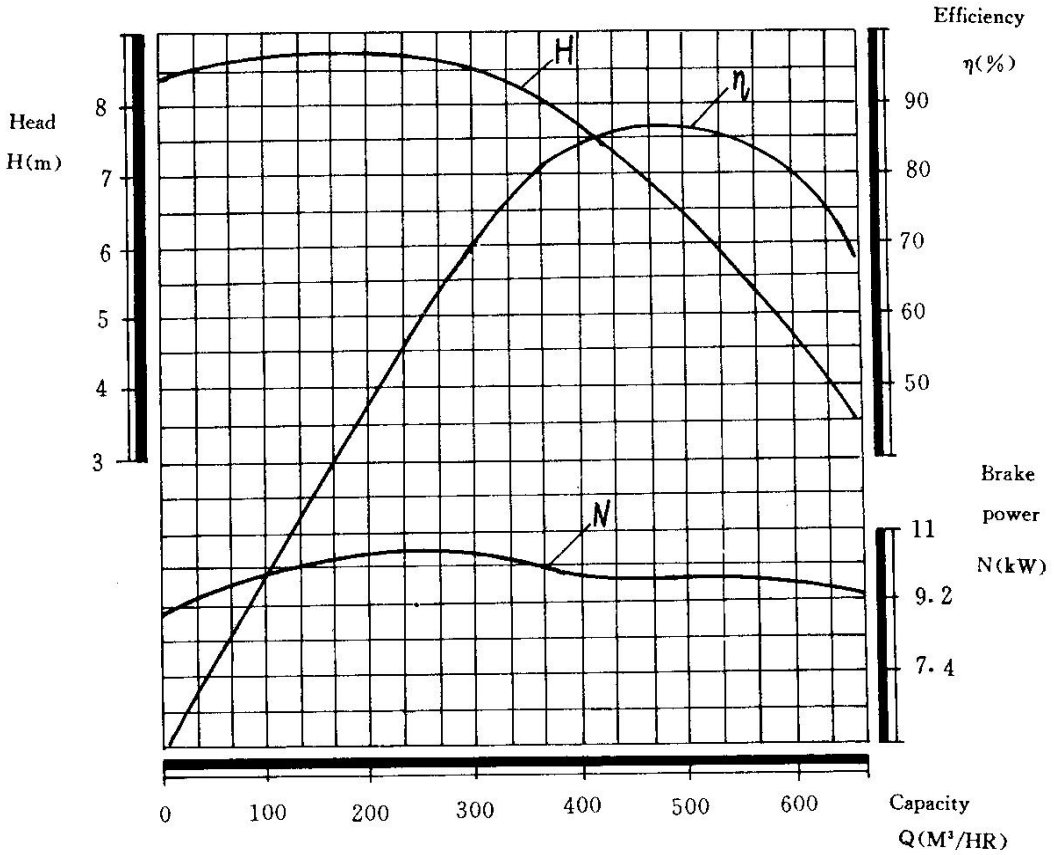
Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m^3/h)	(l/s)			Brake power	Motive power					
140	38.9	6.6	1450	3.4	5.5	75	2.7	150	196	65
180	50	6.0		3.7		80				
200	55.6	5.0		3.5		78				
164	46	9.0	1700	5.4	7.5	75	3.2	150	196	65
211	59	8.2		6.0		80				
234	65	6.9		5.7		78				

8HBC—35 Mixed-flow pump performance curves
(n=1200r/min)



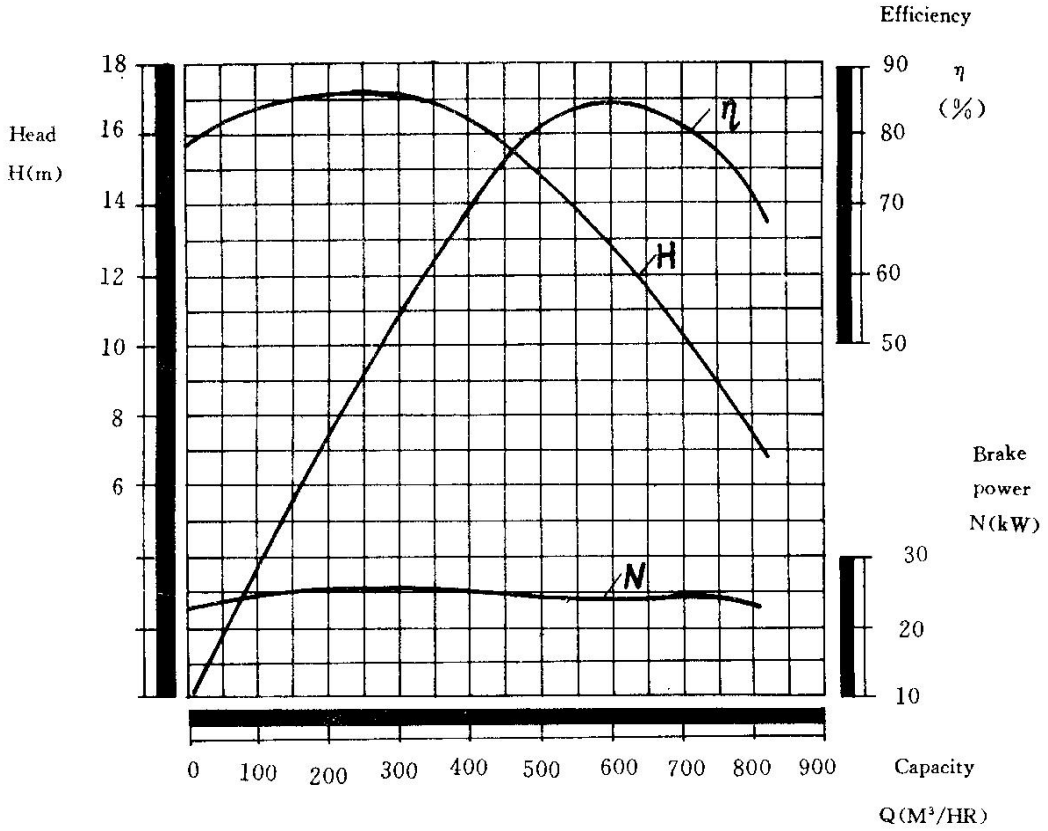
Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
300	83	8.0	1200	8.46	11	77	3.0	200	256	119
360	100	7.0		8.39		82				
450	125	5.1		8.10		77				
360	100	12.0	1450	15.3	18.5	77	4.2			
450	125	10.0		14.9		82				
540	150	7.5		14.4		77				
400	111	14.5	1600	20.5	30	77	5.2			
500	139	12.2		20.2		82				
600	167	9.5		20.2		77				

10HBC—35 Mixed-flow pump performance curves
(n=980r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m^3/h)	(l/s)			Brake power	Motive power					
400	111	8.0	980	10.7	15	81.5	4.0	250	304	160
450	125	7.0		10.3		83.5				
500	139	6.3		10.9		79.0				

