BTS ENGINEERING

https://prom-nasos.pro
https://bts.net.ua
https://prom-nasos.com.ua
+38 095 656-37-57,
+38 067 360-71-01,
+38 063 362-12-31,
info@prom-nasos.pro

GREATWALL MIXERS

PRODUCT CATALOGUE

TOP-ENTRY MIXERS

GMV BELT MIXERS

DOUBLE-OUTPUT SHAFT MIXERS

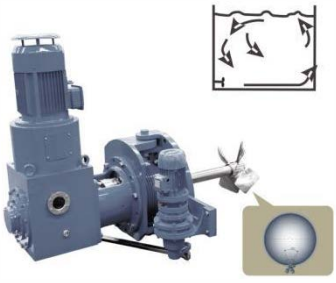
GMR RIGHT-ANGLE MIXERS

GMP PARALLEL SHAFT MIXERS

GMC CO-AXIAL MIXERS

MTC TOP-ENTRY MAGNETIC MIXERS

SIDE-ENTRY MIXERS



CKJ SWIVEL ANGLE SIDE-ENTRY MIXERS

CFJ FIXED ANGLE SIDE-ENTRY MIXERS

SPECIAL MIXERS

XKJ SERIES PORTABLE MIXERS

PIPE MIXERS

LAB TESTING MIXING EQUIPMENT

MECHANICAL SEAL

PRODUCTS

202,204 SERIES SINGLE MECHANICAL SEAL

205,206 SERIES DOUBLE MECHANICAL SEAL

261 SERIES FOR SIDE-ENTRY MIXERS

285, 286 SERIES FOR BOTTOM-ENTRY MIXERS

IMPELLERS

KSX

FY

CCJ

FY

BTD

XCK

HQ

ZCX

Contents

1 General description for mixing equipment

There are various types of mixing, such as mechanical mixing, gas mixing, etc. The common type is mechanical mixing in industries. This catalogue focuses more on mechanical mixing, which is commonly used, especially for middle and low pressure conditions. A typical mixing equipment is shown in Fig. 1-1， which includes the following main parts, motor, reducer, coupling, pedestal, mechanical seal, mounting base, shaft, impeller, in-tank supporting parts, etc. For other types of mixers, please refer to chapter 9 for detail.

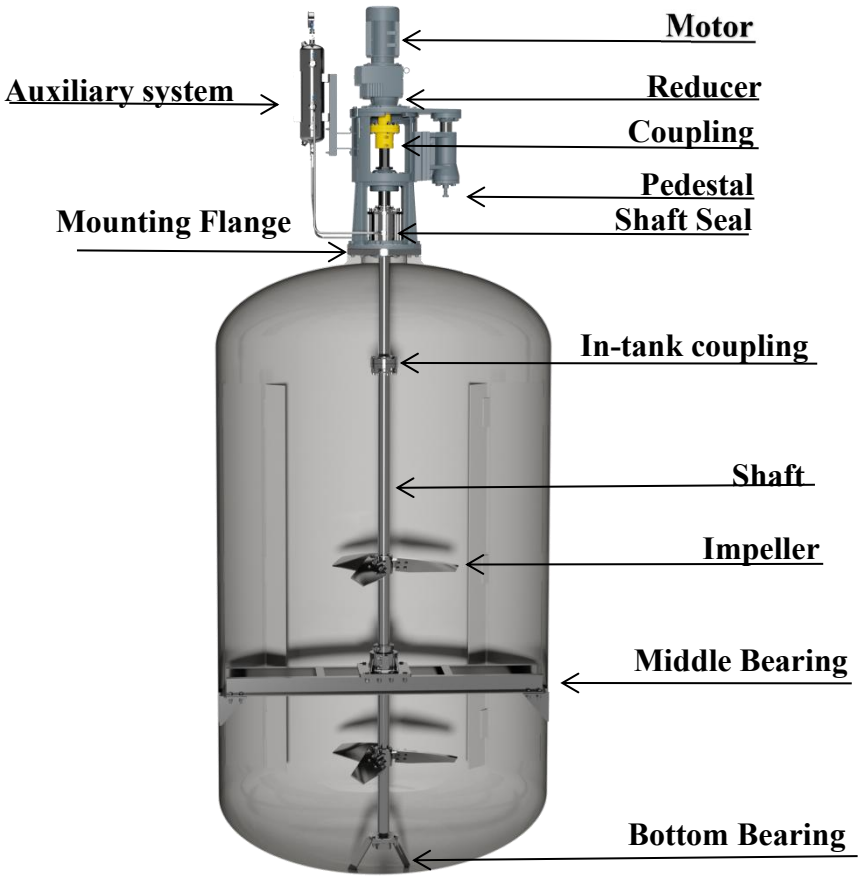


Fig.1-1 Sketch of typical mixing equipment

1.1 General design method for mixing equipment

The design of mixing equipment needs the combination of theory and experiences. The general design steps are as follows:

① Get the detail of the process character and requirements, such as mixing purpose, fluid parameters, operating temperature and pressure, etc.

② Decide the proper impeller type, baffle conditions and speed according to mixing purpose and fluid parameters;

③ Calculate the mixer process parameters, such as the power consumption, discharge flow rate, critical suspension speed, etc.

④ Select proper mechanical seal according to process requirements;

⑤ Select proper motor, reducer, pedestal, coupling according to the power and seal type;

⑥ Calculation of shaft critical speed and mechanical design of the shaft;

⑦ Design of other parts of the equipment, such as mounting base, in-tank supporting, etc.

During the design processes, impeller selection is the most important step, which needs more experiences. The impeller characteristics, such as shear-circulation, adaptability of fluid viscosity, flow field type should be known carefully. Combine the mixing purpose, proper impeller type should be decided finally. At present, most of the mixer design is based on experiences, select the commonly used type and choose proper parameters from these types. There are also other design methods, such as getting design data from lab scale experiment or Computational Fluid Dynamics (CFD) and then scaled the mixer to industry size.

1.2 Rules for main parts selection

1.2.1 Selection of motor

1. The selected motor should have the consideration of power increase during mixer start-up.
2. For explosion conditions with gas or vapor, select proper motor type and explosion-proof grade according to the dangerous environment grade or gas (vapor) classification.
3. For corrosive conditions, select proper motor protection type according to environment classification.
4. Except the above factors, also consider other factors that may cause mechanical or electrical damage, such as dust, temperature, rain, wet, pest, etc. during motor selection. For high explosive, small dimension and torque adaptive requirement, hydraulic or air motor can be selected.

1.2.2 Selection of reducer

1. Select the standard reducer or products from professional companies first.
2. Consider the stable and continuous running at vibration or load variation conditions. Choose gear reducer first which has higher transmission efficiency.
3. For bi-directional running, do not use worm reducers.
4. For flammable and explosion conditions, do not use belt reducers. Otherwise, antistatic methods should be adopted.
5. Generally, the axial force should not be borne by reducer. Otherwise, please check the permitted load of reducer.
6. The reducer rated power should be no less than the output shaft driving power, which includes the shaft power, friction power at mechanical seal and pedestal bearing. At the same time, also fulfill the requirement of power increase during start-up.
7. The reducer input speed should match motor output speed, and the reducer output speed should match the mixing speed. If there is confliction, adjust the mixing speed at the permission of process technology.
8. The choose of relative position for input and output shaft should fulfill the requirements for vessel top and bottom layout.
9. Selection of reducer cooling method (such as additional oil box, self-cooling, fan cooling, water cooling, pumping circulation).
10. Selection of service factor. For common middle and small gearbox, SF. ≥1.8, for large gearbox SF. ≥2.0

1.2.3 Selection of pedestal

1. Select the standard pedestal from this handbook first.
2. Generally, non-support pedestal is suitable for low power and low axial load mixers. There must be two support points in motor or reducer, and the bearings must be checked to be strong enough to bear the axial and radial load from the shaft.
3. Select single-support pedestal if one of the following is fulfilled.
   （1）There is one support point in motor or reducer, which can bear the shaft load.
   （2）The bottom bearing could be used as a support point.
   （3）The mechanical seal could be used as a support point
   （4）There is guide bearing at the middle of shaft in vessel, which could be used as a support point.

4. Choose double-support pedestal if non-support or single support pedestal is not available.
5. Choose proper bearing type (such as radial, thrust, self-aligning or sliding bearing) and dimension according to load rate and direction, aligning requirements, etc.
6. The vibration isolation between pedestal and vessel should be considered when flexible shaft is used.

1.2.4 Selection of coupling

1. Select standard coupling from this handbook.
2. Choose rigid coupling for non-support pedestal (there is no other support except the motor and reducer).
3. If the middle, bottom bearing and mechanical seal are not used as support point, choose rigid coupling for single support pedestal.
4. Choose flexible coupling for double-support pedestal.
5. Use rigid coupling for connection of segmented shaft.

1.2.5 Selection of mechanical seal

1.2.5.1 Selection of mechanical seal

1. Suitable for pressured and vacuum vessel with corrosive, flammable, explosive, toxic fluid or fluid with solids.
2. According to the usage in chemical equipment, installation and maintenance, external type should be used.
3. For seal contacted with fluid (such as bottom entry mixers) and the fluid has solids, inward flow type should be used.
4. Use balanced type for high pressure; non-balanced type could be used at low pressure.
5. Choose double mechanical seal for severe conditions, such as flammable, explosive, corrosive, low temperature fluid or fluid with solids, and vacuum conditions.
6. If the seal liquid temperature is higher than 80℃, cooling system for the seal liquid should be adopted.
7. The seal liquid should not affect the material in tank if there is leakage. Also, it should have good lubrication performance, does not erode the seal parts, has higher vaporization temperature and specific heat. The seal liquid pressure should higher than vessel working pressure (0.1~0.2MPa).
8. The bearing in the mechanical seal is to control the vibration at radial direction. Generally, it could not be used as support point at shaft design.
9. Choose anti-corrosive material for seal rotating and stationary ring. Generally, choose hard material for rotating ring and soft material for stationary ring.
10. Except the above rules and seal selection according to seal's application range, pay attention to several special problems, such as maintenance of seal without drain out the liquid for bottom entry and side entry mixers.

1.2.5.2 Selection of stuffing box

1. Suitable for vessels of atmospheric, pressured and vacuum operations, and routine maintenance is permitted.
2. If stuffing box is designed properly and has good lubrication and cooling system, it could be used at higher pressure, temperature and shaft speed.
3. If there is not cooling system and lubrication, the shaft velocity should not exceed 1m/s.
4. If the liquid temperature in tank is higher than 120℃, the stuffing box should be cooled effectively.
5. If seal oil need to be pressured into stuffing box, the oil pressure is usually higher than working pressure to prevent leakage from the vessel. The seal liquid should not affect the material in tank if there is leakage.
6. There is not supporting bush for stuffing box. The shaft support is usually set on pedestal.

1.2.5.3 Selection of liquid seal

1. Liquid seal could be used to prevent dust go into vessel or just isolate the working material with external environment.
2. The working material should be non-flammable, non-explosive, or just mildly toxic.
3. The working pressure is ATM, the working temperature is usually between -20℃ and 80℃ according to the character of

different seal liquid.

4. For working volume less than 0.63m^3, shaft diameter range 25~40mm, the shaft speed could reach 1500r/min; for working volume greater than 0.63m^3, shaft diameter range 40~130mm, the shaft speed should be limited to 320r/min.
5. The working fluid should not fill the whole volume of the vessel.
6. Choose the working fluid or other neutral fluid that does not react with working fluid as seal liquid. The seal liquid should difficult to evaporate at working temperature, and does not pollute the air.

1.2.6 Design of shaft

1. Choose material with better plasticity for shaft.
2. For convenient installation and maintenance, the in-tank shaft could be segmented and connected with in-tank coupling. The connection between mixing shaft and reducer shaft could use coupling with stub.
3. For top entry shaft, consider shaft lift structure at shaft end if necessary. Also consider shaft support structure for maintenance.
4. Calculate the shaft strength and critical speed for shaft design. If necessary, shaft rigidity also should be calculated.
5. Flexible shaft design must fulfill the following conditions.
   (1) The shaft diameter should be consistent for the single-span shaft and overhung shaft.
   (2) Removable coupling is not permitted in the calculating part.
   (3) Flexible shaft is only suitable for high speed impellers, such as three sweptback, open turbine, disc turbine and propeller etc.
   (4) Internal parts are not permitted for vessel without baffles.
   (5) Flexible shaft could not use in gas and gas-liquid conditions.
   (6) The liquid level should not less than 1/2 of the vessel diameter.
   (7) The vortex depth should not exceed 1/2 liquid height and also should not lower than impeller.
   (8) For axial flow from the impeller, let the shaft just bear pulling force.

