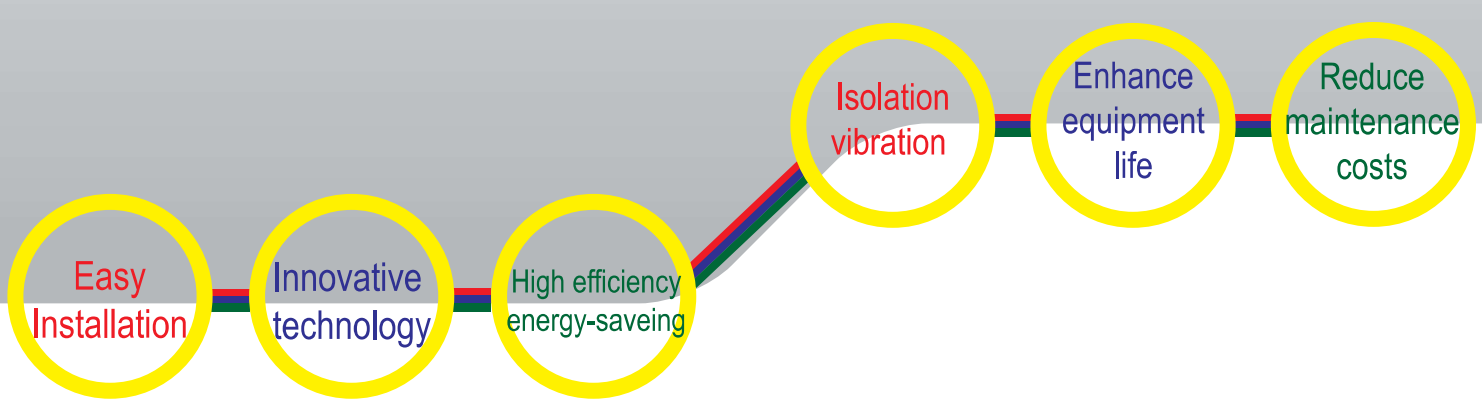
KIMAX

CONTROLS INC.

# TAIWAN

# Permanent Magnet Drives

*start saving form the magnet*



# Company introduction

## Professional management in all areas of industry.

Kimax Controls, Inc. is incorporated both in Taiwan and China. Kimax is engaged in the supply of Actuation Systems for Valves and Dampers including Electric Actuators, Pneumatic Actuators, Hydraulic Actuators, Solenoid valve, Permanent-Magnet Coupling (PMC)- (Permanent Magnet Coupling - adjustable gap + Permanent Magnet Coupling - fixed gap, Save energy and Divided vibration) , Cooling tower water turbine all types of valves as well as packaged valves and the related accessories.

Kimax was established in 1993 in Taiwan and started to develop overseas in 1997.
Kimax liaison office in China was established in 2002 and became incorporated in 2007.
Kimax Controls operations over directed by head office, in Taichung Taiwan, and associated with our own hardworking factory team-Kimax China. Our Products are sold and serviced worldwide through Distributors and Manufacturers.

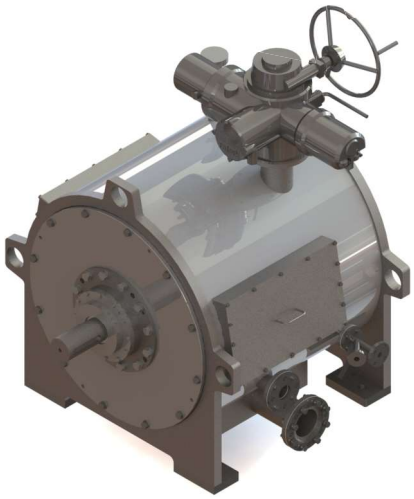
As well as developing our own products, OEM and ODM businesses are very important to us. Our goal for our customers is: Always to do business with honesty, reliability and to satisfy customers needs as best as we can.Kimax is the best solutions of fluid equipment on industry.











**Years of experience in production and management and good sales pipeline.**

# Product Introduction

Permanent-Magnet Coupling (PMC)
(Permanent Magnet Coupling - fixed gap & Permanent Magnet Coupling - adjustable gap)

1. Energy cost saving from 5% up to 50% by changing the gap.
2. Soft start with less impulse current on power grid and reducing mechanical stresses of system.
3. Higher eccentric tolerance of axial deviation on alignment.
4. Reliable in harsh or dirty environment no matter outdoor or indoor.
5. Automatic slip through upon overload which ensures the reliability of motor-driving system.
6. Simple structure and no electronic components which keep the equipments with long life.
7. High performance in vibration reduction by non-contact air gap of torque transmission.
8. The most economic cost, easy installation and no maintenance required.
9. Ideal usage for tight space; easiest solution to change flow rate in pipes. Easy to use on the new and old equipment.
10. No electromagnetic interference and harmonic current.