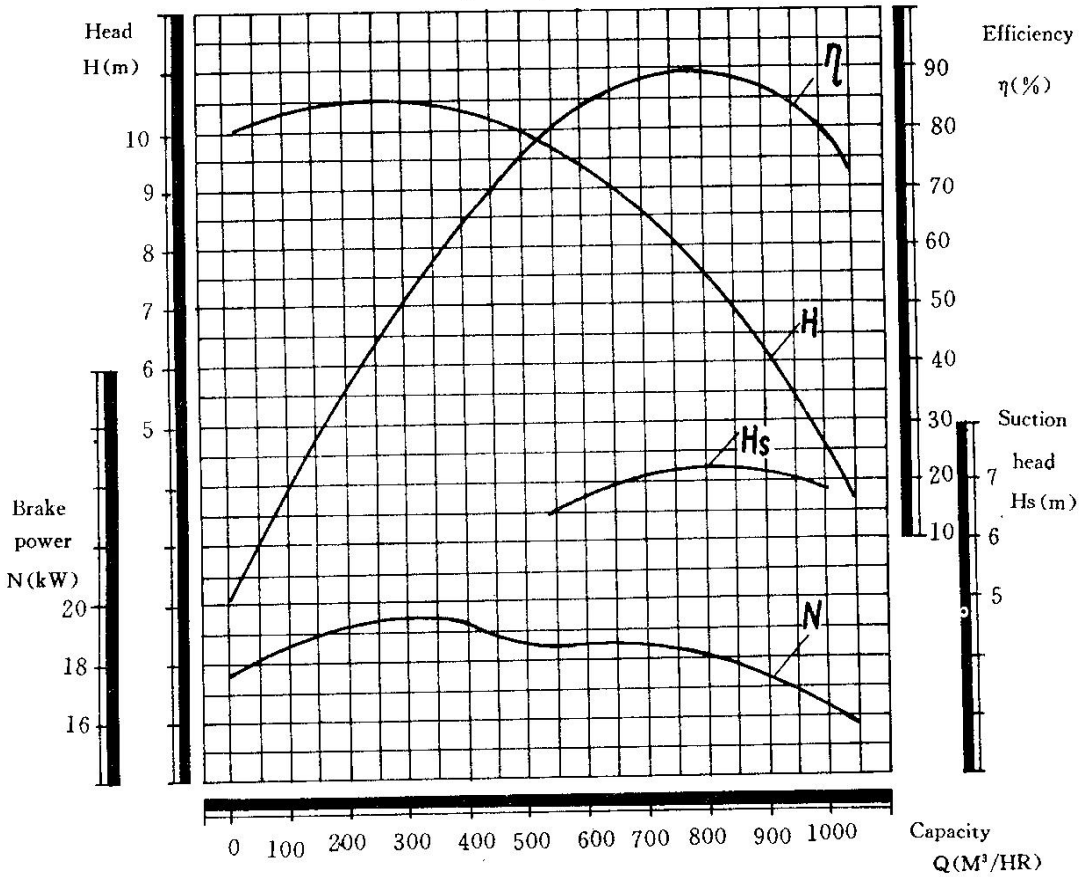
10HBC—40 Mixed-flow pump performance curves
(n=1450r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
400	111	5.5	980	7.2	11	83.0	4.0	250	280	160
450	125	4.8		7.5		83.0				
500	139	4.0		7.4		80.0				
550	153	13.2	1450	24.0	30	83.0	5.5			
650	180	11.6		24.6		83.0				
720	200	9.8		24.0		80.0				
640	178	15.5	1600	32.8	37	83.0	7.0			
720	200	14.3		32.8		83.0				
800	222	11.8		32.4		80.0				

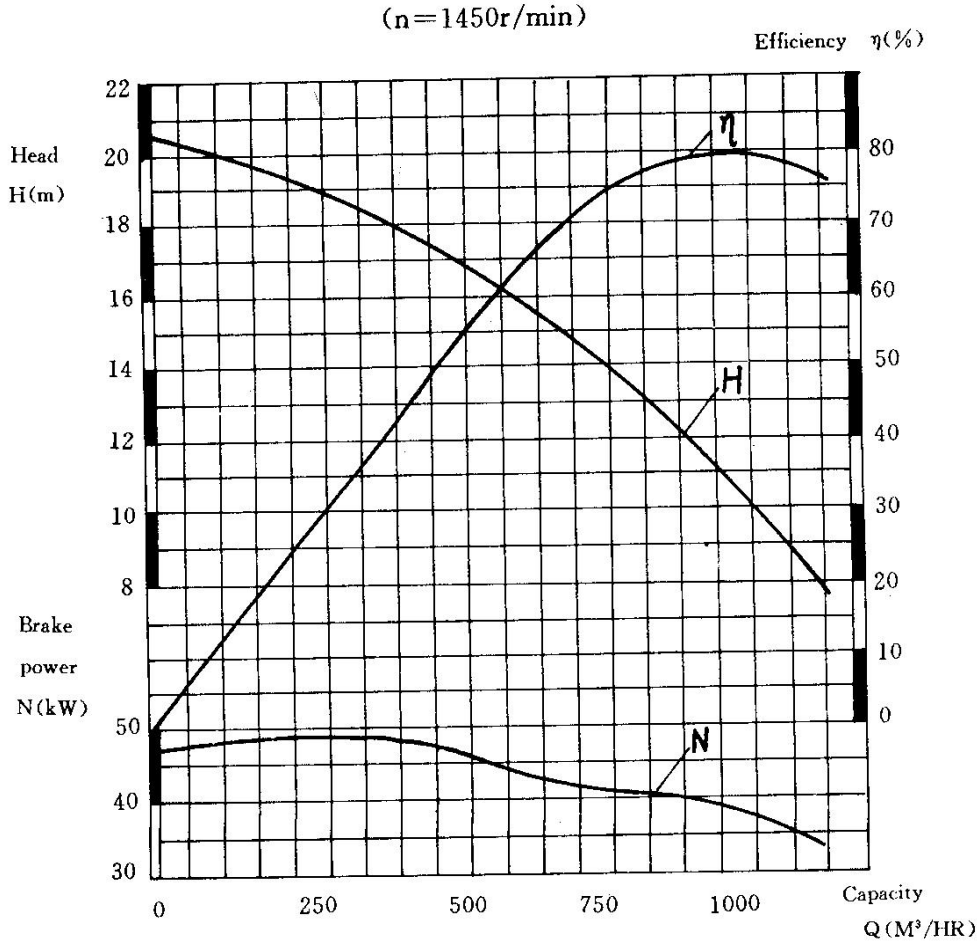
12HBC$_2$—40 Mixed-flow pump performance curves

(n=980r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
507	141	4.4	730	7.4	11	82	3	300	341	200
518	161	3.9		7.3		84				
678	188	2.8		6.6		78				
680	189	8.0	980	18.1	22	82	4			
780	217	7.0		17.7		84				
910	253	5.0		15.9		78				
902	251	14.1	1300	42.3	55	82	7			
1035	288	12.3		41.3		84				
1207	335	8.8		37.1		78				