1.2.7 Selection of impeller

The variety of mixing purpose, working fluid, vessel types and complexity of flow field make the selection and design of impeller complicated and professional. There lots of research for impeller selection, but the different research emphasis leads to different conclusions. Please refer to the related books and research reports for detail.

2 Commonly Used Mixers

2.1 General Vertical Mixers

General Vertical Mixers mainly include GMC co-axial Mixers, GMP Parallel Shaft Mixers, GMR Right-angle Mixers and GMV Belt Mixers. GMC series with co-axial reducer have the advantages of compact structure, convenient maintenance, high transmission efficiency, low noise, widely use , high reliability. GMC series belong to low or medium power mixers, motor power is generally below 132 KW. GMP series with parallel shaft reducer have the advantages of stable transmission, low noise, heavy load capacity, low temperature rise. Motor power can reach at 200 KW. GMR series with right-angle reducer have the advantages of heavy load capacity, long life, low noise, which are particularly suitable for high power and limited space situations. GMV series with belt reducer have the advantages of simple structure, stable transmission, convenient installation and maintenance. General Vertical Mixers are widely used in bio-pharmaceutical, petrochemical industry, metallurgy, mining, fine chemical, food and beverage, environmental protection and other industries.

GMC Co-axial Mixers

GMP Parallel Shaft Mixers

GMR Right-angle Mixers

GMV Belt Mixers

Fig. 2-1 Types of General Vertical Mixers (GMC、GMP、GMR and GMV series)

2.2 CFJ Series Gear Drive Side-Entry Mixers

CFJ series side-entry mixer is driven by a pair of spiral gears, so the structure is compact and the transmission efficiency is high. With box structure design, the appearance is nice. The motor and pedestal are all mounted on the box, and the adjustment is convenient. The shaft is fastened by cone sleeve in the box. The coupling is cancelled, so the length is shortened and the stability is strengthened. With 261 mechanical seal for side-entry mixers and special shut-off device, the mixer is suitable for complex conditions, such as fluid with solids.

Table 2-1Main parameters for CFJ mixers

Type	Motor Power (KW)	Rotation Speed of Output Shaft (r/min)			
		Use 4-pole Motor		Use 6-pole Moto	
		i_{I}	i_{II}	i_{I}	i_{II}
CFJ1	0.55，0.75，1.1，1.5	350	280	230	190
CFJ2	2.2，3，4	350	280	230	190
CFJ3	5.5，7.5，11	350	280	230	190
CFJ4	15，18.5,22	350	280	230	190
CFJ5	30，37, 45	340	250	230	170

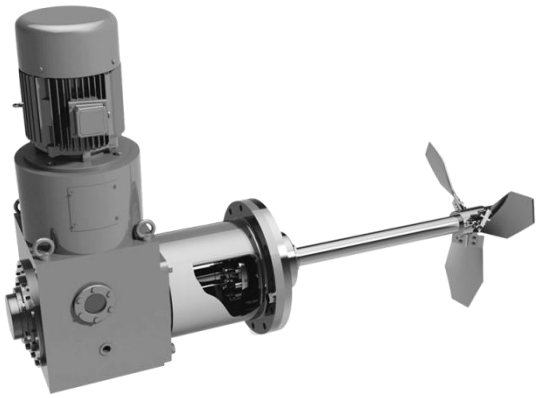


Fig. 2-2 CFJ CFJ mixers

2.3 CKJ Series Swivel Angle Side-Entry Mixers

CKJ series swivel angle side-entry mixers are developed based on CFJ fixed angle mixers by adding periodically swivel device. It is suitable for such supergiant vessels, such as slurry or crude oil storage tanks, or vessels which needs perfect mixing. The swivel angle design could reduce power consumption, shorten mixing time and enhance mixing effect. With 261 mechanical seal for side-entry mixers and special shut-off device, the seal faces and mechanical seal could be maintenance without drainage of the tank fluid.

Table 2-2 Main parameters for CKJ mixers

Type	Motor Power (KW)	Rotation Speed of Output Shaft (r/min)			
		Use 4-pole Motor		Use 6-pole Moto	
		i_{I}	i_{II}	i_{I}	i_{II}
CKJ1	0.55，0.75，1.1，1.5	350	280	230	190
CKJ2	2.2，3，4	350	280	230	190
CKJ3	5.5，7.5，11	350	280	230	190
CKJ4	15，18.5,22	350	280	230	190
CKJ5	30，37, 45	340	250	230	170

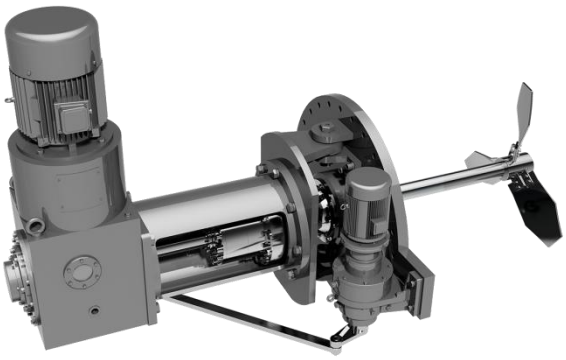


Fig. 2-3 CKJ mixers

2.4 TD Series Belt Drive Side-Entry Mixers

TD series side-entry mixers use synchronize tooth belt, so the structure is compact and the transmission efficiency is high. With inner pedestal structure, this mixer is suitable for such conditions as fluid without solids, or long extended shaft. The shut-off device at the head of the pedestal permit the maintenance of the seal or reducer without discharge the tank fluid.

Table 2-3 Selection table for TD mixers

Output Speed (KW)	200	240	300	370	470	600
Reduction Ratio	5	4	5	4	3.15	2.5
Motor Power (KW)	6-pole Motor		4-pole Motor			
0.55						
0.75						
1.1				TD_1		
1.5						
2.2						
3.0						
4.0			TD_2			
5.5						
7.5						
11						
15						
18.5			TD_3			
22	×					
30	×	×	×			

Notes: The mixer of 0.55～7.5KW is hanged by rope and 11～30KW is foot-mounted type.

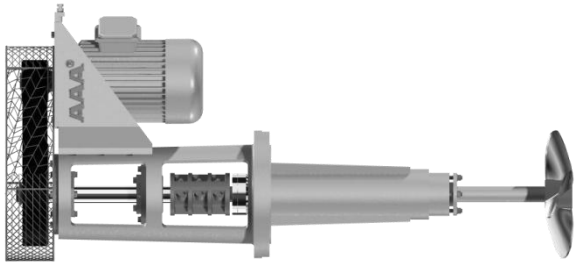
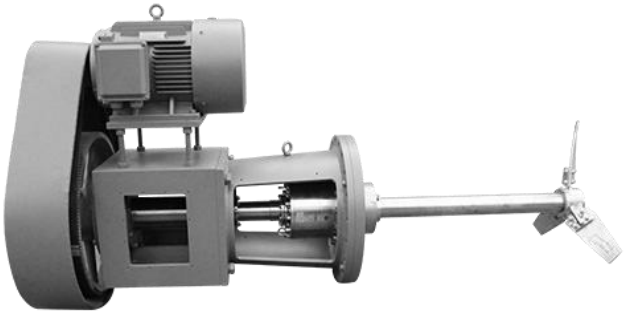


Fig. 2-4 TD mixers



2.5 CPT Series Belt Drive Side-Entry Mixers

CPT series side-entry mixers use synchronize tooth belt, so the structure is compact and the transmission efficiency is high. With box structure design, the appearance is nice. The motor and pedestal are all mounted on the box, and the adjustment is convenient. The shaft is fastened by cone sleeve in the box. The coupling is cancelled, so the length is shortened and the stability is strengthened. With 261 mechanical seal for side-entry mixers and special shut-off device, the mixer is suitable for complex conditions, such as fluid with solids.

Table 2-4 Selection table for CPT mixers

Output Speed (r/min)		Reduction Ratio	Motor Power (KW)												
			1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45
4-pole Motor	350	4.3													
	280	5.3		CPT2							CPT4			CPT5	
6-pole Motor	230	4.3					CPT3							×	×
	190	5.3												×	×

2.6 XKJ Series Portable Mixers

XKJ gear drive portable mixers are the best choice for various, from simple to complex, mixing applications. Various motor choice and adjustable speed by VFD (or speed controller) provider flexible usage. The compact structure and strong housing reduce weight for really portable and at the same time ensure enough strength and service life. With additional pedestal or adapters, it can also be used at lots of special conditions. On invest will fufill various applications. XKJ direct drive portable mixers provide high speed mixing for those jobs, such as dispersion, emulsification, etc., where greater shearing is needed and it is usually used for smaller batch mixing. Greatwall high shear saw teeth impeller can be used to create locallized high-velocity eddies to provide good mixing of two fluids or dissolving of dry powders into solution. Except that, the gear boxes of both potable mixers, could be made of aluminum alloy. They could be used for pharmaceutical, food industries, which have sanitary requirements

Table 2-5Gear drive XKJ model list

Model	Motor power (KW)	Speed (rpm)	Weight (kg)
XKJ37	0.37	190/215/260	~29
XKJ55	0.55	190/215/260/ 290/335/400/ 450/500	~32
XKJ75	0.75		~36
XKJ110	1.1		~40
XKJ150	1.5	290/335/400/ 450/500	~42

Notes:

1. Variable shoud be equipped with speed controller or VFD.
2. The shaft and impeller will be defined according to applications.

Fig. 2-6 Gear drive XKJ mixers

Table 2-6Motor drive XKJ model list

Model	Motor power (KW)	Speed (rpm)	Weight (kg)
XKJ37	0.37	0-1450	23
XKJ55	0.55	0-1450	27
XKJ75	0.75	0-1450	31
XKJ110	1.1	0-1450	35
XKJ150	1.5	0-1450	37
XKJ220	2.2	0-1450	45

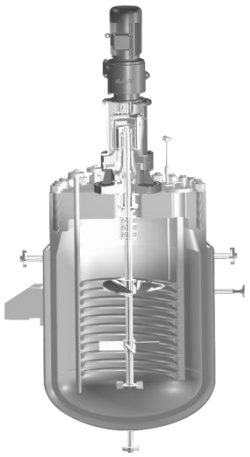
Notes:

1. Variable shoud be equipped with speed controller or VFD.
2. The shaft and impeller will be adjusted according to applications.

Fig. 2-7 Motor drive XKJ mixers

2.7 MTC Series Magnetic Drive Mixers

MTC series magnetic drive use permanent magnet steel for the transfer of torque. Different from the moving seal (such as mechanical seal or stuffing box), the static seal solves the leakage problem at last. So it is suitable for industries which do not permit any leakage, such as pharmaceutical, chemical, biochemical, pesticide, etc. The MTC drive could be designed for top and bottom entry type, which is illustrated in Fig. 2-8. It is suitable for temperature from -40~350℃, pressure from 0~15Mpa, torque from 5~10000N.m.



(a) Top entry type

(b) Bottom entry type

Fig. 2-8 Sketch for MTC

Table 2-7 Torque list for MTC

Type	First series		Second series		Third series		Fourth series	
	Designed temp.(℃)	Torque (N.M)	Designed temp. (℃)	Torque (N.M)	Designed temp. (℃)	Torque (N.M)	Designed temp. (℃)	Torque (N.M)
MTC40		30		25		30		25
MTC63		45		35		50		45
MTC80		55		45		60		55
MTC100		70		55		80		70
MTC125		90		70		95		85
MTC160		115		90		125		110
MTC200		145		115		155		140
MTC250		180		145		195		175
MTC315		225		180		245		220
MTC400	≤120	290	120～180	230	180～250	310	250～350	270
MTC500		360		290		390		340
MTC630		450		360		490		430
MTC800		580		460		620		550
MTC1000		720		570		780		690
MTC1250		900		720		970		870
MTC1400		1010		800		1090		970
MTC1600		1150		820		1250		1110
MTC1800		1300		1030		1400		1250
MTC2000		1440		1150		1560		1390

2.8 MTS Series Sanitary Magnetic Bottom-Entry Mixers

MTS series magnetic drive mixers also use permanent magnets for the transfer of torque in order to prevent leakage. It suits applications which demand high levels of cleanability and durability. Features include temperature-resistant and high-efficiency magnets, ceramic bearing design, one-piece tank plate, flow-through channels can be cleaned in place and all wetted parts of the impeller and the tank plate made of AISI 316L stainless steel. It is suitable for up to 30000 liters and viscosity up to 1000cP.