# Technology of PMC -Air Gap(Gap)

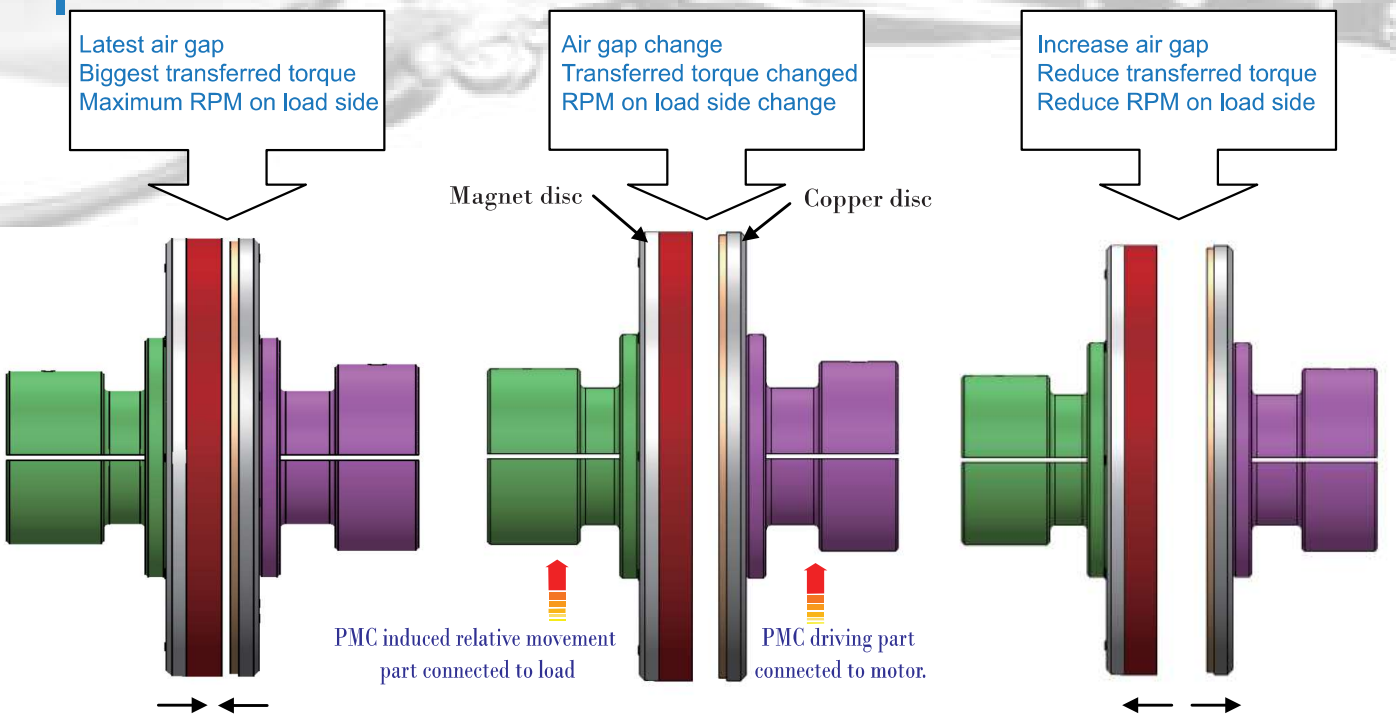
The French physicist, Arago discovered this effect in 1824. The principle of Arago's disc goes that, when a disc made of copper or aluminum is sandwiched between magnets and the magnets are moved, eddy current is generated on the disc. And this eddy current causes the force that tries to move the disc in the moving direction of the magnets to be generated on the disc.






PMC technology is equipped with permanent magnets made from rare earth to create an induced magnetic force used for torque transfer.PMC physically separates the two elements of the motor system and loaded side, coupling the load shaft and the motor shaft without physical assembly contact. Motor torque is transferred to the load side across an adjustable gap. Varying the gap between the magnets and conductor changes the strength of the magnetic field and hence controls output speed. Meanwhile, by changing the strength of the magnetic field getting torques change. As transfer torque enlarges ,RPM becomes low , current consumption is reduced. That is how PMC safes energy.

# Relationship brtween air-gap variation and torque




Remarks：moter power = torque x angular velocity

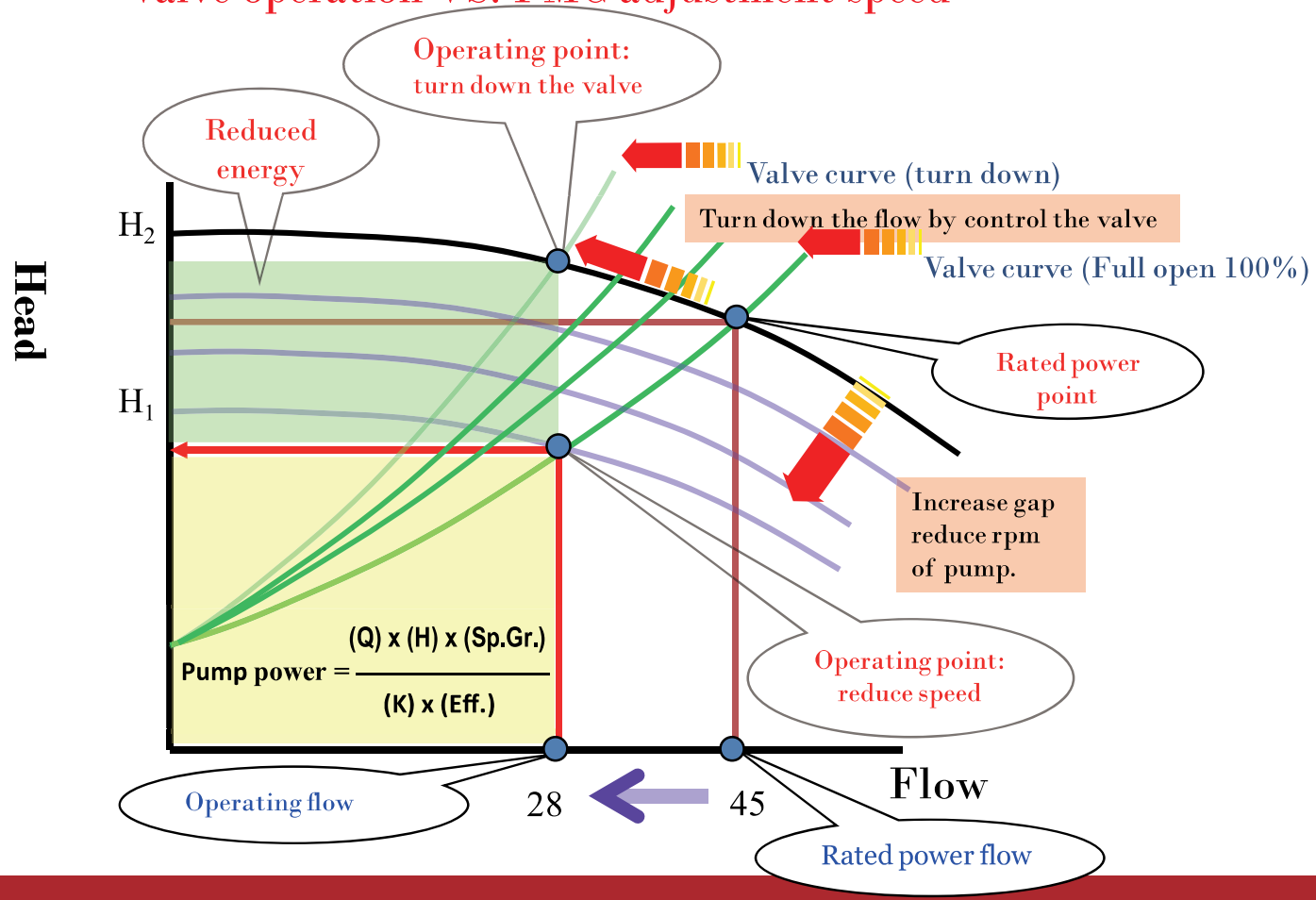
P = T x ω

◎PMC does not change the motor speed, but changes the motor torque through the air gap to save energy.