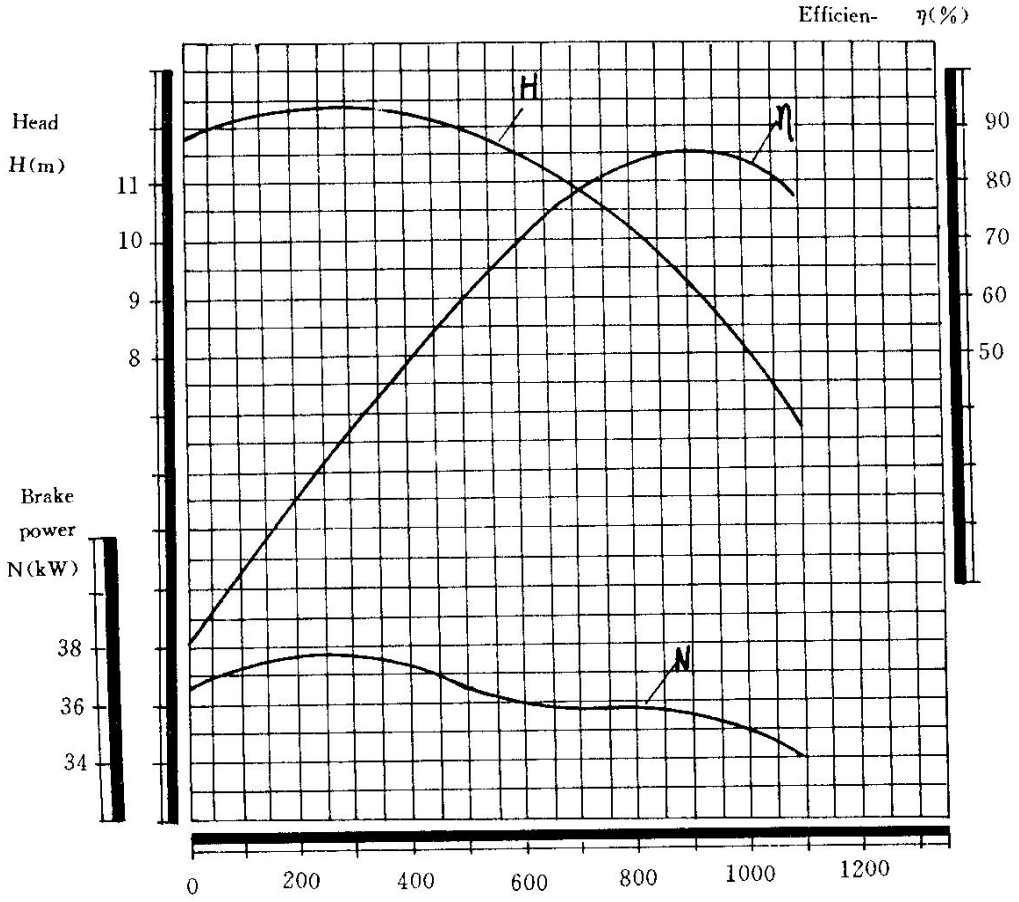
12HBC—50 Mixed-flow pump performance curves
(n=1450r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m^3/h)	(l/s)			Brake power	Motive power					
880	244	13.0	1450	40.5	55	74	7.5	300	345	200
1020	283	10.6		38.5		77				
1150	319	8.3		34.9		74				
970	269	16.0	1600	54.0	75	74	8.0			
1140	317	12.8		51.7		77				
1250	347	10.7		47.0		74				

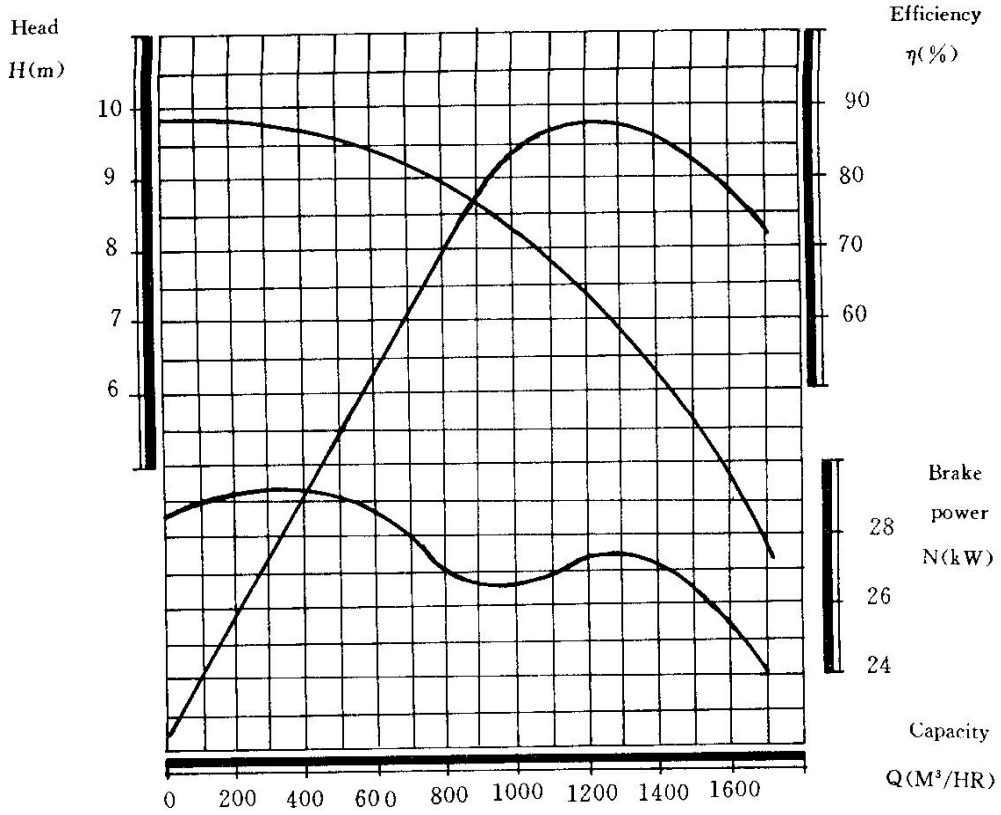
14HBC—40 Mixed-flow pump performance curves

(n=980r/min)