Table 2-8 Selection guide and options:

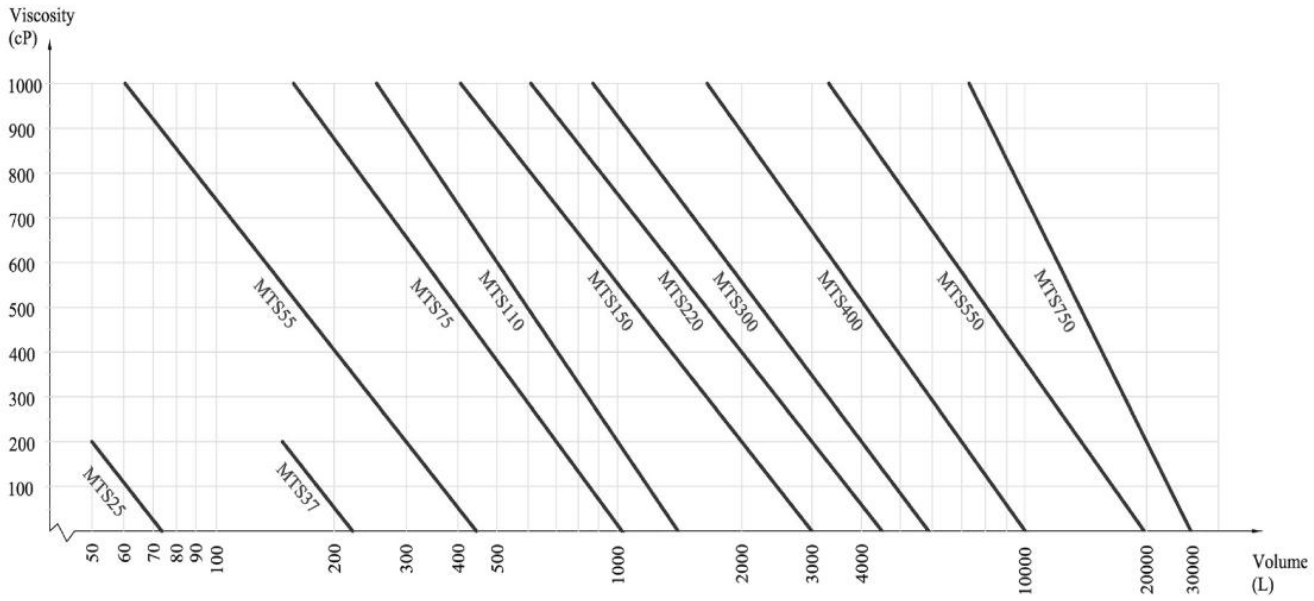


Table2-9Selection table for MTS mixers

Model	Power (KW)	Speed (rpm)	Impeller diameter mm)	Design torque (N.m)
MTS25	0.25	358	140	5
MTS37	0.37	358	140	5
MTS55	0.55	347	190	10
MTS75	0.75	347	190	30
MTS110	1.1	354	220	30
MTS150	1.5	352	280	63
MTS220	2.2	352	280	63
MTS300	3	302	330	100
MTS400	4	306	380	160
MTS550	5.5	278	420	250
MTS750	7.5	200	550	315

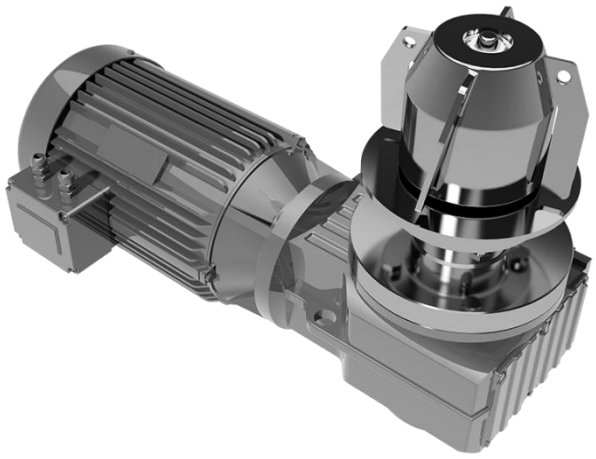


Fig. 2-9 MTS mixers

Notes:

1.Speed varies when equipped with VFD;

2.Parametes such as diameter of impeller, etc. can be customized.

2.9 DTM Series Dynamic Mixing in-tube Mixers

Dynamic Mixing in-Tube Mixer (DTM) is a high-performance piece of equipment for continuous production processes. They are installed on pipelines. Feedstock is fed in on one side and discharged on another side. The dispersion, emulsification and homogenization of the material can be achieved by a high-speed rotating blade and a refined mesh at the inlet. Material mixing is more homogeneous and a narrow particle size distribution can be easily obtained, thereby reducing the energy loss in the subsequent step to improve productivity. It is mainly used for on-line mixing in petrochemicals, fine chemicals, etc. and can replace some traditional batch processes in various applications.

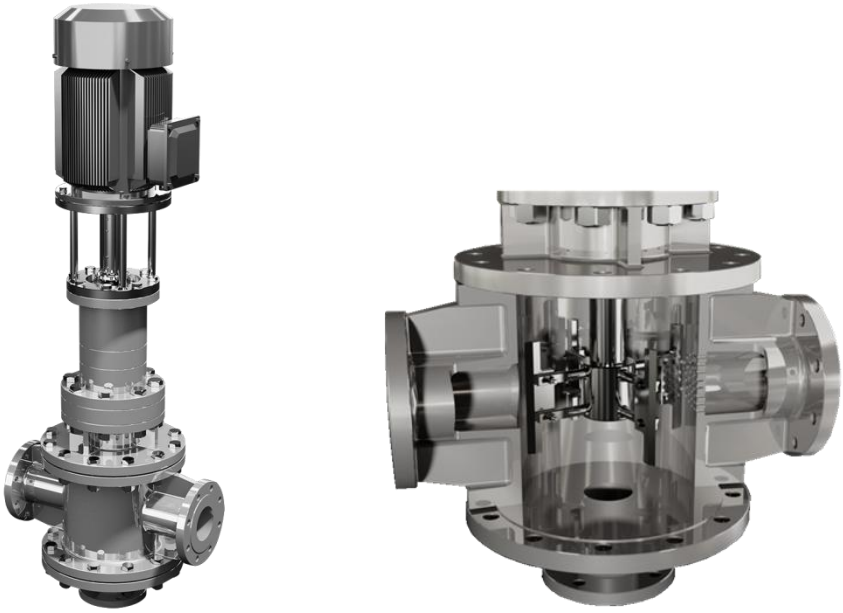


Fig. 2-10 Sketch for DTM mixers

Features for DTM mixers:

Suitable for large flow capacities and continuous industrial production lines;

Material can be more homogeneous with narrow particle size distribution;

Save time, efficiency, save energy;

Eliminate quality differences in production between batches;

Notes:

1. Speed varies when equipped with VFD.
2. All the technical parameters can be customized.

Table2-10 DTM Main parameters for DTM mixers

Type	Power (KW)	Speed (rpm)	Pipe Diameter (mm)	Flow Rate (m^3/h)
DTM110	1.1	1425	50	6
DTM220	2.2	1430	65	11
DTM400	4	1450	80	17
DTM750	7.5	1465	100	27
DTM1500	15	1470	125	42
DTM2200	22	1470	150	60
DTM3000	30	1480	200	100

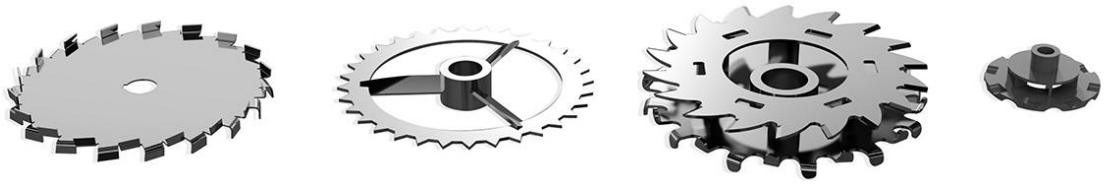
2.10 HDM series High-speed Disperser with Multi-tanks

High-speed Disperser with Multi-tanks (HDM) is designed to disperse and mix materials in production lines with durability, reliability and minimal noise. The HDM can use a variety of mixing blades for various industrial applications. The HDM is very mobile due to it's reliable, environmentally friendly, non-leaking hydraulic system. The HDM's swivel system is capable of high turnover working with 2-4 tanks at once.

Applications for the HDM will involve the industrial mixing of organic materials, pharmaceuticals, food, paints, inks, adhesives and pesticides to name a few. The HDM can mix liquids with a maximum viscosity of 50,000 cps and solid content of less than 60% like emulsion paints, industrial paints, water-based inks, pesticides and adhesives.

Fig. 2-11 HDM　HDM series High-speed Disperser with Multi-tanks

HDM series high-speed disperser includes swivel system, force transmitter, disperser, motor and hydraulic system (see Fig.9.10-1). Toothed disc turbines (see Fig.9.10-1) usually be employed .



FY　　TZC　　FYM　　FYU

Fig.2-12 Toothed disc turbines

Selection guide and options

Viscosity: The upper viscosity range of materials is 50,000 centipoise. Materials are thixotropic and good liquidity under shearing conditions.

Volume: The volume of the product to meet production forecasts needs to be provided. Please consider the optimum production volume to match your capabilities considering your facilities and available staff.

Tank Design: The most suitable tank is one that has an elliptical bottom because this design optimizes the flow and minimizes the possibility of a dead zone. Flat and sloped bottom tanks can also be used but are not as optimal. Ideally a tank that has approximately the same diameter as the height is preferred for the dispersers. The liquid should only be filled up to 70% of the tank to allow for the vortex when in operation. The mixing blade should be half its diameter from the bottom of the tank. The tank diameter should be triple the diameter of the mixing blade. The liquid level should only go above the mixing blade by 1.5 times it's

diameter. Power consumption is determined by the diameter of the mixing blade, density of the material and rotational speed of the mixing blade.

Table2-11 Selection table for HDM disperser

Type	Power (KW)	Speed (rpm)	Impeller diameter (mm)	Capacity (L)	Hydraulic power	Lift (mm)
HDM750	7.5	0~1450	230	~400	0.55	900
HDM1100	11	0~1450	250	~500	0.55	900
HDM1500	15	0~1450	280	~700	0.55	900
HDM1850	18.5	0~1450	300	~800	0.75	1100
HDM2200	22	0~1450	350	~1000	0.75	1100
HDM3000	30	0~1450	400	~1500	0.75	1100
HDM3700	37	0~1450	420	~2000	1.1	1600
HDM4500	45	0~1450	450	~2200	1.1	1600
HDM5500	55	0~1450	500	~2500	1.1	1600
HDM7500	75	0~1450	550	~4000	2.2	1800
HDM9000	90	0~950	600	~6000	2.2	1800
HDM11000	110	0~950	700	~8000	3	2100
HDM13200	132	0~950	800	~10000	3	2300

Notes:

1. The capacity assumes materials with a viscosity of roughly 1000 cps and specific gravity of 1g/cm³.
2. All technical parameters can be adjusted to suit the application.

2.11 HZZC Series Jointed Reducer

This type of jointed reducer is assembled with cycloid pin gear reducer and four supporting reducing unit. The structure is showed in F.9.10.1. The unit has two types of alarming. One type uses the travel switch as run unit (denote by S), the other uses pressure senor (denote by F). The unit has lifting device. This standard type has automatic lifting device. Symbol A for the type with hand lifting device, and symbol B for the type without lifting device. This type of reducer is suited for super low velocity, high torque conditions. Equipped with rake agitator (such as PSA, PSB, or PSC), the unit performs well in settling tank, slurry tank etc.