03

# Flow regulation type

## Valve operation VS. PMC adjustment speed



# Classification of Permanent-Magnet Coupling (PMC)

**Permanent-Magnet Coupling (PMC)**

**Permanent Magnet Coupling - fixed gap (PMC-F)**
(Stop motor to adjust the gap)

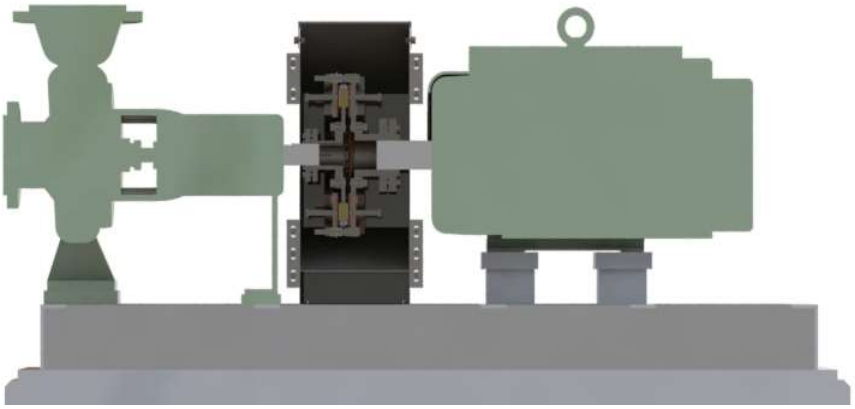
**Permanent Magnet Coupling - adjustable gap (PMC-A)**
(Adjust gap in operation)







## Permanent Magnet Coupling- fixed gap



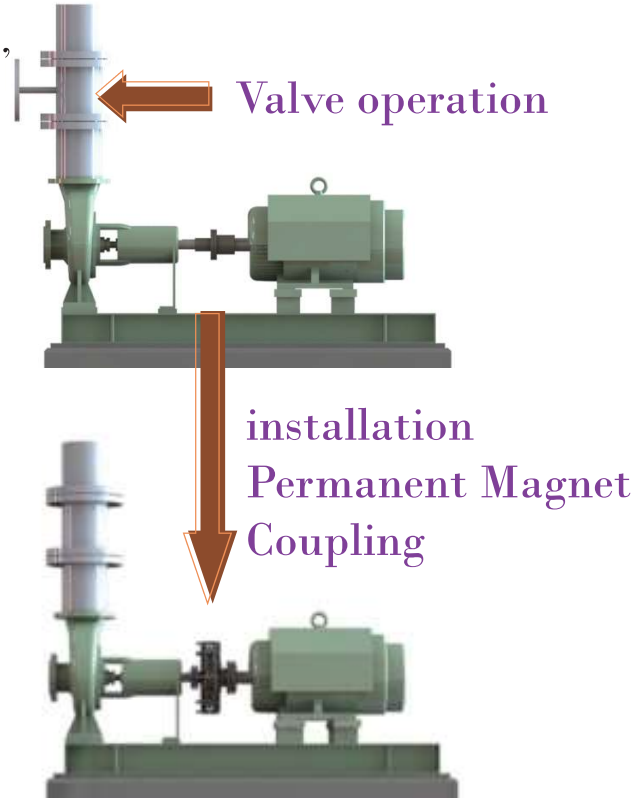


## Applications

1. To replace the fluid coupling or Variable-frequency drive (VFD).(save energy)
2. Throttling valve of pupm or fan is not fully opened and fixed opening.(save energy)
3. Throttling valve needs to be operated very often due to too big designed capacity or reduced demand, PMC + valve can be an effective solution to be close to the investor function.(save energy)
4. Change process or system, output speed by different period of time.(save energy)
5. Difficult to solve the misalignment that causes wear or tear on coupling, bearing, and dealing. (Reliability)
6. System is easily stuck or transfer torque needs to be limited.(Reliability)
7. Transfer belt or conveyor.(Reliability)
8. Best suited for high-voltage electrical appliances.(Reliability)
9. Power grids and equipment for electricity strict.(Reliability)
10. Harsh environment, such as dust & outdoor & large temperature difference.(Reliability)

# Permanent Magnet Coupling- fixed gap
# Applicable and opportunity

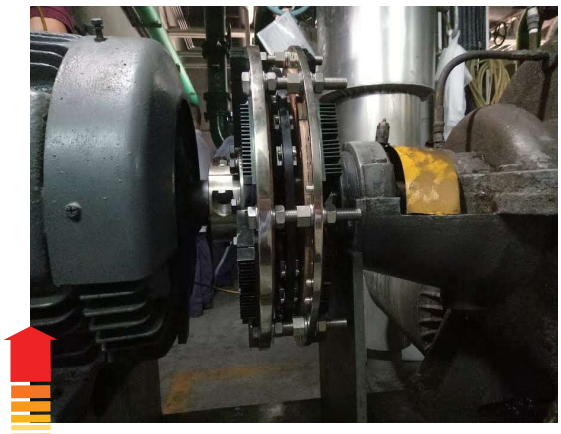
Suitable for centrifugal pumps, centrifugal fans, belt drive equipment, various variable torque and constant torque equipment.