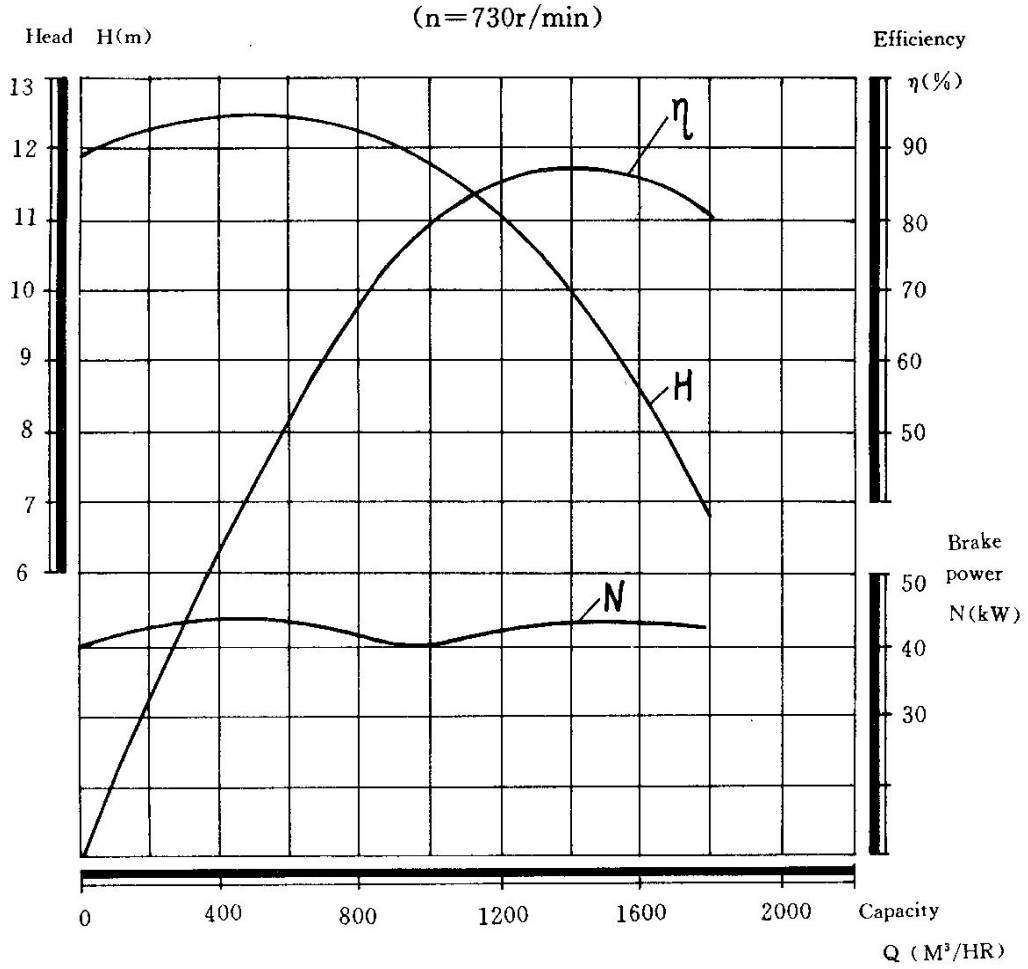
Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
670	186	5.2	730	11.2	15	85.0	4.5	350	376	330
745	207	4.4		10.4		85.5				
819	228	3.7		10.1		81.5				
900	250	9.4	980	27.1	30	85.0	4.5			
1000	278	8.0		25.5		85.5				
1100	306	6.7		24.6		81.5				

16HBC—40 Mixed-flow pump performance curves
(n=730r/min)



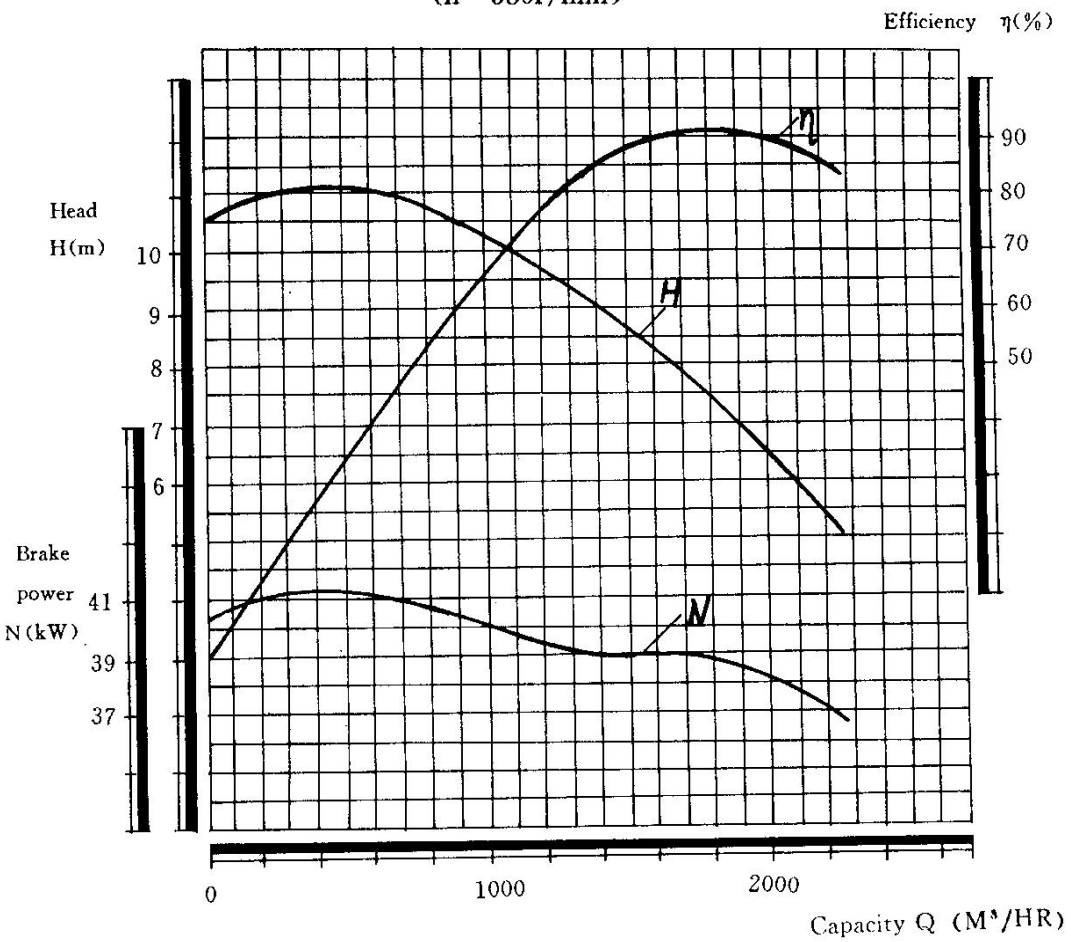
Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
1080	300	7.8	730	27.9	30	84.0	4	400	445	550
1260	350	6.8		27.7		86.0				
1368	380	6.2		28.1		84.0				
1450	403	14.1	980	66.3	75	84.0	5.5	400	445	550
1692	470	12.3		66.0		86.0				
1836	510	11.2		66.7		84.0				

16HBC－30 Mixed-flow pump performance curves
(n＝730r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Effic-iency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
1098	305	11.5	730	41.5	55	83.0	4	400	480	560
1400	389	9.94		44.3		85.5				
1720	478	7.55		42.4		83.5				
1474	409	20.7	980	100.2	110	83.0	5.5			
1880	522	18.0		107.9		85.5				
2309	641	13.6		102.5		83.5				