Type Denotations and Examples

B HZZC— S A —3/4 — 0.112 III

- III — code of output shaft type (I =clamp, II =general, III =flange)
- 0.112 — Output speed
- 3/4 — Motor power/Motor poles
- A — (A: Auto; M: Manual; N: None)
- S — Alarm type (S: position switch: F: Pressure sensor)
- HZZC — Mixer size
- B — Code for motor

Table 2-12 Main parameters for HZZC mixers

Model	Motor power KW	Rated torque	lifting device motor power KW
HZZC390	1.1～3	30000	0.75
HZZC590	2.2～5.5	45000	1.5
HZZC1070	3～7.5	60000	2.2

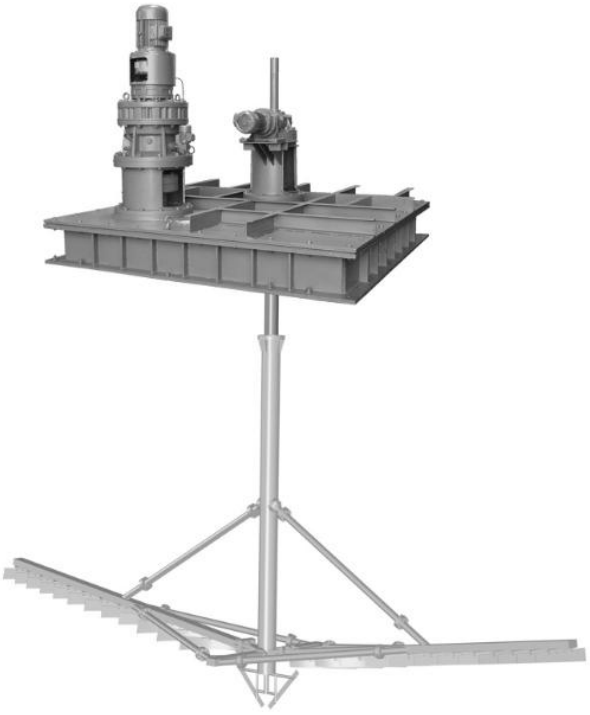


图 Fig. 2-13 HZZC series jointed reducers

Parts of Mixers

3.1 Motor

Motor, hydraulic and air-driven motor can all be used for mixing equipment. This chapter just gives an introduction of the electric motor. Refer to other brochures for detail of hydraulic and air driven motor.

3.1.1 Type denotations of motor

The motor product model usually composes of four parts, the product code, size code and special environment code. For detail, refer to standard GB/T4831

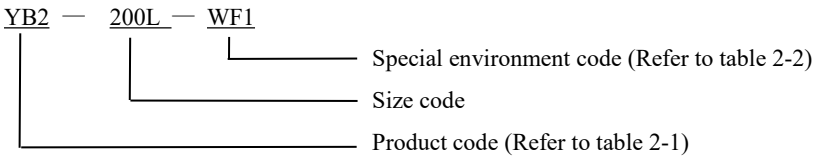


Table 3-1 Product code

Code	Meaning	Code	Meaning
Y	Common asynchronous motor	YBCT	Explosion proof electromagnetic speed-adjustable motor
YA	Explosion proof safety type	YEJ	Brake motor
YB	Explosion proof type	YBEJ	Explosion proof brake motor
YD	Multi-speed type	YVP	Variable Frequency Drive motor
YBD	Explosion proof multi-speed type	YBVP	Explosion proof variable frequency drive motor
YCT	Electromagnetic speed-adjustable motor		

Table 3-2 Special environment code

Code	Meaning	Code	Meaning
W	Outdoor type	TH	wet and tropical type
WF1	Outdoor middle anticorrosive type	WTH	Outdoor wet and tropical type
WF2	Outdoor strong anticorrosive type	TA	Dry tropical type
F1	Indoor middle anticorrosive type	T	Mixed dry and wet type
F2	Indoor strong anticorrosive type	H	For ship or sea used type
		G	For highland used type

3.1.2 Protection types of motor

IPXX is used to describe the motor protection type.。

The first X means: protect the body to touch the motor inner electric parts or rotating parts, and protect solid parts go into the motor (refer to table 3-3); the second X means: protect the motor damaged by water (refer to table 2-3).

Table 3-3 Meaning of the first and second X

code	Meaning of the first X	code	Meaning of the second X
0	Without protection	0	Without protection
1	Protect solids bigger than 50mm to go into the motor.	1	No effect for vertical water drop
2	Protect solids bigger than 12mm to go into the motor .	2	No effect for vertical water drop inclined 15 deg.
3	Protect solids bigger than 2.5mm to go into the motor.	3	No effect for water splash in 60 deg from centerline.
4	Protect solids bigger than 1mm to go into the motor.	4	No effect for water splash at all directions
5	Dust protection motor	5	No effect for water spray at all directions
6	Dust tight motor	6	No effect for strong waves or water spray
-	-	7	No effect for immersed in the specified pressure of water for a specified period of time
-	-	8	The motor can be submerged for a long time under the conditions given by the manufacturer

Refer to table 3-4 for motor protection selection.

Table 3-4 Motor protection type selection

Environmental condition	Protection class requested	Motor type available
Common condition	Protection class ≥IP23	All kinds of common motors
Hot & humid condition (relative humidity ≥90%)	Wet tropical type Protection class ≥IP55	1.Common motor with damp-proof treatment 2.Select wet tropical type motor
Dry heat & high temperature workshop (ambient temperature≥40℃	Dry tropical type Protection class ≥IP55	1. Select F, H high temperature rise insulation class or pipe-ventilated motor 2. Select dry tropical type motor
Dusty condition	IP55 with enclosed type or pipe-ventilated type	Common motor with enclosed type
Outdoor	Protection class ≥IP55	Enclosed motor with weather-proof cover
Corrosive environment	Protection class ≥IP55	Chemical anti-corrosive type or pipe-ventilated type
Hazardous environment containing explosive materials	Protection class ≥IP55	Select explosion proof motor (YB)
Outdoor, corrosive, with explosive gas environment	Protection class ≥IP55	Select outdoor, anti-corrosive, explosion proof motor

Note: Common environmental condition is defined as follows, not corroded by rainwater, -15℃≤ambient temperature≤40℃, relative humidity≤90%, height above sea level≤1000m.

3.1.3 Insulation level of the motor

The insulation structure of motor is different according to different insulation material, different combination type and different manufacture technology. The insulation level and limited temperature is listed in table 3-5.

Table 3-5 Insulation level and limited temperature

Insulation level	A	E	B	F	H	C
Highest temperature (℃)	105	120	130	155	180	>180

3.1.4 Explosion-proof of the motor

The motor explosion-proof types are classified according to ignition energy, minimum lighting temperature and existing time of dangerous gas.

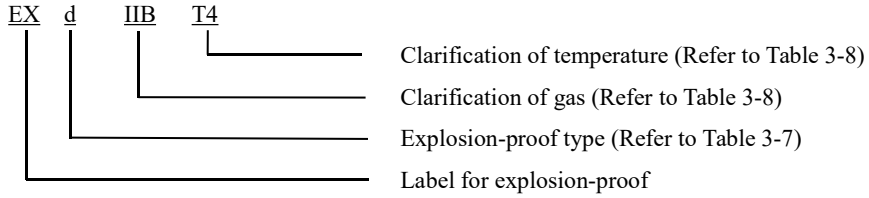


Table 3-6 Classification of dangerous zones

Explosion material	Description of the zone	Chinese standard	(NEC)
(CLASS I)	At normal conditions, explosion gas mixture will exist continuously or for long time.	Zone 0	Div.1
	At normal conditions, explosion gas mixture will probably exist.	Zone 1	
	At normal conditions, explosion gas mixture will not exist. At unmoral conditions, it will exist occasionally or at very short time.	Zone 2	Div.2

Table 3-7 Explosion-proof types

No.	Type	Code	Standard	Method for explosion-proof	Application
1	Fame-proof	d	GB3836.2	Isolate the existed ignition source	Zone 1 zone 2
2	Increased safety	e	GB3836.3	Prevent the exist of ignition source	Zone 1 zone 2

3	intrinsic safety	ia	GB3836.4	Limited the energy of ignition source	Zone 0~2
		ib			Zone 1 zone 2
4	Pressurized	p	GB3836.5	Isolate the dangerous material with ignition source	Zone 1 zone 2
5	Liquid immersion	o	GB3836.6	Isolate the dangerous material with ignition source	Zone 1 zone 2
6	Powder filling	q	GB3836.7	Isolate the dangerous material with ignition source	Zone 1 zone 2
7	No spark	n	GB3836.8	Prevent the exist of ignition source	zone 2
8	Encapsulation	m	GB3836.9	Prevent the exist of ignition source	Zone 1 zone 2

Table 3-8 Typical gas clarification and temperature grade

Grade	Allowable max surface temperature group (divide according to firing temperature of explosive gas) ℃					
	T1 (≤450)	T2 (≤300)	T3 (≤200)	T4 (≤135)	T5 (≤ 100)	T6 (≤ 85)
IIA	Ethane, propane, styrene, xylene, benzene, carbon monoxide, acetone, acetic acid, ammonia, pyridine, etc	Butanol, butane, propylene, ethylene acetate, dioxyethane, vinyl chloride, chloroethanol, thiophene, cyclopentane, dimethylamine	Pentane, decane, ethyl cyclopentane, turpentine, naphtha, petroleum (including gasoline), fuel oil, pentanol tetrachloride	Acetaldehyde, trimethylamine		Ethyl-nitrite
IIB	Propylene, cyclopropane, propylene fine, hydrogenated ammonia, coke oven gas	Ethylene, butadiene-1,3, ethylene oxide, 1, 2-epoxy propane, 1, 4-dioxane, methyl acrylate, ethyl acrylate, furan 1-chloro-2,3 epoxy propane	Dimethyl ether, methylhydrofuran methanol, butenal, acrolein, tetrahydrofuran, ethylmercaptan, hydrogen sulfide	Ethyl methyl ether, diethyl ether, dibutyl ether, tetrachloroethylene		
IIC	hydrogen	acetylene			Carbon disulfide	

3.1.5 Energy efficiency classes of the motor

。

The division of motor energy efficiency standards is different in different periods. For different countries, the standards are different. In China, the division of motor energy efficiency classes also changes as time passes. For the comparison of energy efficiency standards of three phased asynchronous motor, please see details below.

Table 3-9 Comparison of energy efficiency standards of three phased asynchronous motor

IEC60034-30 (International standard)	GB18613-2020 （2020 China national standard）	GB18613-2012 （2012 China national standard）	GB18613-2006 （2006 China national standard）
IE5	energy efficiency Level Ⅰ		
IE4	energy efficiency Level Ⅱ	energy efficiency Level Ⅰ	
IE3	energy efficiency Level Ⅲ	energy efficiency Level Ⅲ	energy efficiency Level Ⅰ
IE2		energy efficiency Level Ⅲ	energy efficiency Level Ⅱ
IE1			energy efficiency Level Ⅲ

Note: The energy efficiency standard is available for low-voltage three-phased cage asynchronous motor.

3.2 Reducer

Greatwall Mixers is the drafter of chemical industry standard “Vertical reducer for tank”(HG/T3139). Refer to the following for products detail description.

1. CF series Gear Reducer

Characteristics:

CF series are co-axial hard surface gear reducer. Two-stage and three-stage are all available. It is designed from the combination of improvement of LC and international advantage technology. It has the characteristic of modular structure, compact volume, high loading, long life and low noise level. .

speed range(RPM): 65≤n≤500

Standards: HG/T3139

2. PF series Gear Reducer

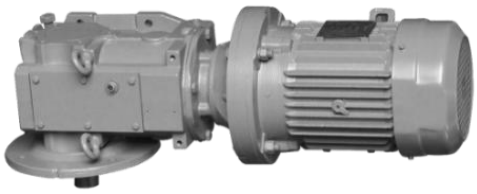
Characteristics:。

PF series are two-stage or three-stage parallel shaft hard surface gear reducer. It is designed based on international advantage technology. It has the characteristic of modular structure, compact volume, high loading, long life and low noise level.

speed range(RPM): 12≤n≤320

Standards: 企业标准 Enterprise standard

3. ZF series Gear Reducer



Characteristics:

ZF series are hard surface right-angle type gear reducer. It is designed based on international advantage technology. It has the characteristic of modular structure, compact volume, high loading, long life and low noise level.

speed range(RPM): 13.5≤n≤265

Standards: HG/T3139

4. P series Belt Reducer

Characteristics:

Driving belts with narrow V belts is very efficient and type PT with synchronous cog belts has a long life， and has a compact structure and calm driving ratio, type LPV and PT especially used in sewerage .The output shaft matches clamp type coupling . If you have special requirements, contact us.Bi-directional rotation is allowable. For explosion-proof situation, select explosion-proof motor and special anti static V belts or synchronous belts.

speed range(RPM): 200≤n≤500

Standards: HG/T3139

5. FP series Belt Reducer

Characteristics:

High-strength V belt or narrow V belt can improve load capacity by 50% than general V belt. It is suitable for high environmental health conditions such as food, pharmaceutical industries. The structure of the output axle head has two types: Ⅰ (connect with clamp coupling) and Ⅱ(general type). The height of the reducer base has three types: low type, standard type and high type to match variable couplings and mechanical seals. The height (H) should be marked in the parentheses at the end of the type denotation.

speed range(RPM): 135≤n≤400

Standards: HG/T3139

6. YP series Belt Reducer

Characteristics:

The YP series belt reducers use high power narrow V belt and high intensity belt. Belt transmission will produce heat, but do not require auxiliary cooling equipment. The structure of belt reducer is simple and operation and maintenance is convenient, so it is suitable for biological fermentation systems and so on.

speed range(RPM): 85≤n≤250

Standards: HG/T3139

3.3 Coupling

Coupling is used to connect the output shaft of two separate units, and at the same time movement and power is also transmitted. There are three kinds of coupling, rigid type, flexible type and fluid coupling.