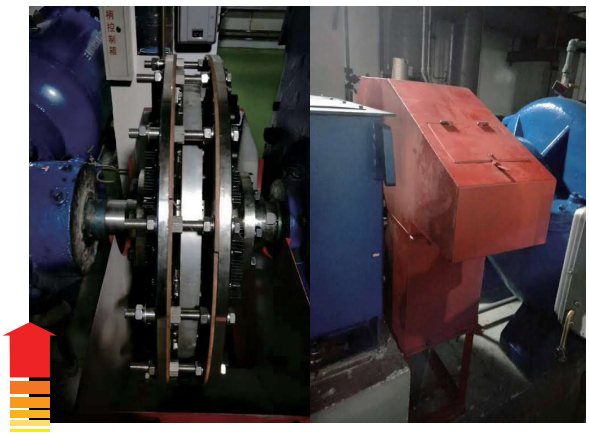

◎Centrifugal pump, fan, medium and high voltage motor system
◎Energy saving demand
◎The environment requires high harmonics or electromagnetic waves
◎High reliability requirements
◎Speed control, control requirements
◎Bad environment (dust, vibration)
◎Periodic load stall
◎Burst load
◎Heat up and down, not easy to center



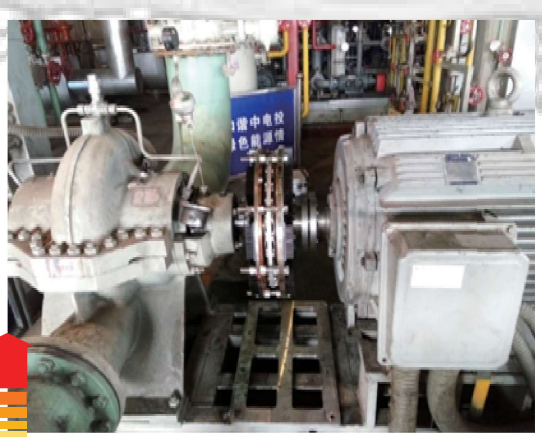
## Application: Permanent Magnet Coupling - fixed gap



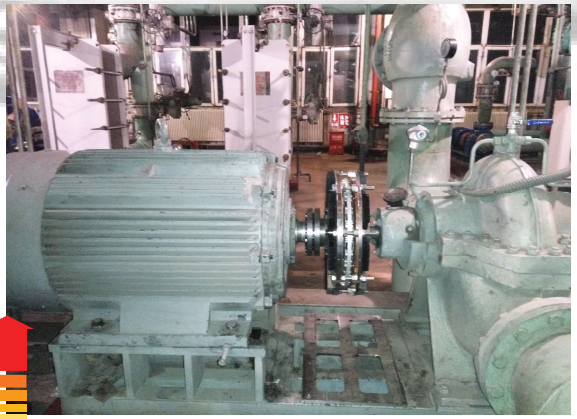
【Taiwan-Chemical company】
Cooling water circulation system
90kw pump



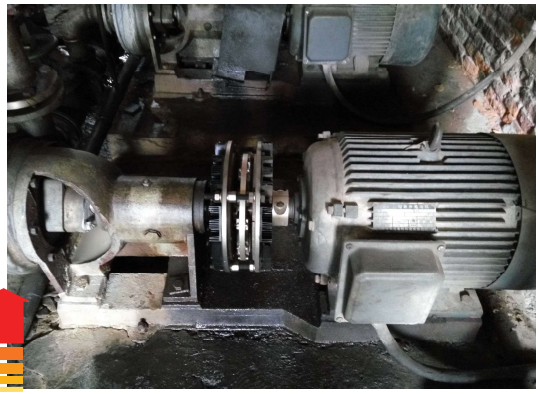
【Chian-Power Plant】
Closed cooling water system
355kw pump



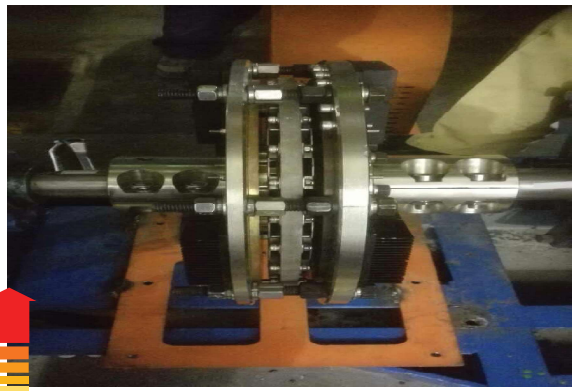
【Chian-Thermal Power Plant】
Closed cooling water system
132kw pump