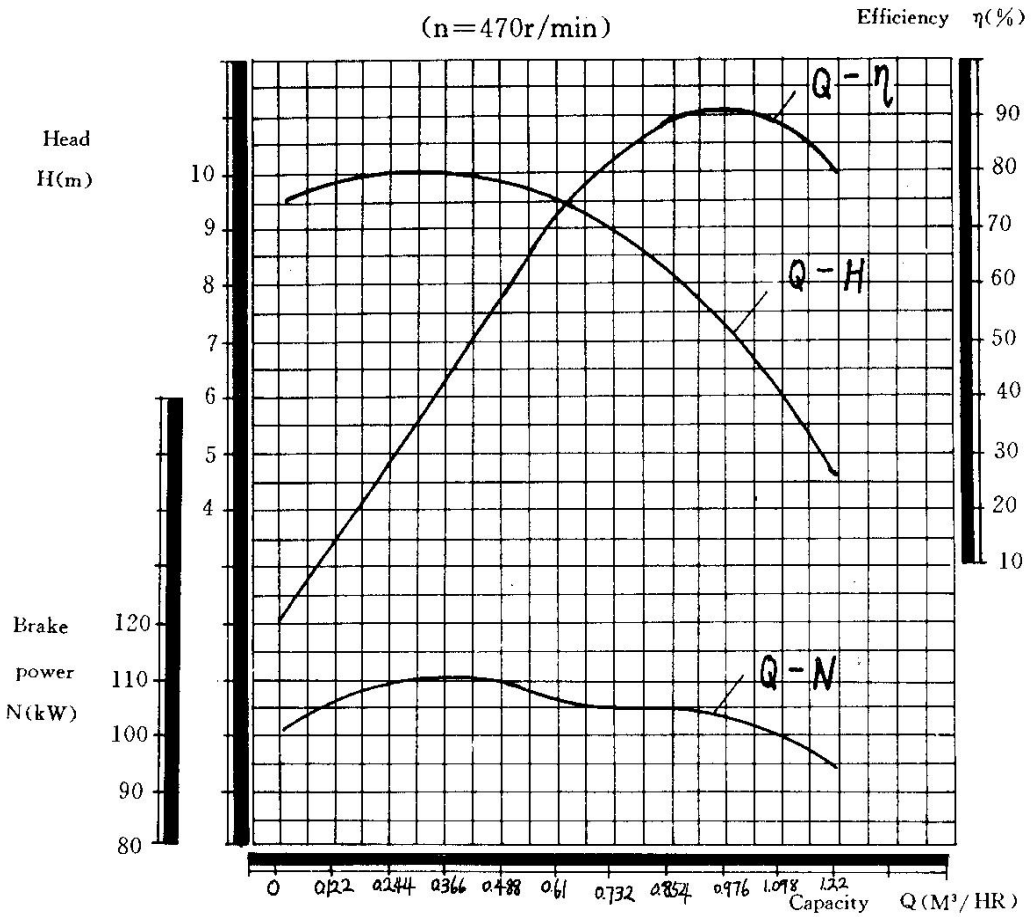
20HBC—40 Mixed-flow pump performance curves
(n=580r/min)



Capacity Q		Head	Speed	Power N (kW)		Efficiency	(NPSH)r	Inlet and outlet bore	Impeller diameter	Weight
(m^3/h)	(l/s)	H (m)	n (r/min)	Brake power	Motive power	η (%)	(m)	(mm)	(mm)	(kg)
1690	469	7.6		41.9		83.4				
1980	550	6.2	580	38.9	55	86.0	5.5	500	556	790
2180	606	5.3		39.1		80.4				
2127	591	12.0		83.4		83.4				
2492	692	9.8	730	77.3	95	86.0	6.5	500	556	790
2744	762	8.4		78.0		80.4				

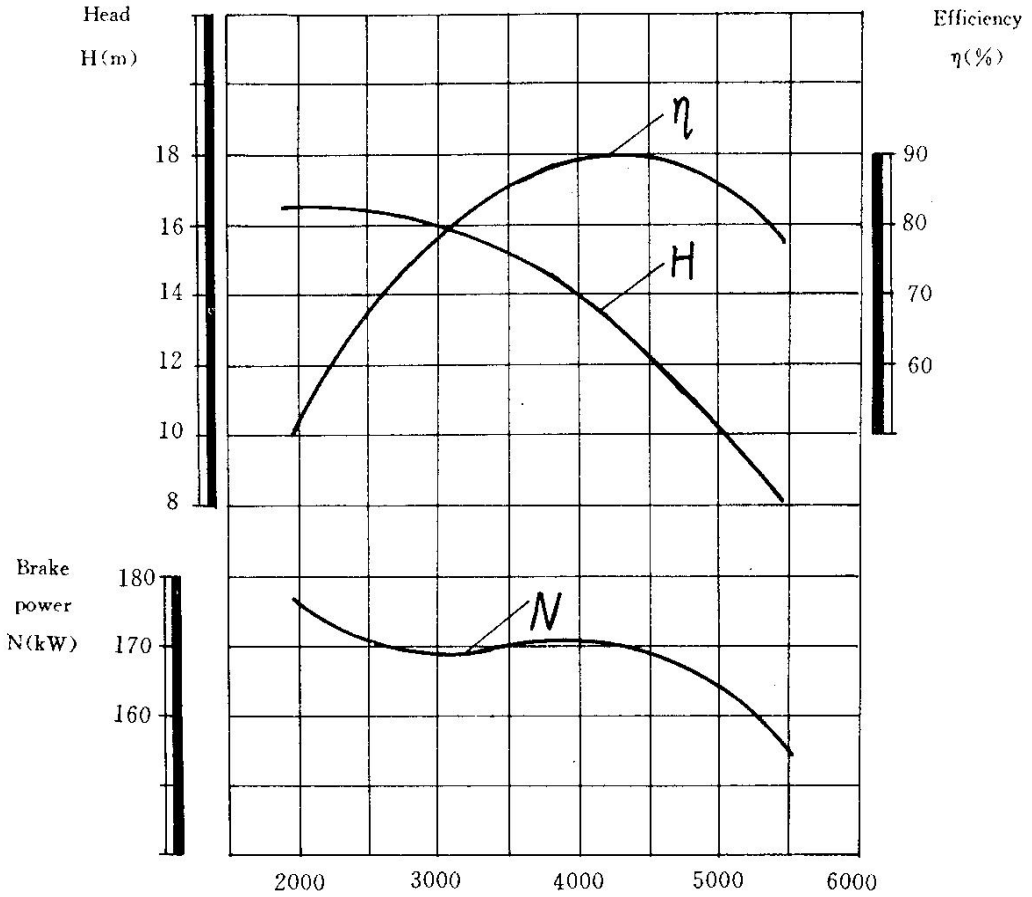
26HBC—40 Mixed-flow pump performance curves

(n=470r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m^3/h)	(l/s)			Brake power	Motive power					
3060	0.850	7.4		70.9		87				
3400	0.944	6.5	450	66.8	90	90	5.5			
3960	1.100	5.0		62.0		87				
3295	0.915	8.6		88.7		87				
3663	1.017	7.6	485	84.2	100	90	5.5	650	730	1800
4244	1.185	5.9		78.8		87				
4014	1.115	12.70		159.6		87				
4457	1.238	11.18	590	150.8	180	90	5.5			
5193	1.442	8.59		139.6		87				