1. Rigid Coupling

Rigid coupling can be good center of axes, running in any direction, simple structure and easy manufacture. The following are common type of rigid coupling.

Clamp coupling are easy to align and disassemble conveniently. The dimension of radial is small, but the frame of exterior is complex. The cost of produce is high. They are used in middle and low rotation speed which must be aligned and disassembled often and the connection of the ends which are in tank. (Model: JQ,JJQ)

Flange coupling have good center of axes. DT has press board and it can support axes load. GT has no press board and it can only transfer torque. (Model: GT,DT)

Triplex coupling is a product derived from clamp coupling and flange coupling, which combined for convenient maintenance. The pedestal's bearing and seal can be disassembled easily without removal of reducer and pedestal.

JQ,JJQ

GT,DT

DF

SF

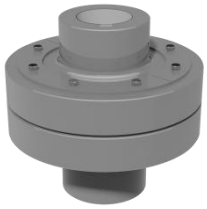
2. Flexible Coupling

Flexible coupling has virtues of equalizing relative displacement and cushion, absorbing vibrancy, because it has elastic parts which can produce great spring transmutation and damp. The following are common type of flexible coupling.

T

TK

TL



HL

3.4 Pedestal。

1. Nonsupport

Features and applications:

WJ is standard type and LWJ is heightened type. WJ usually used for single-face mechanical seal or stuffing box, while LWJ usually used for double-face mechanical seal. JQ or DT type coupling are used for the connection of reducer shaft and mixing shaft.

Type: WJ　LWJ

Specification: 30-180

Standards: HG/T 3139

2. Single Support

Features and applications:

DJ is the standard type and LDJ is heightened type. GT series flange coupling usually used for these pedestal. Rules for shaft seal are the same as WJ (LWJ).

Type: DJ　LDJ

Specification: 25-180

Standards: HG/T 3139

3. Single Support

Features and applications:

The bottom flange of JD (LJD) complies with the standard HG 20615-97 (ANSI 150#). GT series flange coupling usually used for these pedestal. Rules for shaft seal are the same as WJ (LWJ).

Type: JD　LJD

Specification: 20-180

Standards: Enterprise standard

4. Single Support

Features and applications:

The bearings are at the bottom of JXD and DXJ. There is no seal for these pedestals. It usually used for ATM or open tanks. The bottom flange of JXD complies with the standard HG 20615 (ANSI 150#).

Type: JXD　DXJ

Specification: 20-180

Standards: Enterprise standard　HG/T 3139

5. Single Support

Features and applications:

TB special single support pedestal is suitable for glass lining equipment. GT coupling usually used in this pedestal. Special mechanical seal for glass lining equipment, such as 212, usually used in this pedestal.

Type: TB

Specification: 1-6

Standards: Enterprise standard

6. Single Support

Features and applications:

XD series pedestal complies with the standard HG21566 . It has two types, A and B. 2000 series mechanical seals usually used in these pedestals. With DF flange type triple clamp coupling, the seal could be repaired without removal of the reducer and pedestal.

Type: XD

Specification: 1-7

Standards: HG/T 3139

7. Double Support

Features and applications:

SJ (LSJ) has two supporting points, and usually used flexible coupling. SJ is standard type, and LSJ is heightened type. Rules for shaft seal are the same as WJ (LWJ).

Type: SJ LSJ

Specification: 55-180

Standards: HG/T 3139

8. Double Support

Features and applications:

XS series pedestal complies with the standard HG21567-95. It has two types, A and B. 2000 series mechanical seals and flexible coupling usually used in these pedestals. With DF flange type triple clamp coupling used between the two supporting points, the seal could be repaired without removal of the reducer and pedestal.

Type: XS

Specification: 3-7

Standards: HG/T 3139

9. others

Features and applications: 。

SWJ and SDJ series pedestals are specially designed for convenient maintenance of mechanical seals. Without removing the reducer and motor, the mechanical seal could be replaced. This special design could reduce the work of equipment maintenance. SWJ is non-support type and SDJ is single-support type. If this series pedestal is selected, there should have shaft shelf structure, and 2000 series mechanical seals are recommended.

Type: SWJ SDJ

Specification: 1-5

Standards: Enterprise standard

3.5 Shaft seals

Shaft seal for mixers usually use mechanical seal, stuffing box, lip seal or liquid seal etc.

3.5.1 Mechanical seal

3.5.1.1 Single face mechanical seal

204 series single face mechanical seal

Characteristics:

204 series mechanical seal is single face balance type, which are widely used for common weak corrosion operations. By using proper seal rings, dry running designs (204F, 204FF) are widely used for fermentation processes.

Working conditions：

Temp.：-10℃～250℃（With proper cooling method）

press.：ATM~0.6MPa;　speed：0~2m/s

GW204 series single face mechanical seal

Characteristics：

GW204 is updated version of 204 seals. With the collection well design, it can prevent the friction dust coming into the tank and can meet sanitary design requirement.

Working conditions：

Temp.：-10℃～250℃（With proper cooling method）

press.：ATM~0.6MPa　speed：0~2m/s

212 series single face mechanical seal

Characteristics：

212 series seals use corrugated PTFE pipe and ceramics as friction rings. By PTFE lining for inner surfaces, the seals can be used for high corrosion operations, especially for glass lining reactors, high alloy tanks, etc. This design is also suitable for vacuum operations and allowable for high radial shaft run-out.

Working conditions：

Temp.：-10℃～120℃（With proper cooling method）

press.：-0.1~0.5MPa　speed：0~3m/s

2001 series single face mechanical seal

Characteristics：

Type 2001 is packed, axial single face, multi-springs, non-balanced mechanical seal. It is applied to weak corrosive liquid and low leakage conditions.

Working conditions：

Temp.：-10℃～250℃（ With proper cooling method）

press.：-0.1~0.6MPa　　speed：0~2m/s

2002 series single face mechanical seal

Characteristics：

2002 series are single cartridge, balance type seals, used for operations of common or weak corrosion materials.

Working conditions：

Temp.：-10℃～250℃（ With proper cooling method）

press.：-0.1~0.6MPa　　speed：0~2m/s

261 series single face mechanical seal

Characteristics：

261 series seals are specially designed for side entry mixers. By using hard-hard friction rings, it is suitable for operations with solids, such as FGD absorption tower, biogas digester, oil storage tanks, etc.

Working conditions：

Temp. ：-10℃～130℃

Press. ：0~0.6MPa　Speed：0~3m/s

3.5.1.2 Double faces mechanical seal

GW205 series double faces mechanical seals

Characteristics：

GW205 series seals are designed for low pressure, common or weak corrosion materials, but sealing requirement is high. The inner bearing will limit the shaft vibration. Proper sealing rings selection, such as hard-hard, will allowable for operations with solids, such as crystallization.

Working conditions：

Temp.：-40℃～350℃（ With proper cooling method）

Press.：-0.1~0.6MPa　Speed：0~3m/s

206 series double faces mechanical seals

Characteristics：

206 series seals are designed for medium pressure, common or weak corrosion materials, but sealing requirement is high. The inner bearing will limit the shaft vibration. Proper sealing rings selection, such as hard-hard, will allowable for operations with solids, such as crystallization.

Working conditions：

Temp.：-40℃～350℃（ With proper cooling method）

Press.：-0.1~1.6MPa　Speed：0~3m/s

207 series double faces mechanical seals

Characteristics：

207 series seals are designed for high pressure, common or weak corrosion materials, but sealing requirement is high. The inner bearing will limit the shaft vibration. Proper sealing rings selection, such as hard-hard, will allowable for operations with solids, such as crystallization.

Working conditions：

Temp.：-40℃～350℃（ With proper cooling method）

Press.：-0.1~2.5MPa　Speed：0~3m/s

GW2007 series double faces mechanical seals

Characteristics：

GW2007 series seals, updated from original 2000 series, are designed for high pressure, common or weak corrosion materials, but sealing requirement is high. It has compact structure, and can be used for most of conditions which need double faces seal.

Working conditions：

Temp.：-40℃～250℃（ With proper cooling method）

Press.：-0.1~2.5MPa　　Speed：0~3m/s

2010 series double faces mechanical seals

Characteristics：

2010 series seals are designed for super high pressure operations. With inner bearing, balance type design, it is suitable for high pressure tanks with common or weak corrosion materials, but sealing requirement is high.

Working conditions：

Temp.：-40℃～350℃（ With proper cooling method）

Press.：-0.1~4MPa　　Speed：0~3m/s

221 series radial double faces mechanical seals

Characteristics：

221 series are radial double faces mechanical seals, especially for conditions of limitation in axial spacing. It can be designed for glass lining tanks (high corrosion) or common stainless steel tanks (weak corrosion).

Working conditions：

Temp.：-40℃～250℃（ With proper cooling method）

Press.：-0.1~1.6MPa　　Speed：0~2m/s

285 285 series double faces mechanical seals

Characteristics：

285 series are double cartridge mechanical seals. With specially designed shaft support and pre-stuffing, they are suitable for processes using bottom entry mixers with common or weak corrosion material. The pre-single face seal instead of pre-stuffing allows fluid with solids or powder.

Working conditions：

Temp.：-40℃～200℃（ With proper cooling method）

Press.：-0.1~0.6MPa　Speed：0~3m/s

286 series double faces mechanical seals

Characteristics：

286 series are double cartridge mechanical seals. With specially designed shaft support and pre-stuffing, they are suitable for processes using bottom entry mixers with common or weak corrosion material. The pre-single face seal instead of pre-stuffing allows fluid with solids or powder.

Working conditions：

Temp.：-40℃～200℃（ With proper cooling method）

Press.：-0.1~1.6MPa　Speed：0~3m/s

263 series double faces mechanical seals

Characteristics：

Type 263 is packed, double face, multi-springs, inner bearing, balanced mechanical seal. It can be used for various weak corrosive medium and strict requirements for seal leakage, especially for side-entry conditions.

Working conditions：

Temp.：-10℃～150℃（ With proper cooling method）

Press.：-0.1~0.6MPa　Speed：0~3m/s

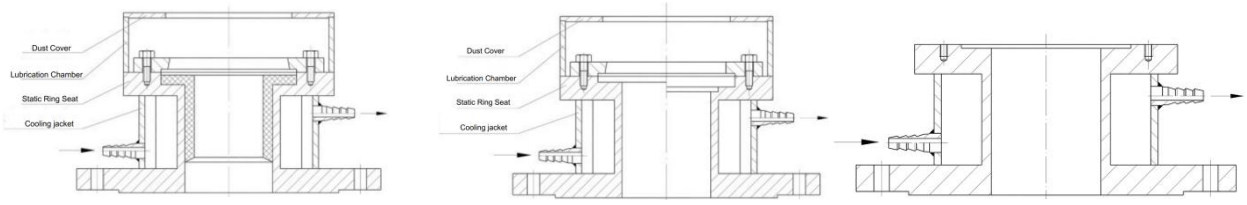
3.5.1.3Auxiliary systems for seal

Auxiliary systems are critically important for the safe running of seals. Different cooling method (or system) should be used according to the temperature and pressure. For single face seals, when operating temperature is higher than 100℃, different types of cooler will be used. For double faces mechanical seals, different types of auxiliary systems (usually equal to API PLAN52, PLAN 53, PLAN54) must be used. The auxiliary system should keep pressure 0.1~0.2 Mpa higher than tank operating pressure.

Cooler

。

Cooler is cooling jacket designed at seal bottom to cool the seal. They can be integrated in the seal seat. XT or LT for single face seal and CT for double faces seal.



XT LT CT

Fig. 3-1 Sketch for seal thermoregulator

Auxiliary systems for double faces seal

Referring to API682, PLAN52, PLAN53 and PLAN54 are usually used as auxiliary systems for double faces seals. Most of cases, PLAN53A is adopted. The sketch map shows the working principle. The sealing liquid with higher working pressure will isolate the tank fluid with atmosphere, and at the same time, lubricate and cooling the seal faces. The sealing liquid usually uses industry white oil, glycerine, glycol, de-ionized water, edible oil, etc.

G series seal pot equipped with instruments for pressure and liquid level will equal to the API pipe plan. There are two types of seal pots, GCL and GDL. GCL, without cooling coil, is used for temperature <100℃ (or <160℃ for seal with cooler). For higher temperature, GDL with cooling coil is used. The seal pot volume (2L, 4L, 10L) is related with shaft diameter and temperature.

For operating pressure higher than 2.5Mpa, D series hydraulic power unit (equal to PLAN54) is used for the lubrication, cooling of the high pressure mechanical seals.