【Chian-Cement Plant】
Boiler water system
155kw pump



【Chian-Chemical company】
Process water circulation system
37kw pump



【Chian-Thermal Power Plant】
Closed cooling water system
132kw pump





【Chian-Chemical company】
Cooling water circulation system
90kw pump

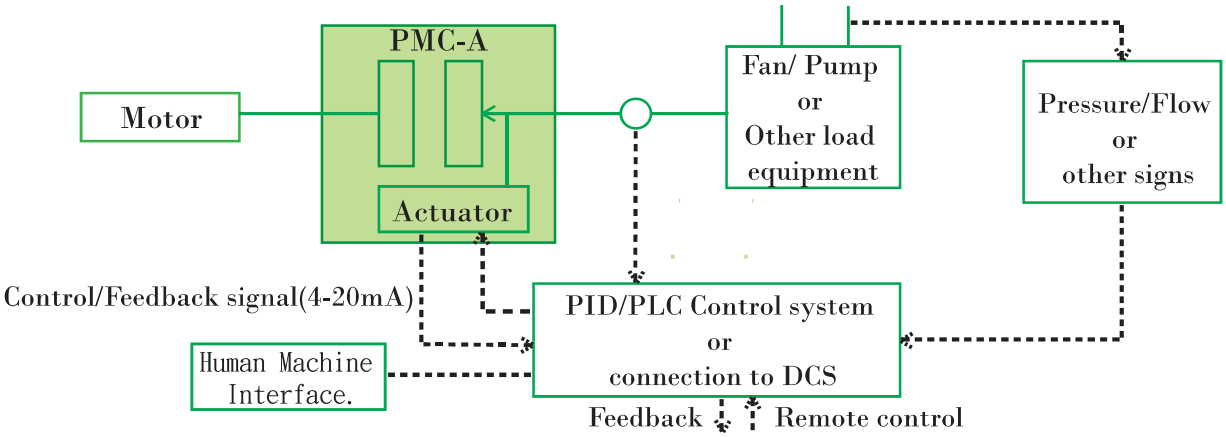


【Chian-Thermal Power Plant】
Closed cooling water system
110kw pump

# Permanent Magnet Coupling - adjustable gap (Air Cooling & Liquid Cooling)

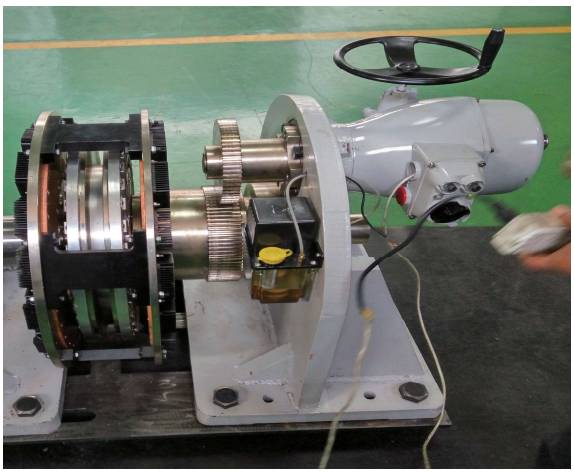
## Applicable and opportunity

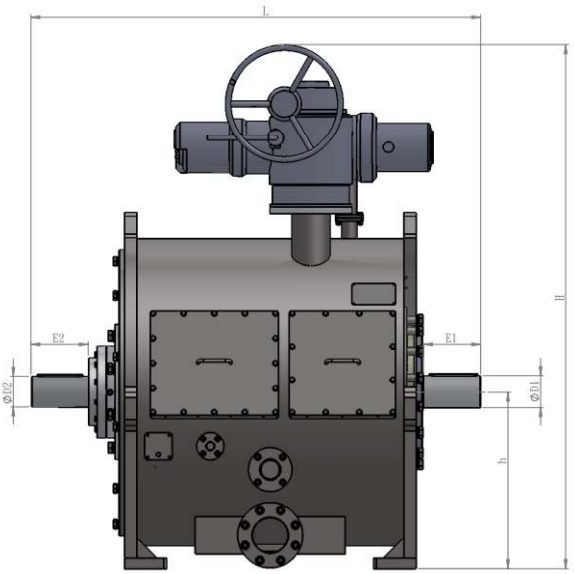
1.To replace the fluid coupling or Variable-frequency drive (VFD).(save energy)
2.Pump or fan need to save energy, and the load conditions change at any time.(save energy)
3.Throttling valve needs to be operated very often due to too big designed capacity or reduced demand, PMC + valve can be an effective solution to be close to the investor function.(save energy)
4.Difficult to solve the misalignment that causes wear or tear on coupling, bearing, and dealing.(Reliability)
5.System is easily stuck or transfer torque needs to be limited.(Reliability)

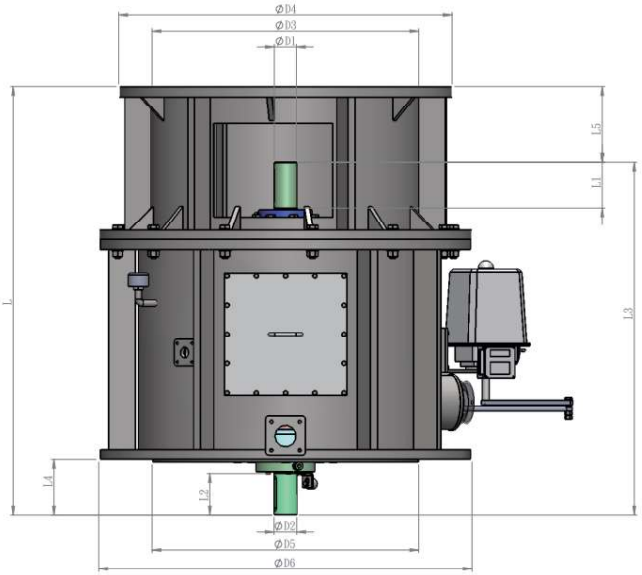










# Application: Permanent Magnet Coupling - adjustable gap



【Poewr Plant】
Induced draft system
400kw



【Poewr Plant】
Induced draft system
450kw



【Poewr Plant】
Closed circulation pump system
400kw

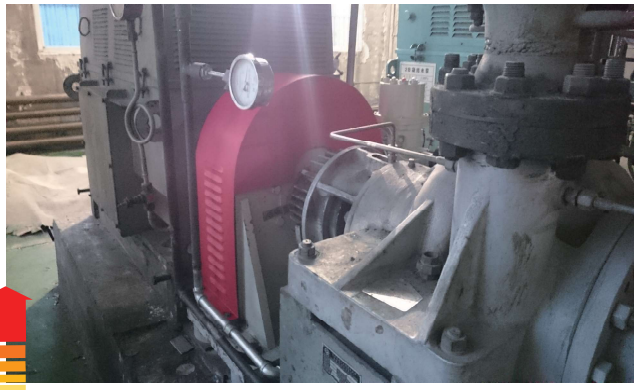



【Petrochemical Plant】
cooling tower system
200kw





【Petrochemical Plant】
cooling tower system
200kw



【Poewr Plant】
Condensate pump system
315kw



【Paper company】
Dust removal system
710kw pump



【Poewr Plant】
Dust removal system
630kw



【Petrochemical company】
Cooling water circulation system
800kw pump



【Poewr Plant】
Circulation pump system
1800kw



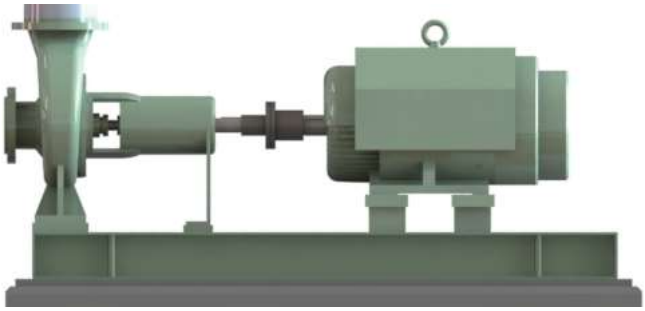
【Poewr Plant】
Fan system
1400kw pump



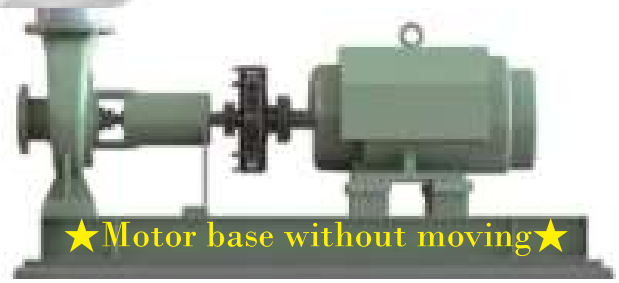
【Petrochemical company】
Cooling water circulation system
800kw pump