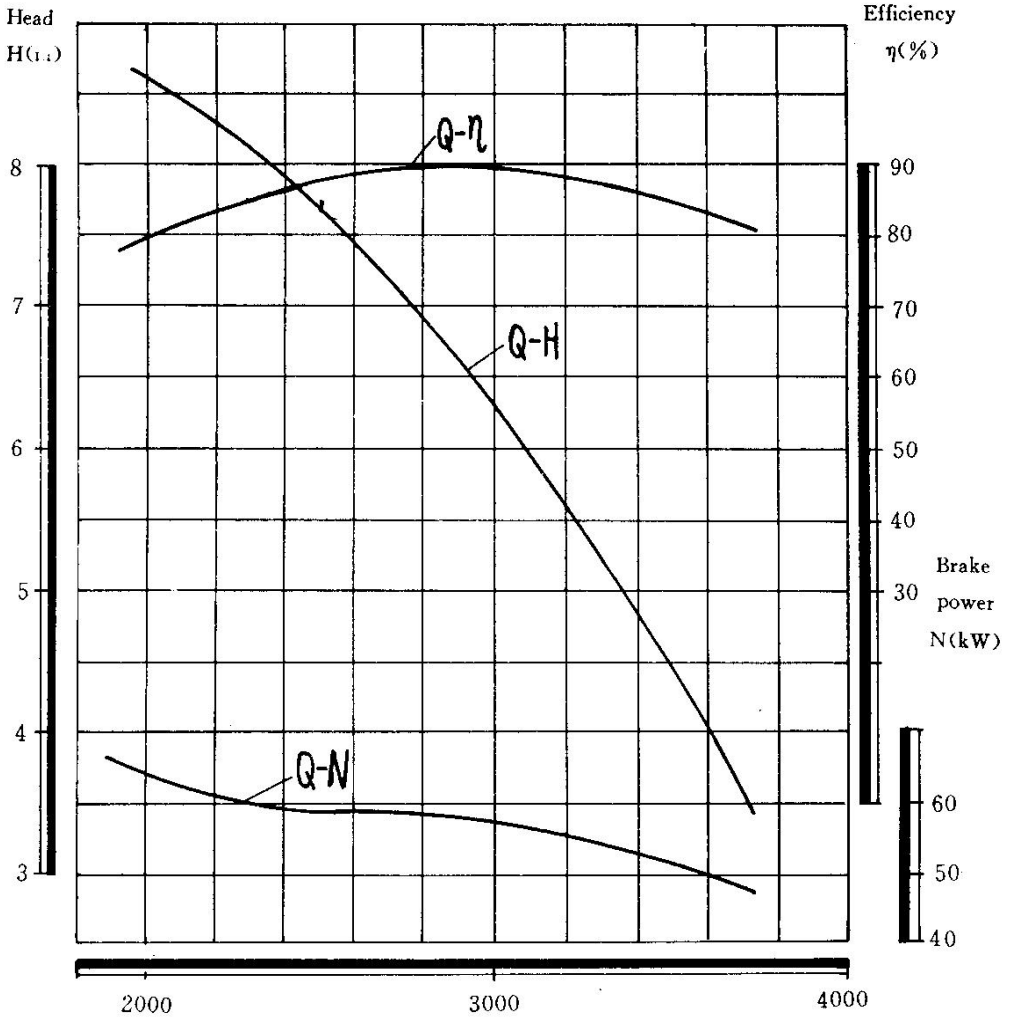
26HBC－30 Mixed-flow pump performance curves
(n＝590r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Effic-iency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m^3/h)	(l/s)			Brake power	Motive power					
3200	889	15.8	590	168	180	82	5.5	650	730	1800
4000	1111	14.0		171		89				
5000	1389	10.4		165		86				
2658	738	10.9	490	96.2	115	82	5.5			
3322	923	9.7		98.6		89				
4153	1154	8.6		94.5		86				

26HBC－50 Mixed-flow pump performance curves

(n＝485r/min)



Capacity Q		Head H (m)	Speed n (r/min)	Power N (kW)		Efficiency η (%)	(NPSH)r (m)	Inlet and outlet bore (mm)	Impeller diameter (mm)	Weight (kg)
(m³/h)	(l/s)			Brake power	Motive power					
2650	736	7.15	485	59.3	75	87	5.5	650	685	1800
3312	920	5.1		53.5		86				
3600	1000	4.0		49.0		80				
3324	896	10.58	590	107	115	87	5.5			
4032	1120	7.55		96.4		86				
4379	1216	5.92		88.2		80				

Ⅳ. Installation

There are three types for the installation of HBC type pumps: underground, semi-underground, over-ground. The semi-underground type is better. The bearings of pumps of underground installation wear out frequently, and this does not exist in the pumps of semi-underground installation. For maintenance, the semi-underground installation takes away the difficulties which exist in underground installation. For suction piping, the semi-underground installation decreases the loss which exists in overground installation because of high suciton head and long suction pipe.

1. Requirements

1.1 Pump position: the bearing case of the pump should be adove the highest water level, and the lowest water level should be considered in such a way that the total suction head including the loss in inlet piping should not exceed the allowable suction head.

1.2 The pump set should be located as close as possible to the water source so as to reduce the length of the suction piping and get a less loss.

1.3 The whole piping system should be as straight and short as possible. When the pump is installed on land, a 90° or 33° elbow is used in inlet piping system (for 26HBC—30,—40,—50 pump, also including a 27° elbow). If the foundation is a one with a proper slope, the elbow at the discharge side can be eliminated. For special requirement, the user may suggest extra elbows before the contract is completed.

2. Attentions

2.1 As for belt drive, the belt pulleys of both driver and pump should be aligned. The pulleys and belts must be covered by a safety guard.

2.2 It is not correct to connect a elbow directly to the pump shroud. There should be a straight pipe between them so as to ensure that the velocity distribution of water flowing into the pump will be uniform.

2.3 Between the flanges of pipes and pipe fittings there should be gaskets of asbestos or rubber in order to prevent water and air from leaking.

2.4 The inlet pipe must be stretched into the suction pool. The submerged length should be proper, and equals to 1D—3D to the river bottom, 1.5D—3D to the lowest water level, and 1D—1.5D to the suction pool wall (D is the dia-me-

ter of the suction pipe). For a bigger pump, a smaller number is more appreciated, vice versa.

2.5 The outlet pipe must be submerged into the discharge pool and its end should be near to the water surface so as to reduce head loss.

2.6 The end of the suction pipe must be netted with steel wire in order to prevent aquatic plants and other alien objects from entering into the impeller.

2.7 When the pump is installed on a ship and lubricated with oil, the inclination of the ship must be taken into consideration. The inclining can make the bearings out of the oil, which will result in breakdown of the bearings.

2.8 Single-row annular contact ball bearings are used in 26HBC—30, —40, —50 pumps. An appropriate axial internal clearance is necessary to get high carrying capacity and prolong operating life.

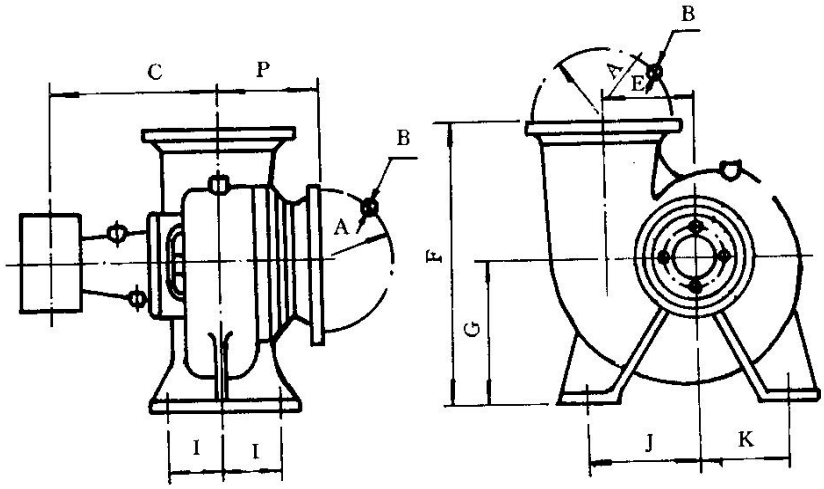


Fig 3. Dimensions for mounting

Model	A	B	C	D	E	F	G	I	J	K	Foundation bolt hole
4HBC−35	Ø142	6−Ø9	298	154	97	278	135	47	100	78	4−Ø12
6HBC−35	Ø210	6−Ø14	346	163	155	390	205	78	154	110	4−Ø18
8HBC−35	Ø270	6−Ø18	408	192	200	520	270	110	240	150	4−Ø18
10HBC−$^{30}_{40}$	Ø320	8−Ø18	526	251	232	585	297	123	262	164	4−Ø23
12HBC$_2$−40	Ø380	8−Ø18	526	245	282	710	360	150	320	200	4−Ø23
12HBC−50T	Ø380	8−Ø18	526	245	282	710	360	150	320	200	4−Ø23
14HBC−40	Ø445	8−Ø23	539	290	290	780	400	150	320	200	4−Ø23