Fig. 3-2 Sketch for GDL seal pot

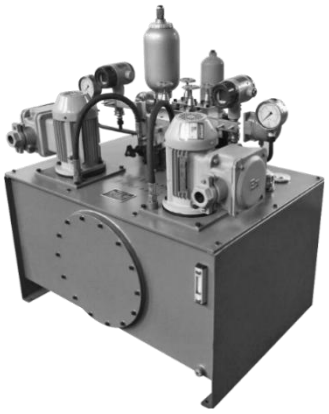
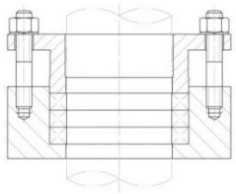
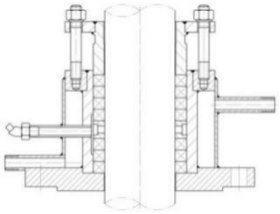
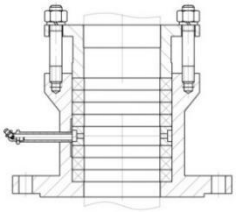
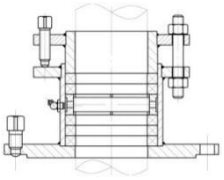
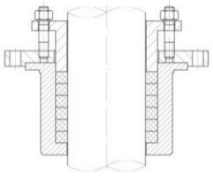
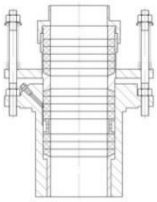


Fig. 3-3 Plan54 circulation system

3.5.2 Stuffing Box

Types, features and main parameters of stuffing box are described in the following table.

Model	Classification	Outline	Features and applications
218 1414	normal pressure stuffing box		Normal pressure stuffing box; 218 is carbon steel, 1414 is stainless steel; Stuffing box 218 & 1414 are used for temperature ＜100℃, atmosphere pressure, tip speed ≤1m/s.
1410 1412	with cooling water jacket		Stuffing box with cooling water jacket; 1410 is carbon steel, 1412 is stainless steel. Stuffing box 1410 & 1412 are used for temperature ＜250℃, pressure ≤0.6Mpa, tip speed ≤2m/s.
1411 1413	with oil lubrication system		Stuffing box with oil lubrication system; 1411 is carbon steel, 1413 is stainless steel. Stuffing box 1411 & 1413 are used for temperature ＜100℃, pressure ≤0.6Mpa, tip speed ≤1m/s.
516 616	with oil lubrication system		。 Stuffing box with oil lubrication system; 516 is carbon steel, 616 is stainless steel. Stuffing box 516 & 616 are used for temperature from -20 to 300℃, pressure ≤1.6Mpa, tip speed ≤2m/s.
401 402	bottom installation type		。 Bottom installation stuffing box; 401 is carbon steel, 402 is stainless steel. Stuffing box 401 & 402 are used for temperature ≤100℃, pressure ≤0.6Mpa, tip speed ≤2m/s.
403 404	double layer type		Stuffing box with double layer; 403 is carbon steel, 403 is stainless steel. Stuffing box 403 & 404 are used for temperature ≤100℃, pressure ≤0.6Mpa, tip speed ≤2m/s.

3.5.3 Liquid seal and lip seal

Liquid seal and lip seal are usually used at ATM conditions, to isolate dust, dirty oil, and air etc.

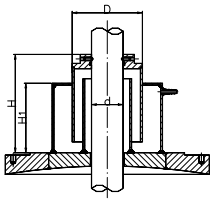


Fig. 3-4 Outline for liquid seal

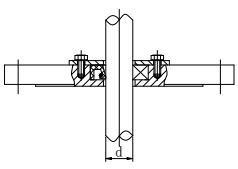


Fig. 3-5 Outline for lip seal

3.6 Impellers

3.6.1 General description for impellers

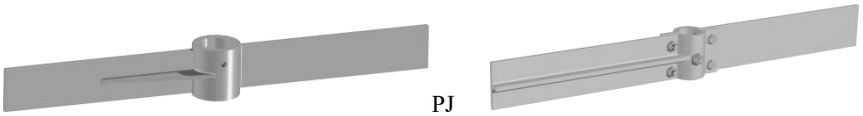
There are lots of types of impellers. According to the structure difference, there are more than ten types, such as paddle, open turbine, disc turbine, saw-teeth type, propeller, hydrofoil, Bulmarking type, screw, helical ribbon, anchor and gate type, and other special types. According to the usage, there are two types, low viscosity type and high viscosity type.

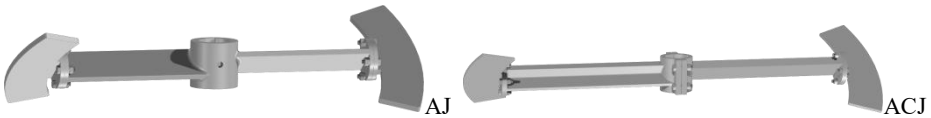
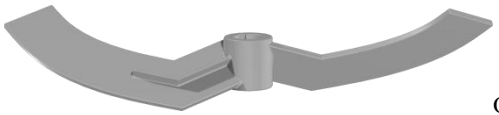
Paddle, open turbine, disc turbine, saw-teeth type, propeller, hydrofoil, Bulmarking type are low viscosity type impellers, operating at turbulent conditions, the ratio of impeller diameter to tank diameter is usually 0.3~0.6.

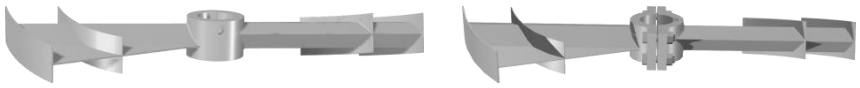
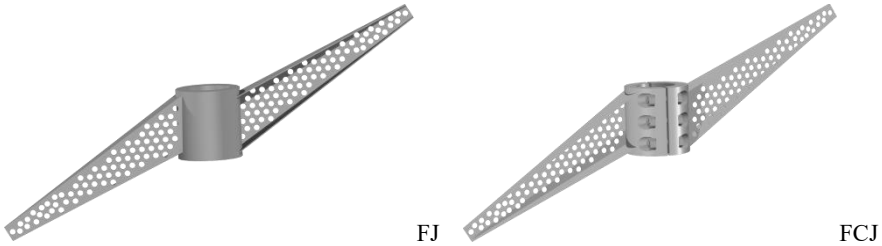
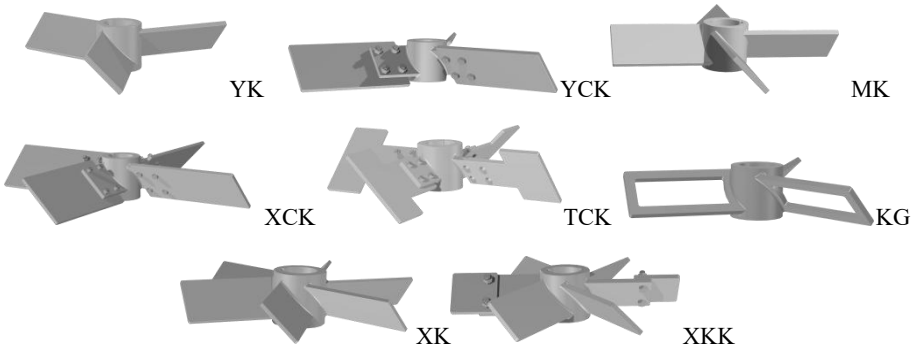
Screw, helical ribbon, anchor and gate type are high viscosity type impellers, usually operating at laminar or transition flow.

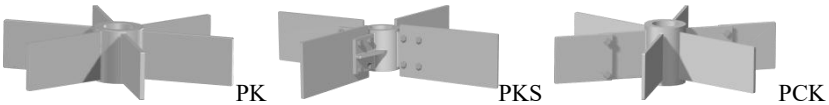
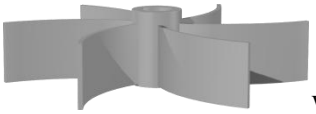
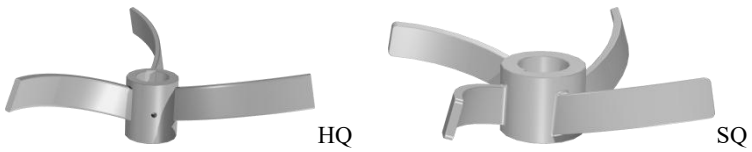
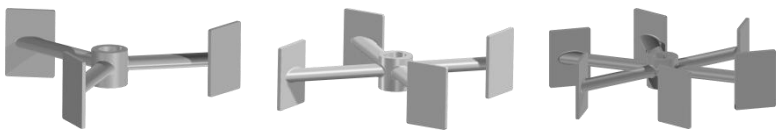
3.6.2 Types of impellers

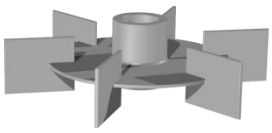
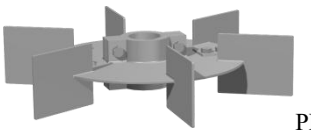
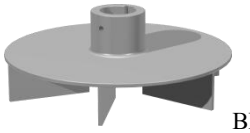
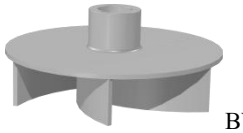
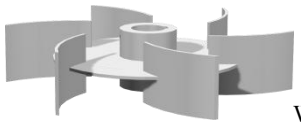
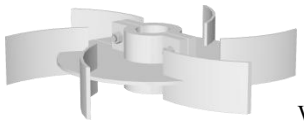
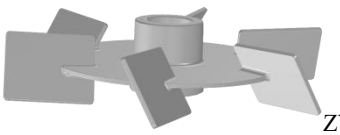
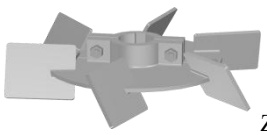
Table 3-15 Impeller List

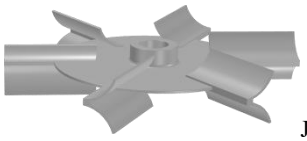
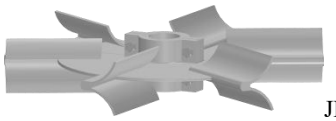
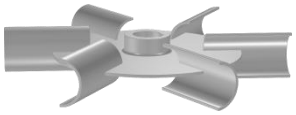
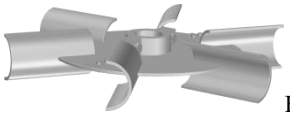
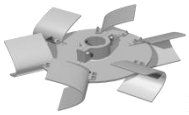
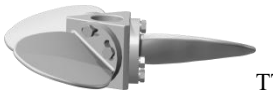
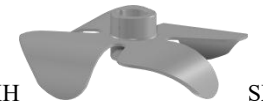
Type		Description	Condition			
			dj/D	Impeller diameter dj(mm)	viscosity μ (cp)	Tip Speed V(m/s)
Two Paddle Type Impeller	Type PJ,PCJ	 PJ PCJ This general paddle acts as horizontal circular flow at low speed and as radial flow at high speed. If there are baffles, result in axial circular flow. It is suitable for mixing, homogenizing, dissolving, heat transfer and crystallization in low viscosity medium. Or operates in laminar region in high viscosity medium, be adopted multi-layer impellers of big diameter at low speed.	0.35～0.9	100～6000	<2000 100000 (Maximum)	1~5
	Type XJ,XCJ	 XJ XCJ The oblique angle of the impeller is 24°, 45° or 60°. It produces radial and axial flow and the flow is more complex than type PJ paddle. It features larger output energy compared to type PJ paddle and has same applications as type PJ, PCJ, so type XJ, ZJ are used more frequently.				