# Installation diagram of Permanent Magnet Coupling (PMC)

Transformation:
Use Permanent Magnet Coupling - fixed gap (PMCF)
(Stop motor to adjust the gap)



Use rigid-coupling link
(Motor output speed = Load speed )







Transformation:
Use Permanent Magnet Coupling - adjustable gap
(Adjust gap in operation)

## Permanent-Magnet Coupling (PMC): applicable and opportunity



【Power station】
【Petrochemical industry】
【Mines industry】
【Steel / Metallurgy industry】
【Municipal Public Project】
【Sewage industry】
【Cement industry】
【Paper-making Industry】
【Pharmacy industry】
【Technology industry】

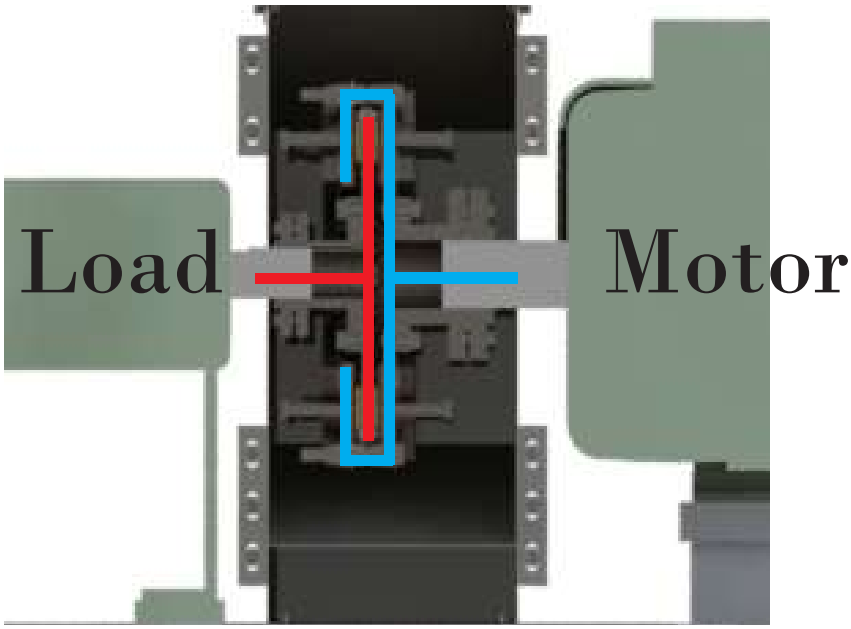
## Permanent-Magnet Coupling link method schematic

Red-magnet plate structure
Blue-Steel plate structure

As the picture shows,Can be seen that the permanent coupling non-hard links.

Energy Saving :

$$P = T \times \omega$$
$$\downarrow \quad \downarrow$$



# Comparison of Permanent Magnet Coupling (PMC-A) and Variable-frequency drive (VFD) and fluid coupling(FC).

| Comparison of Magnet adjustable Drive and other products | | | |
|---|---|---|---|
| Project / Equipment | Permanent Magnet Coupling (PMC-A) | Variable-frequency drive (VFD) | Fluid coupling (FC) |
| Operating Principle | Torque transmission by gap (no contact) | Electric component control multi-frequency | Control and adjust fluid volume |
| Control flow and Pressure | Yes | Yes | Yes |
| Automatic control | Yes | Yes | Yes |
| Efficiency | 97% | 95% | 85% |
| Energy efficiency | (1-speed ratio2) x efficiency | (1-speed ratio3) x efficiency | (1-speed ratio2) x efficiency |
| Overload protection | Yes | Yes | Yes |
| Input-Voltage sensitivity | No | Yes | No |
| Climatic sensitivity | No | Yes | No |
| Adapt to environment | Good | Bad | Normal |
| Vibration Reduction | Good | Bad | Normal |
| Increase life of Bearing and Seal | Yes | No | Yes |
| Soft start | Yes | Yes | Yes |
| Frequent stop / start | Yes | No | Yes |
| Response time | Middle | Fast | Slow |
| Accuracy control | Middle | High | Low |
| Input Power-Factor | Equal to Motor | Lower than Motor | Equal to Motor |
| EMI and harmonic current | No | Yes | No |
| Life | >20 years | 5-10 years | 5-10 years |
| Alignment time of axial | Easy | Hard | Hard |
| Space | Low | Big | Big |
| Protection | No need | Air-condition, Prevent dust, Prevent lightning / thunder | Prevent leakage, Prevent burning |
| Difficulty of trouble-shooting | Easy | Hard | Middle |
| Maintenance time | Low | High | Middle |
| Change parts of bearing and Seal | Low | High | High |

## Permanent Magnet Coupling - fixed gap (PMC-F) (Stop motor to adjust the gap model table

| Motor Power | Motoer【50Hz】【60Hz】 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KW | 3600rpm | 3000rpm | 1800rpm | 1500rpm | 1200rpm | 1000rpm | 900rpm | 750rpm |
| 37 | 280 | 330 | 330 | 380 | 380 | 430 | 430 | 430 |
| 45 | 330 | | 380 | | 430 | | | 480 |
| 55 | | | | 430 | | 480 | 480 | 530 |
| 75 | | 380 | 430 | | 480 | 530 | 530 | 580 |
| 90 | 380 | | | 480 | 530 | | 580 | 630 |
| 110 | | 430 | 480 | 530 | | 580 | 630 | 585 |
| 132 | 430 | | 530 | | 580 | 630 | 585 | 730 |
| 160 | | | | 580 | 630 | 585 | 730 | 780 |
| 185 | | 480 | 580 | 630 | 585 | 635 | 780 | 795 |
| 220 | 480 | | 630 | 585 | 635 | 735 | 735 | |
| 250 | | 530 | 585 | 680 | 780 | | | |
| 280 | 530 | | 680 | 635 | 735 | | | 895 |
| 315 | | 580 | 730 | 780 | | 835 | 835 | |
| 355 | 580 | 630 | 780 | 735 | | | | 935 |
| 375 | | | | | | | | |
| 400 | | | 735 | | | | | |
| 450 | 630 | 680 | | | 835 | 935 | 935 | |
| 500 | 680 | | | 835 | | | | 1035 |
| 560 | | 635 | | | 935 | | | |
| 630 | 730 | 780 | 835 | 935 | | 1035 | 1035 | |
| 710 | 780 | 735 | | | 1035 | 1135 | 1135 | 1135 |
| 750 | | | | | | | | |
| 800 | 735 | | 935 | 1035 | | | | 1235 |
| 900 | | | | | 1135 | 1235 | 1295 | |
| 1000 | | | | 1135 | | | | |
| 1120 | | 835 | 1035 | | 1235 | | | |
| 1250 | 835 | | | 1235 | | | | |
| 1400 | | | | | | | | |
| 1600 | | 935 | 1135 | 1235 | | | | |
| 1800 | 935 | | | | | | | |
| 2000 | | | | | | | | |
| 2250 | | 1035 | | | | | | |