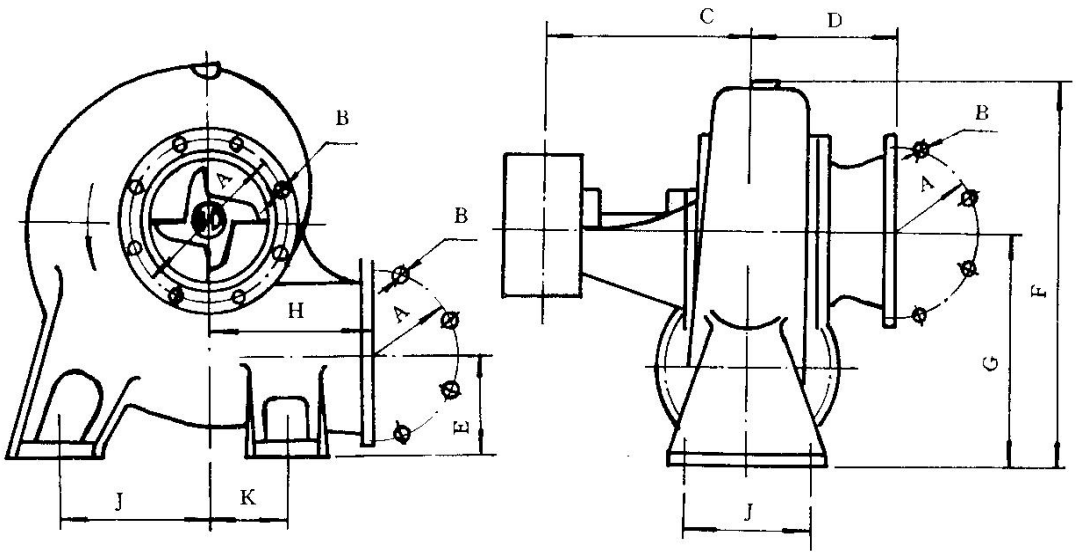


Fig 4. Dimensions for mounting

Model	A	B	C	D	E	F	G	H	I	J	K	Foundation bolt hole
14HBC—40	Ø445	8—Ø23	539	290	255	903	545	380	300	300	200	4—Ø23
16HBC—30 40	Ø500	8—Ø23	674	305	285	1082	655	450	380	320	230	4cast holes Ø30
20HBC—40	Ø600	8—Ø23	806	332	330	1226	730	565	390	425	335	4cast holes Ø30
26HBC—30 40 50	Ø770	12—Ø27	1138	480	430	1670	1000	735	580	550	430	4cast holes Ø34

Note:

1. The dimension "C" of model 26HBC—30, —40, —50 pumps refers to the distance between the pump center line and the end of coupling.