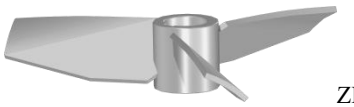
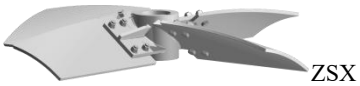
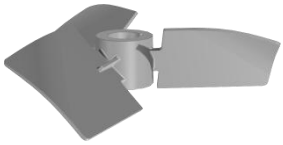
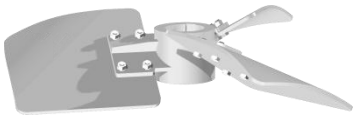
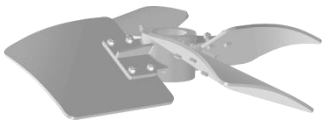
Type HJ,HCJ	 HJ HCJ This new paddle can substitute for type XJ and ZJ. In the same condition, the capability of discharging is 30% higher than XJ and the integrated capability is better than XJ.					
Type SCJ,CCJ	 SCJ CCJ The contranatant paddle of several segments, type CJ is improved on type SJ. When it works, the paddle expedite liquid to come into being axial circulation flow, its mixing time is 30% less than type XJ. Usually multi-impellers are used together. It is suitable for mixing, solid-liquid dispersing, dissolving and heat transfer of transition region.	0.4～0.95	100～6500	<10000	1～10
Type GJ,GCJ	 GJ GCJ This is a high efficiency and axial flow impeller. The assistant paddles which are on the master paddle can dispel the phenomenon whose flow peels off, and saves on the power of mixer, at the same time comes into being separate flow which is crossed and vertical to improve the mixing effect. It is suitable for mixing, dispersing, and heat transfer of low viscosity medium, especially for solid-liquid suspending of large-sized vessel.	0.35～0.6	100～6500	<5000	1~10
Type AJ,ACJ	 AJ ACJ The paddle is made up of the arc paddle and the pitch paddle. It is suitable for mixing, homogenizing, heat transfer and reaction, etc. Usually multi-impellers are used together. It has the same feature as screw ribbon type.	0.85～0.95	100～5000	<50000	<3
Type QJ	 QJ These types are derived from type XJ paddle. They are used at low speed in laminar region.	0.6～0.9	100～5000	<5000	1~5

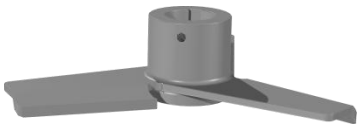
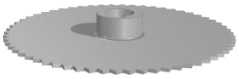
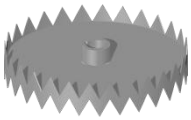
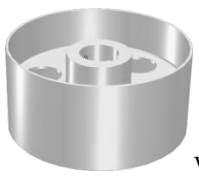
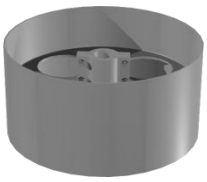
	Type BJ,BCJ	 BJ BCJ These types with special blades are used for situations like low circulating flow rate and low shearing force. It produces shake and turbulent flow inside and is applicable in process of bleaching and dip-dye.	0.4～0.8	100～5000	<5000	1~4
	Type FJ, FCJ	 FJ FCJ The two blades of the impeller are unsymmetrically distributed. One is high, the other is low. It makes good shearing effect at low rotation speed in laminar flow region. Usually, it is used for mixing fiber medium. n=1～80rpm.		100～5000		
Turbine Type Impeller	Type YK,YCK…	 YK YCK MK XCK TCK KG XK XKK The axial flow paddles which have convection circulation and onflow diffusivity capacities. It is suitable for mixing, dispersing, crystallization, reaction, dissolving, solid suspending and heat transfer, etc. The betterment type which has stabilizer uses for the occasion where the shaft which is designed critical point need radial support. Type KG works in laminar region to avoid heavy element depositing. It is also suitable for crystallization, extraction and washing, and heat transfer of high viscosity medium.	0.3～0.6	100～3000	<50000	2~8

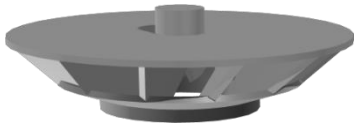
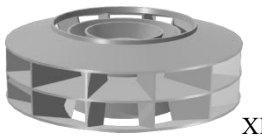
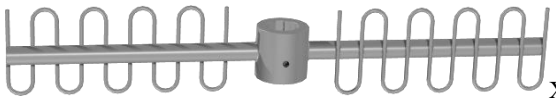
Type PK…	 PK PKS PCK	0.2～0.5	100～3000	<50000	3～10
	Radial flow type impeller with high shearing force and onflow diffusivity is used widely in varied speed and viscosity. Without disc, they don't counteract mixing and can become convection circulation. Make it especially for shearing and dispersing, and for dissolving, reaction, heat transfer, emulsification, crystallization and solid suspending.				
Type WK	 WK	0.2～0.5	100～3000	<50000	2~8
	The types which have back angle paddles have large output flow. Make it especially for solid suspending.				
Type SZP	 SZP	0.2～0.5	100～3000	<10000	2~8
	。 The radial flow paddles are used in the lowest layer of conical bottom tanks. Make it suitable for reaction, dissolving, suspending, heat transfer, emulsification and crystallization.				
Type HQ,SQ	 HQ SQ	0.2～0.5	100～3000	<10000	2~8
	Types HQ, SQ are axial flow type impellers. They produce strong circulation and good shearing force with finger baffles. They are used in processes of heat transfer, mass transfer, dissolving, suspending.				
Type BM	 BM	0.2～0.5	100～3500	50000	2～8
	These radial flow type impellers with good pumping rate, reduced shearing force and lower power consumption. Circulation flow and onflow diffuse can be produced when baffles are set. It is used in processes of heat transfer, mass transfer mixing and fiber dissolving.				

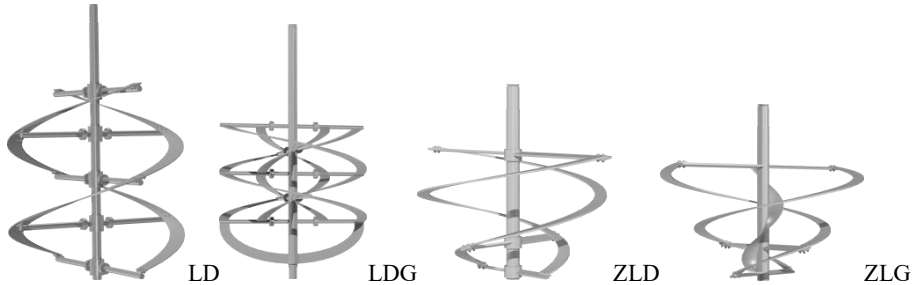
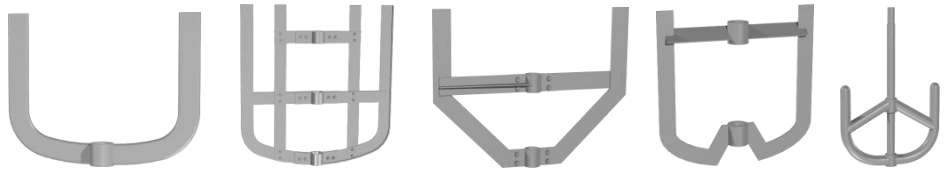
Disk turbine Type Impeller	Type PY,PDJ	 PY  PDY	0.2～0.5	100～3500	<50000	4~10
		The radial flow type impellers have powerful shearing force and good circulation power and good dispersing power. Because of the disc, it can disperse gas smoothly. It is used specially in processes of dispersing, absorbing, and it is also suitable for suspending, heat transfer and non-homogeneous phase reaction.				
	Type BPY,BWY	 BPY  BWY  GSJ	0.2～0.5	100～3500	<50000	4~10
		The radial flow type impellers BYP and BWY have higher pumping-feeding power similar to pump and powerful shearing force and powerful dispersing force and used in high speed. It is used specially in processes of gas dispersing, absorbing, leaching, and it is also suitable for suspending, heat transfer and non-homogeneous phase reaction. GSL is generally used at low speed and is suitable for water treatment.				
	WY…	 WY  WDY	0.2～0.5	100～3500	<50000	4~10
		The capabilities of these impellers are similar to type PY. Type WY impellers installed back bend blades with big sweepback can generate good pumping rate at low power consumption. It is used in processes of gas dispersing, absorbing, suspending.				
	Type ZJ…	 ZY  ZDY	0.2～0.5	100～3500	<10000	2~8
		Pitch-blade types have slope angle and can produce axial flow. It has good circulation power but the shearing force is lower than straight-blade type. Curved blade types have back angle and have large output flow rate and low power consumption. It is used specially in processes of mixing, dispersing, and heat transfer, emulsification.				

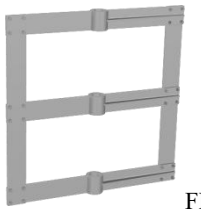
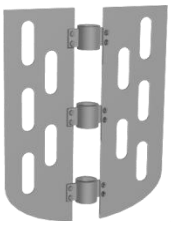
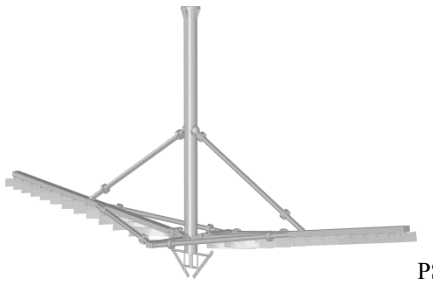
	Type…	 JY  JDY The main radial flow type impellers have low power consumption and powerful shearing force. Make it suitable for gas dispersing, absorbing, mass transferring, mixing and suspending.	0.2～0.5	100～3500	<10000	4~10
	Type HY…	 HY  HDY  BTD The radial flow type impellers have large radial flux and powerful dispersing force. Its coefficient of mass transfer is advanced 30% and its power of gas holding is advanced 30% at same power. So it is used specially in processes of oxygen dissolving, and it is also suitable for gas dispersing, absorbing, mixing and mass transferring.	0.2～0.5	100～3500	<10000	4~10
Propeller Type Impeller	Type TXL…	 TXL  TVL  TTL  SXL  TXH  SXH Triple-blade propellers are typical axial flow type impellers with high output flow rate and low shearing force. Axial circulation is stronger and output rate is larger when baffles or flow guide tube is selected. Their powerful circulation capacity and low power loss can be fully applied in mixing processes of low viscosity, large volume homogenous medium. They are widely used in heat transfer, reaction of low viscosity and suspension, dissolving low content solute. Blades of adjustable propeller type impellers can be adjusted in a range of ±15°. That will take important effect in experimental technique process. Separable propellers have three blades which can be assembled expediently. The types with stabilizer ring are used to keep shaft stable in high speed, and its critical speed advance 10~20 percent.	0.1～0.5	100～2000	<2000	3~15

Paddle Type Impeller	Type ZHX…	 ZHX  ZCX	0.2～0.5	100～6600	<2000	2~15
		The axial flow paddles are widely used. It has high output flow rate and low shearing force. Its output flow is advanced 20%. Make it suitable for gas mixing, dissolving, suspending, heat transfer, crystallization and reaction. It is the best type for large-sized mixing tank.				
		 GXL  ZSX	0.2～0.5	100～6600	<2000	2~15
		The axial flow paddles are widely used. It has large circulation flow rate and low shearing force.				
	Type KHX…	 KHX  KCX  KSX	0.2～0.5	100～4000	<25000	2~10
		The axial flow paddles have large onflow diffusivity and low shearing force. It economizes power 30~40% in the same mixing intensity, and its mass transfer coefficient advanced 20% in the same power. It is used specially in processes of mass transferring, heat transfer, suspending and oxygen dissolving of biology ferment.				

High -speed decentralized Type Impeller	Type CL,QL	 CL  QL	0.2～0.5	100～4000	≤2000	8~15
		Type CL increases small-vortex amount, improves performance of dissolving, dispersing and function of splitting and smashing. They can be used for dissolving and dispersing in low viscosity solid medium and mixing and dispersing in high viscosity dispersed phase. Type QL is an axial flow impeller, and has low power. Make it suitable for dissolving, mixing and liquid-liquid reaction.				
	Type CY…	 CY  TY  FY  TZC	0.2～0.5	100～2000	≤50000	10～30
		At high rotation speed, toothed disc turbine has high shearing force, but low circulation capacity. Dispersion and comminution are strong. They are used in mixing and smashing two different phases such as dope dispersing process. Type CY has horizontal teeth, thick and sparse. Type FY and TY have two layers of vertical teeth, thin and dense.				
Stabilizers	Type WH,WF	 WH  WF				
		Stabilizers are used with impellers to keep shaft stable.				

Special Impellers	Type BAY,BDY,BQY	 BAY  BDY	0.2～0.5	100～3500	<2000	2~15
		These are special impellers used in gas-liquid absorbing and dispersing. They rotate with high speed and absorb gas. Liquid will be thrown off by centrifugal force. Inside the impeller, gas will be sheared into a lot of air bubble by paddle. With air bubble dispersing into liquid medium, turbulent flow will be increased. They are used in processes of wastewater treatment and oxygen transfer.				
	Type XPY,XPJ	 XPY  XPJ		100～4000		
		These impellers have a special usage, which can clear foam above liquid level. Type XPY is a high-speed impeller. Foam can be imbibed and thrown off through middle section. It has good performance of clearing foam, but it consumes much energy and increases cost. Type XPJ is a middle or low speed impeller. The rotating impeller strikes and breaks foam continuously and foam amount is under control. It is widely used in fermenter.				
Screw Type Impeller	Type LG, LGH	 LG  LGH	0.4～0.5	100～1500	⩾50000	<2
		These low speed impellers operate in laminar region. They are used in processes of mixing and heat transfer of middle, high viscosity medium. The screw type impeller has the feature of small mixing diameter, strong axial thrust. Along the screwed plane, medium appears axial circulation flow.				