## Permanent Magnet Coupling - adjustable gap (PMC-A) (Adjust gap in operation) model table (Air Cooling & Liquid Cooling)

| Motor Power | Motor RPM【50Hz】【60Hz】 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KW | 3600rpm | 3000rpm | 1800rpm | 1500rpm | 1200rpm | 1000rpm | 900rpm | 750rpm |
| 75 | 320 | 320 | 370 | 370 | 420 | 470 | 420 | 470 |
| 90 | 320 | 320 | 370 | 420 | 420 | 470 | 470 | 520 |
| 110 | 320 | 370 | 420 | 420 | 470 | 520 | 520 | 570 |
| 132 | 370 | 370 | 470 | 470 | 520 | 550 | 570 | 620 |
| 160 | 420 | 420 | 470 | 520 | 570 | 600 | 620 | 670 |
| 185 | 420 | 470 | 520 | 550 | 620 | 620 | 620 | 700 |
| 220 | 470 | 550* | 550 | 600 | 620 | 670 | 670 | 670 |
| 250 | * | 550* | 600 | 600 | 670 | 700 | 670 | 670 |
| 315 | * | * | 650* | 650* | 620 | 620 | 720 | 720 |
| 355 | * | * | 700* | 700* | 670 | 670 | 800 | 800 |
| 400 | * | * | 620 | 620 | 720 | 720 | 800 | 800 |
| 500 | * | * | 670 | 670 | 800 | 800 | 850 | 850 |
| 560 | * | * | 720 | 720 | 800 | 800 | 850 | 850 |
| 630 | * | * | 720 | 720 | 800 | 800 | 850 | 850 |
| 710 | * | * | 800 | 800 | 850 | 850 | 850 | 850 |
| 800 | * | * | 800 | 800 | 850 | 850 | 850 | 850 |
| 900 | * | * | 800 | 800 | 850 | 850 | 875 | 875 |
| 1000 | * | * | 850 | 850 | 850 | 850 | 875 | 875 |
| 1120 | * | * | 850 | 850 | 850 | 850 | 900 | 900 |
| 1250 | * | * | 850 | 850 | 850 | 850 | 900 | 900 |
| 1400 | * | * | 850 | 850 | 875 | 875 | 900 | 900 |
| 1600 | * | * | 850 | 850 | 875 | 875 | 950 | 950 |
| 1800 | * | * | 850 | 850 | 900 | 900 | 950 | 950 |
| 2000 | * | * | 850 | 850 | 900 | 900 | 950 | 950 |
| 2240 | * | * | 875 | 875 | 900 | 900 | 950 | 950 |
| 2500 | * | * | 875 | 875 | 900 | 900 | * | * |
| 2800 | * | * | 900 | 900 | 950 | 950 | * | * |
| 3000 | * | * | 900 | 900 | 950 | 950 | * | * |
| 3500 | * | * | 900 | 900 | * | * | * | * |
| 4000 | * | * | 950 | 950 | * | * | * | * |
| 4500 | * | * | 950 | 950 | * | * | * | * |

12

Air cooling  Liquid cooling

★★Table Reference★★

# Permanent Magnet Coupling calculation method of enenrgy saving

| | | | |
|---|---|---|---|
| Moter Power | 315 kW | Year of operation hours | 5000 hours |
| Moter RPM | 2969 RPM | Electricity price(USD) | 0.1 dollar/KwH |
| Voltage | 6000 V | Pump flow | 230 m3/h |
| Rated Current | 36.2 A | Actual operating current | 32 A |
| Moter Effectiveness | 90% | Moter Power Factor | 90% |

Energy saving estimation

Estimation method #1(Moter Power)

Hypothesis 1.

Equipment energy-saving average15%

Energy-saving/year

$(315 - 315 \times 0.85) \times 5000 \times 0.1 \cong 23{,}625$ dollars

Increase effciency loss 15% $= 23625 \times 0.85 \cong 20{,}081$ dollars(USD )

Hypothesis 2.

Equipment energy-saving average30%

Energy-saving/year

$315 - 315 \times 0.7 \times 5000 \times 0.1 \cong 47{,}250$ dollars

Increase effciency loss 15% $= 47250 \times 0.85 \cong 40162$ dollars(USD )

---

Estimation method #2(Actual operating current)

Hypothesis 1.

Equipment energy-saving average15%

Energy-saving/year

Save Power：$(32 - 32 \times 0.85) \times 6000 \times \sqrt{3} \times 0.9 \times 0.9 \div 1000 \cong 40KW$

Saving electricity/year：$40 \times 5000 \times 0.1 \cong 20{,}000$ dollars(USD )

Hypothesis 2.

Equipment energy-saving average30%

Energy-saving/year

Save Power：$(32 - 32 \times 0.7) \times 6000 \times \sqrt{3} \times 0.9 \times 0.9 \div 1000 \cong 81KW$

Saving electricity/year：$81 \times 5000 \times 0.6 \cong 243000$ dollars(RMB)

---

Estimation method #3(Power and reduce RPM for the square relationship)

Hypothesis 1.