2. The direction of the outlet of model 26HBC—30, —40, —50 pumps is just opposite to one shown in Fig. 4.

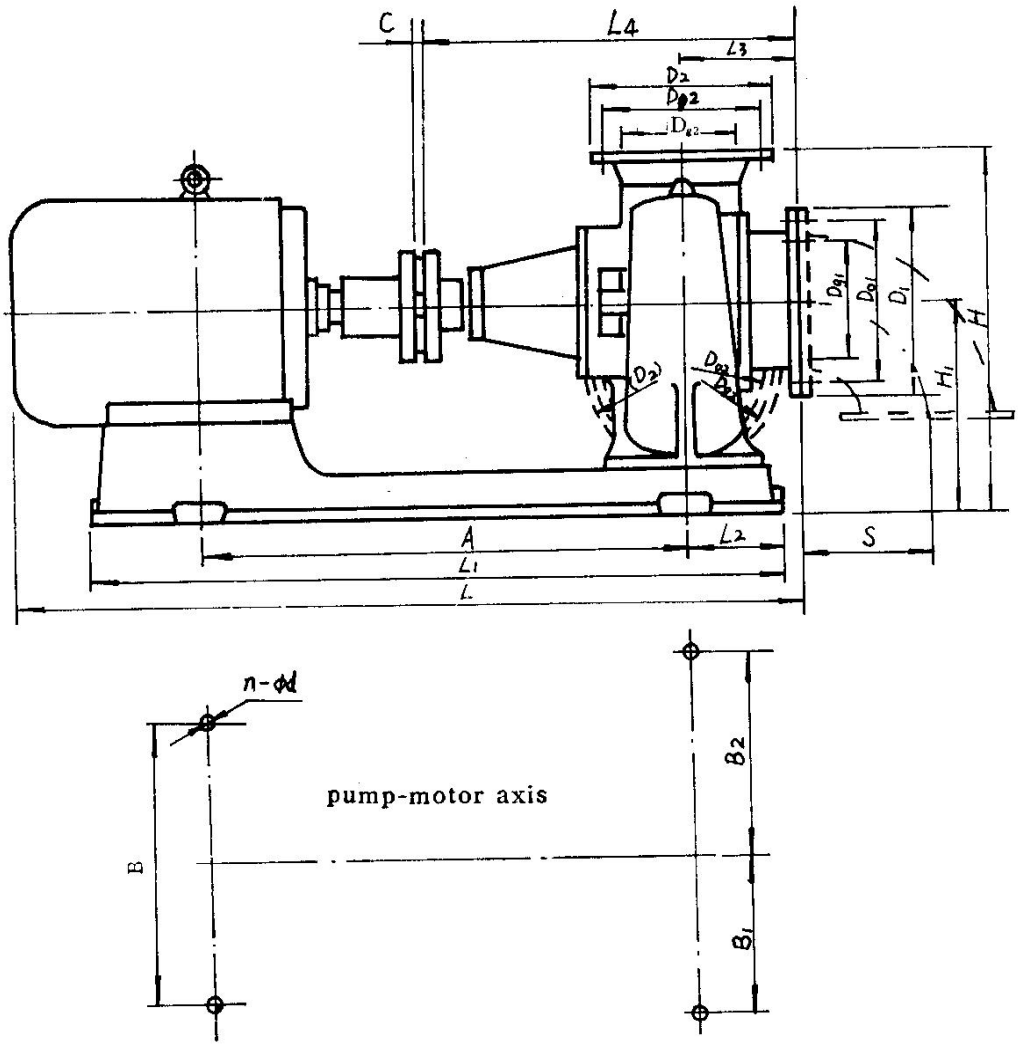


Fig 5. Direct-coupling installation dimensions of HBC pumps with base

Table Direct-coupling installation dimensions of HBC pumps

Model	speed (r/min)	Motor Model	A	B	B_1	B_2	n-Ød	Dg_1 Dg_2	Do_1 Do_2	D_1 D_2	H_1	H	L	L_1	L_2	L_3	L_4	S
4HBC—25	2900	Y100L-2	515	288	144	166	4-Ø18	100	142	164	195	338	825	712	85	124	433	115
6HBC—35	1450	Y132S-4	630	370	185	229	4-Ø21	150	210	240	265	450	1028	878	120	163	538	162
8HBC—35	1450	Y180M-4	820	466	233	323	4-Ø21	200	270	310	350	600	1330	1165	158	192	639	217
10HBC—30	980	Y180L-6	973	468	259	357	4-Ø25	250	320	360	397	685	1564	1368	183	251	832	267
10HBC—40	1450	Y200L-4	998	508	259	357	4-Ø25	250	320	360	397	685	1628	1406	183	251	832	267
$12HB_2C$—40	980	$Y200L_2$-6	998	520	305	425	4-Ø25	300	380	420	460	810	1621	1447	215	245	825	302
12HBC—50T	1450	Y250M-4	1085	610	305	425	4-Ø25	300	380	420	460	810	1778	1573	218	245	825	302
12HBC—50T Welded base	1450	Y250M-4	1085	406	203	323	4-Ø25	300	380	420	530	880	1778	1535	205	245	825	302
14HBC—40 (Upward)	980	Y225M-6	1060	560	325	445	4-Ø25	350	445	495	500	880	1749	1525	225	290	883	377
16HBC—40	730	Y250M-8 / Y280S-8	2×624 / 640+639	640	320	320	6-Ø22	400	500	550	810	1242	2001 / 2071	1928 / 1994	350	306	1046	430
20HBC—40	580	JS116-10	2×814	860	430	430	6-Ø26	500	600	640	910	1415	2425	2458	370	332	1241	500
26HBC—40	470	JS137-12 / 13-12	3×765	992	556	436	8-Ø26	650	770	840	1230	1846 / 1900	3012 / 3142	2777 / 2877	282	480	1618	600
	580	JS138-10	3×765	992	556	436	8-Ø26	650	770	840	1230	1900	3142	2877	282	480	1618	600

Note: The Speed refers to rated speed. The utilization of the inlet elbow of model 16HBC—40 20HBC—40, 26HBC—40 pumps can be determined by users

V. USE AND MAINTENANCE

1. Testing

After installation, the pump must be tested so as to inspect whether the rotation of pump is right and to remedy the troubles caused during installation.

2. Starting the pump

2.1 Shut down the delivery valve or the check valve.

2.2 Start the motive unit and pour water into the pump through the screwed hole on the top of the pump casing; or open the check valve to let water flow from the discharge pool into the pump casing; or evacuate the air from the pump casing by a vacuum pump (soon after water is drawn up start the pump and stop the vacuum pump).

2.3 When the pump is running under normal speed, gradually open the delivery valve, then regulate the packing stuffs. If the running conditions of the pump and the bearing temperature are normal and vibration is soft. keep the pump running (If a check valve is used, hang up its cap to reduce the resistance.

3. Use and Maintenanee

3.1 Inspect the oil level in bearing case frequently.

3.2 Inspect frequently the bearing temperature rise, which is limited to 75℃ (too hot by feeling), and is roughly 35℃ higher than the room temperature. If the bearing temperature is too high. stop the pump, find out the cause and remedy it.

3.3 Note whether the brake power is increased or decreased and the capacity decreased suddenly. If these troubles happen, stop the pump and remedy them.

3.4 Note frequently whether all bolts, screws and nuts are loosened by vibration in running.

3.5 The regulation of packing stuff must be adequate and liquid must be kept flowing out from the gland drop by drop. If the packing stuff is too tight, the shaft will be overheated and brake power is increased; if the packing is too loose, leakage will be too much and efficiency is decreased, even air will probably penetrate into the pump.

3.6 Note whether there is violent rubbing or knocking within the pump during running. If there is rubbing action between pump shroud and impeller, please add the thickness of paper gaskets. The required elearance is 0.3—

0.8mm, and a small elearance is suitable for a small pump.

3.7 When pump is directly coupled with a motor, the centrelines of both the motor and the pump should lie on the same straight line, so as to avoid vibration in running.

3.8 Inspect whether air is penetrating into the suction pipe system.

3.9 In winter, after the pump is stopped, water must be drained off from the pump and pipes so as to prevent the pump from being frozen to crack.

3.10 Replace the lubricating oil ir grease after the pump has been used for first 100 hours, afterwards replace the lubricating oil or grease for every 500 hours.

3.11 After the pump has been used for 1000 hours, dismount and inspect the quick-wearing parts. When the pump will not be used for a long period, dismount all the moving parts, dry and paint them with antirust grease, and then well preserve them.

Ⅵ. TROUBLES AND REMEDIES

Troubles	Causes	Remedies
No water is pumped out	1. Pouring water or evacuation is not enough 2. Leakage in suction piping system 3. Actual suction head is too high 4. The direction of rotation is wrong 5. The actual total head exceeds range of application	1. Pouring water or evacuating continuously 2. Inspect and make no leakage occur 3. Install the pump in a lower position 4. Change the direction of rotation 5. Decrease the total head
Pump runs normally for a few minutes and then ceases to deliver water	1. Too much bubbles surrounding the suction pipe 2. There is air within suciton pipe 3. Leakage in suction piping system 4. Some arresting materials in the impeller or inlet piping system	1. Bottom of suction pipe should be about one meter below water level 2. Get the air out 3. Inspect the gaskets and tighten the unts 4. Taking off
Insufficient discharge	1. Some arresting materials in the impeller or inlet piping system 2. Speed is too low or motive power is not enough 3. The actual head is too high 4. The impeller and pump shroud wear out and clearance is too large 5. The delivery valve is opened not widely or the check valve is clogged 6. The inlet pipe under water	1. Taking off 2. Adjusting 3. Decreasing 4. Repair or replace the worn parts or adjust the clearance by paper gaskets 5. Open the delivery valve or take off the arresting matrials 6. The end of inlet pipe should

Troubles	Causes	Remedies
	level is not enough	be about one meter below water level
Brake power is too large	1. The speed is too high 2. The shaft is bent 3. The packing is too tight 4. The bearing wear out or break 5. The belt is too tight	1. Decreasing 2. Adjusting 3. Lossen the gland nuts or take out the packing and make it narrower 4. Replacing 5. Loosening
Noise and vibration	1. Two shafts not lie on the same straight line 2. The shaft is bent or bearings wear out too much 3. The nuts of foundation bolts have loosened 4. The impeller is clogged 5. Cavitation within the pump due to a too high suction head 6. There is something inside the pump	1. Adjusting 2. Adjusting or replacing 3. Tightening 4. Taking off 5. Install the pump in a lower position 6. Take it off
Bearings are overheated	1. Lubricating oil or grease is insufficient 2. Lubricating oil or grease is bad or dirty 3. Two shafts not lie on the same straight line 4. Bearings wear out 5. The belts is too tight	1. Adding 2. Wash the bearings and bearing case and replace the lubricant 3. Adjusting 4. Replacing 5. Loosening

Troubles	Causes	Remedies
Packing is overheated	1. Packing is pressed too tightly or unevenly 2. The packing is pressed obliquely to cause uneven friction with shaft sleeve	1. Loosen the gland nuts and tighten them regularly 2. Loosen the gland nuts and tighten them evenly
Too much leakage in packing	1. Packing is too loose 2. Position of joints of packing is bad 3. Packing size is wrong or packing wears out 4. Shaft sleeve wears out	1. Tighten the gland nuts adequately 2. The joints of packing should be placed in opposite direction alternatively 3. Replacing 4. Replacing