Large diameter Type Impeller	Type LD…	 LD LDG ZLD ZLG	0.8～0.98	100～4500	≦1000000	~
		These low speed impellers operate in laminar region. Along the screwed plane, medium appears axial circulation flow. They are used in processes of mixing and heat transfer of middle, high viscosity medium. n=0.5～50rpm, μ＜100000 cP, v＜2m/s. Outline of type LD is close to the inwall of tank and type LD has a large mixing diameter, result in the increase of liquid circulation inside the tank. It has applications in processes of heat transfer of high viscosity medium. Type LDG impeller combines the features of helical ribbon and screw impeller. Type ZLD and ZLG are suitable for taper-bottom tanks.				
	Type MS…	 MS KS KSA MKS TS	0.8～0.98	100～4500	<100000	1~5
		These low speed impellers are used in processes of mixing and heat transfer of middle, high viscosity medium. They produce horizontal circulation flow in laminar region. Vortex can be increased near blades when folded or angle blades are selected. Vertical and horizontal blades are optional for widening the mixing range.				

	Type MKS…	 MDS  FKS  FSS  ZBK  BKS  FMS	0.5～0.98	100～4500	≦1000000	~
		These low speed impellers are used in processes of mixing and heat transfer of middle, high viscosity medium. The working conditions are : μ ＜50000cP, n=1～100rpm. Type MDS impeller combines functions of helical ribbon type and frame type. Type FKS and FSS impellers have simple structure and can easily be manufactured. Their performance is similar to frame impellers. They are suitable for mixing and dissolving middle viscosity medium. Type BKS is a simple low speed impeller. The holes in the frame can be adjusted.				
	Type PSB	 PSB	0.9～0.98	1000～20000	≦50000	<0.1
		The low speed impellers are used for deposit pond and liquid waste pond.				

3.7 Other mixing parts

3.7.1 Shaft

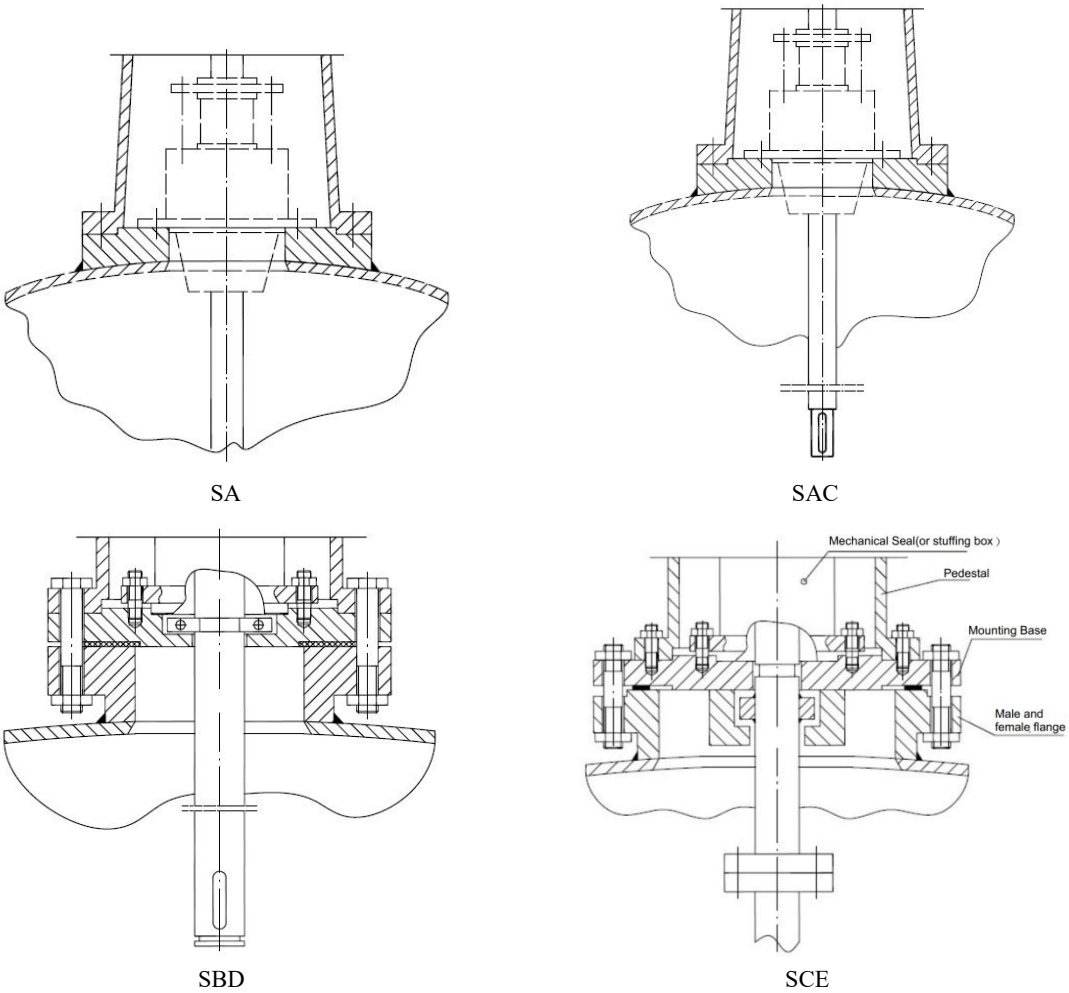
There are various types of shaft. The shaft length should be decided by the pedestal and vessel height; the diameter should be decided after strength check according to the loads and supporting conditions from pedestal or reducer.

Model designations

S □ □

Code for in-tank coupling
(C for DT rigid flange coupling; D for JQ or JJQ clamp coupling; E for weld flange coupling; F for integral shaft flange; Omitted for no coupling)

Code for shaft
（A for non-support type; B install the shaft from top with support; C install the shaft frombottom with support）



SA　　SAC

SBD　　SCE

Fig. 3-6　Sketch for different types of shaft

3.7.2 Mounting Flange

The mounting flange connects the pedestal and the vessel, and it also support the shaft seal. There are various types of mounting flange. The flange design should be based on the pedestal, vessel flange, shaft seal type and dimensions. There are thirteen types of mounting flange, RS、LRS、RX、LRX、RM、LRM、R、UA、UB、UC、UD、VA and VB.

Table 3-16 Code for mounting flange

Code	Flange type	Code	Flange type
RS	Mounting base (flange)	UA	Flat mounting base
LRS	Mounting base (flange) with lining	UB	Dish mounting base
RX	Mounting base (flange)	UC	Flat mounting base with lining
LRX	Mounting base (flange) with lining	UD	Dish mounting base with lining
RM	Male and female flange	VA	Split flat mounting base
LRM	Male and female flange with lining	VB	Split dish mounting base
R	Rectangular plate		

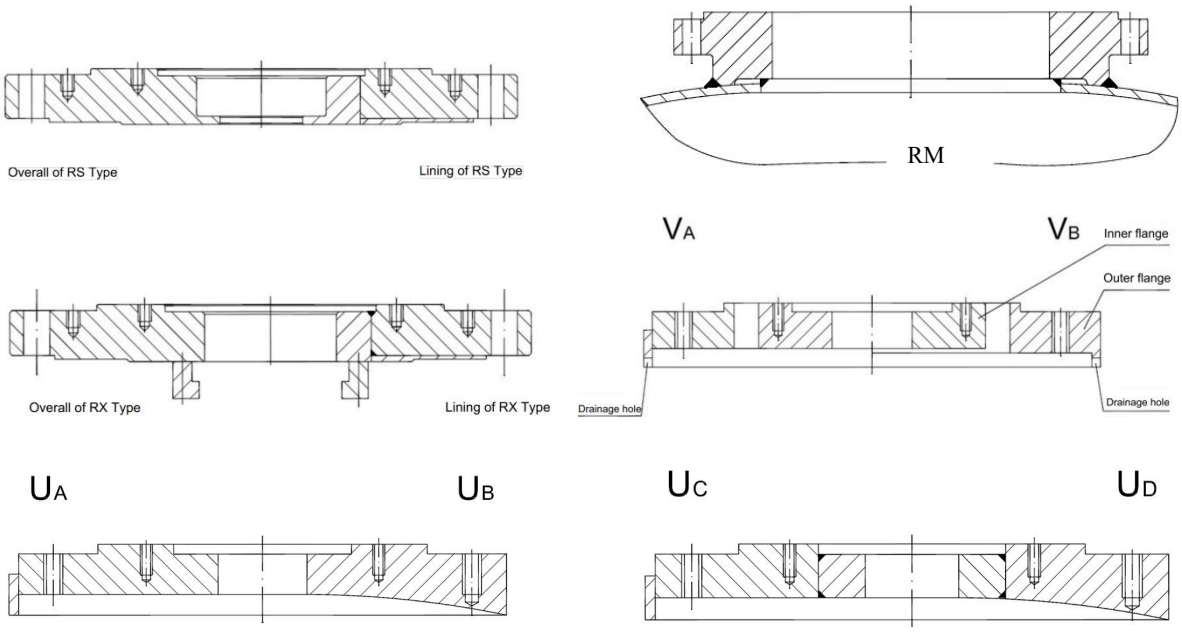


Fig. 3-7 Sketch for mounting flange

3.7.3 Middle Bearing

There are four types of middle bearing, SL,SC and JC .

Fig. 3-8 SL middle bearing

Fig. 3-9 SC middle bearing

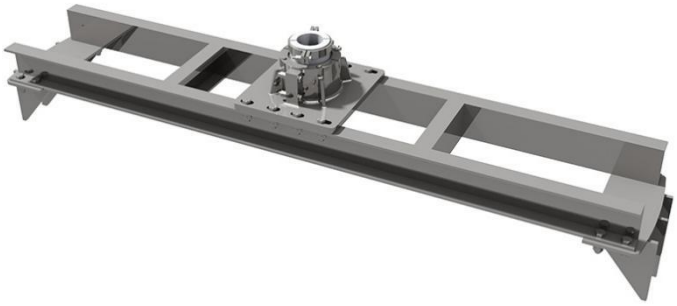
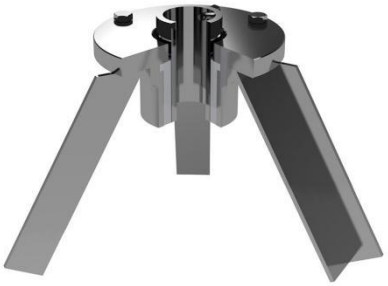


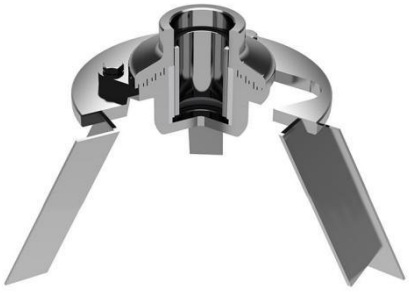
Fig. 3-10 JC middle bearing

3.7.4 Bottom Bearing

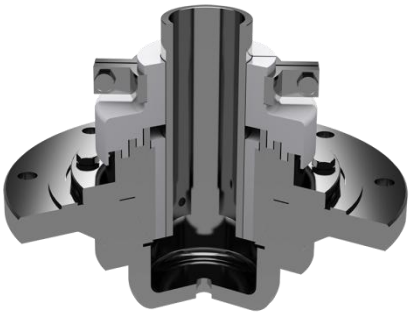
There are five types of base bearing, SZ,, MSZ, MDL, FSZP, FSDS.



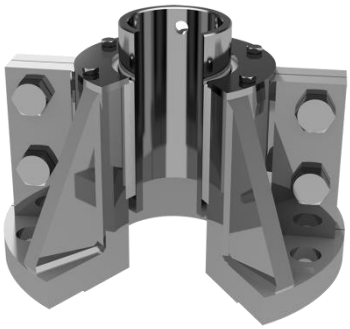
SZ



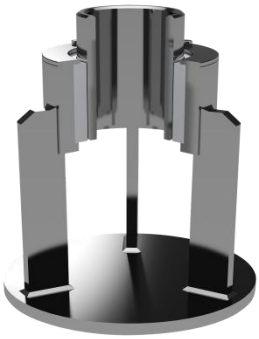
MSZ



MDL



FSZP



FSDS

Fig. 3-11 Five types of bottom bearing (SZ, MSZ, MDL, FSZP and FSDS)