Equipment energy-saving average15%

Energy-saving/year

Actual operating power：$32 \times 6000 \times \sqrt{3} \times 0.9 \times 0.9 \div 1000 \cong 269KW$

Power after reduce RPM：$269 \times (1 - 15\%)^2 \cong 194KW$

Energy-saving rate： $(269 - 194) \div 269 \times 100\% \cong 27.88\%$

Pressure after speed reduction：$68 \times (1 - 15\%)^2 \cong 49m$

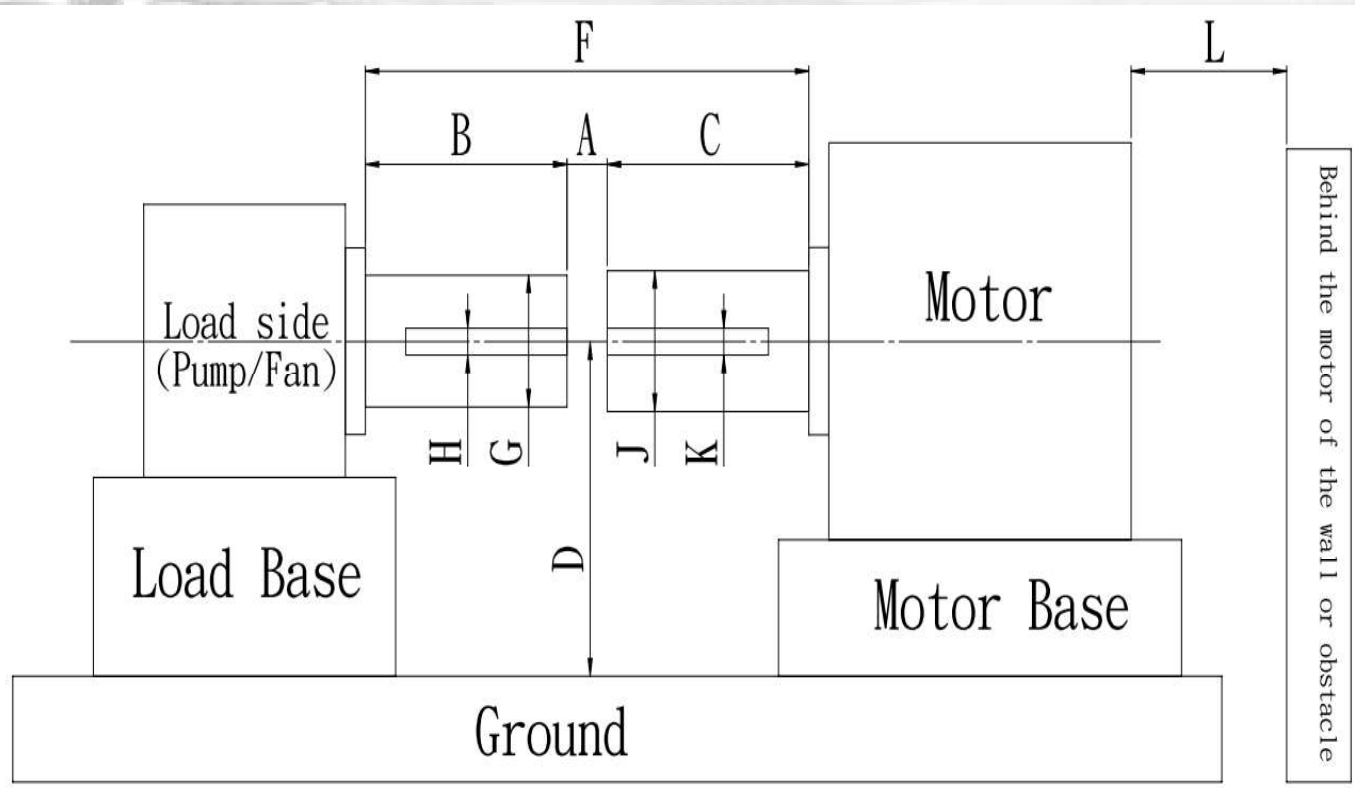
Flow after speed reduction：$230 \times (1 - 15\%)^2 \cong 195.5m^3/h$

Energy-saving/year：$(269 - 194) \times 5000 \cong 375{,}000$ 度

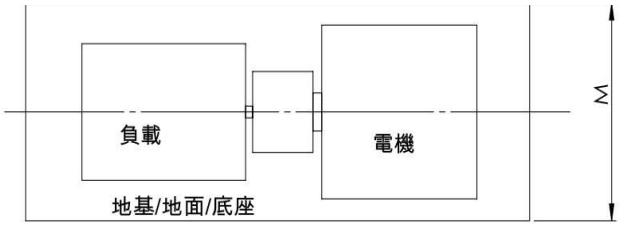
Saving electricity / year：$375000 \times 0.1 \cong 37{,}500$ dollars USD

**Generally reduce RPM of 10%,Energy-aving about 15%~20%**

# Information required for installation PMC



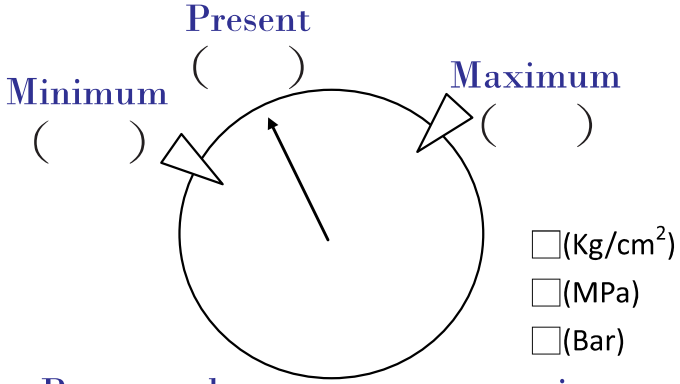

| Evaluation data | |
|---|---|
| Manufacturer's name | |
| Equipment use | |
| Several spare several use | |
| Load modulation at any time | |
| Year of operation hours | |
| Electricity price | |
| Foundation structure | ☐Steel structure ☐Cement |
| Cover demand colors | |




| Motor | |
|---|---|
| Factory | |
| Model | |
| Power | |
| RPM | |
| Voltage | |
| Rated Current | |
| Actual Current | |
| Bearing model | |

| Dimensions | |
|---|---|
| A | |
| B | |
| C | |
| D | |
| F | |
| G | |
| H | |
| J | |
| K | |
| L | |
| M | |

| Load | |
|---|---|
| Pump/Fan | |
| Model | |
| Power | |
| Bearing model | |
| Rated pressure/flow rate | |
| Outlet valve actual operating pressure/flow rate | |
| Minimum pressure/flow rate | |
| Actual demand pressure/flow rate | |
| Outlet valve opening(Please write if there is any change%) | |
| Inlet valve opening(Please write if there is any change%) | |
| Remarks: | |




Pump outlet pressure gauge pointer

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