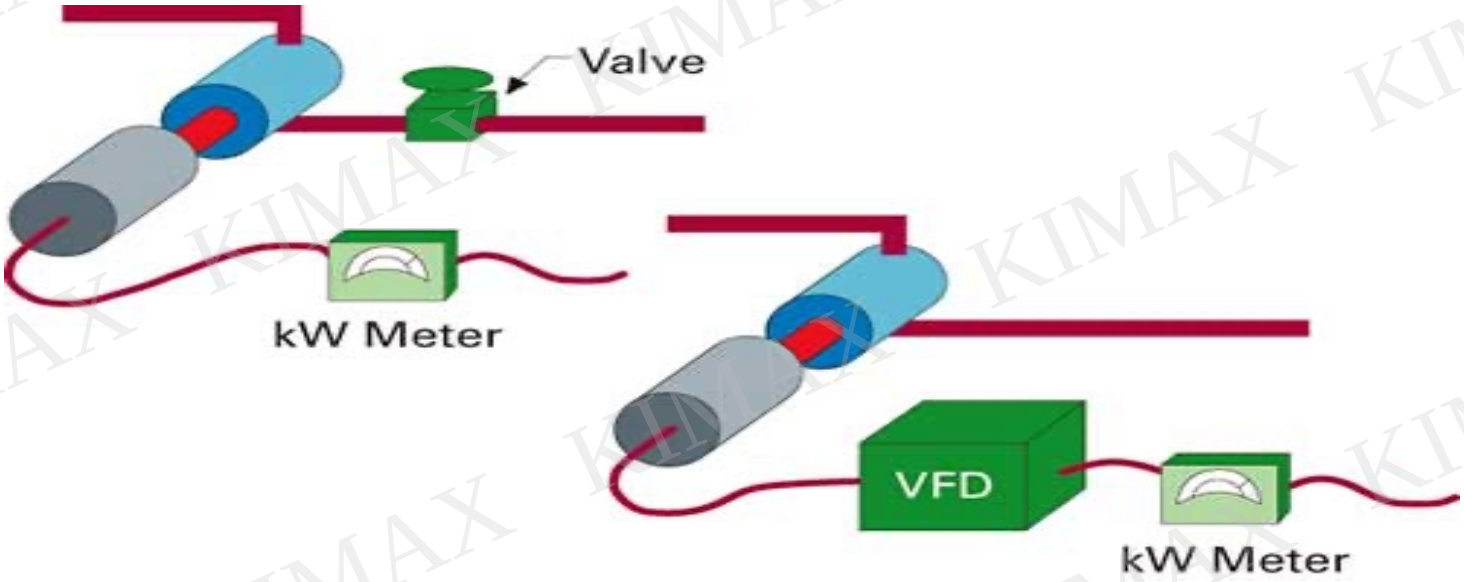
Permanent Magnet Coupling (PMC)

An Energy Saving Equipment Used in PUMP & FAN

KIMAX 專業經營於工業各個領域

Professional management in all areas of industry.

Introduction 1



The following problems generally happen to various fans and water pumps under working frequency:

1. Flow is adjusted by throttle valve or baffle, resulting in huge flow loss and low efficiency.
2. Hard connection between equipment and electrical machinery causes mutually affected larger vibration.
3. Motor is started with load, leading to a large starting current and a large current shock.
4. Valve or baffle is severely deformed due to wear, leading to high system fault rate and high maintenance cost.

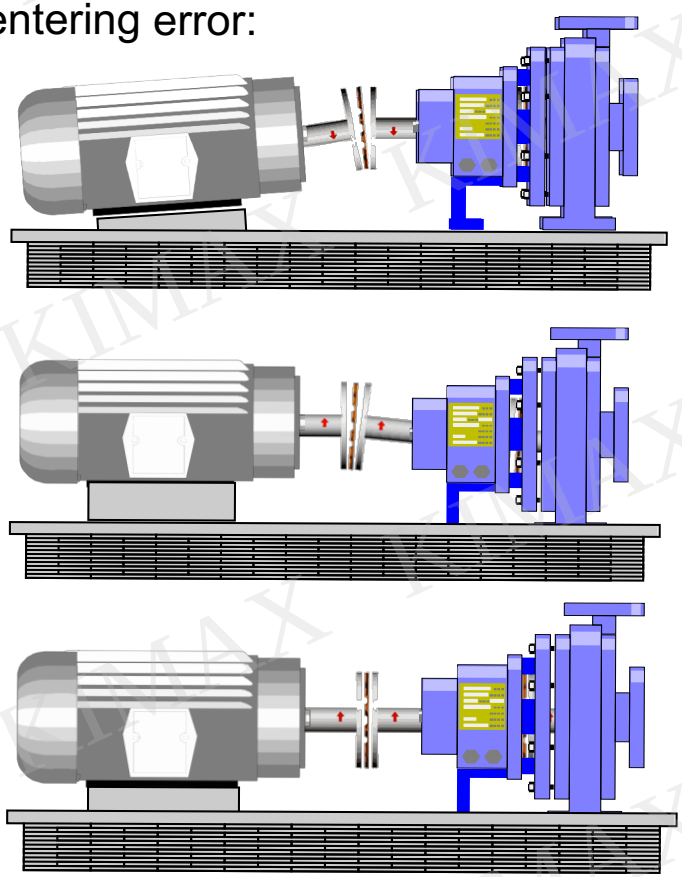
Introduction 2

- All traditional couplings share the following problem of centering error:

angle ---------- Centering error

level ---------- Centering error

angle ---------- Centering error



Most transmissions break down due to vibration, while most vibrations are caused by desaxe, or imbalance and resonance of equipment. Vibration may damage elastic force of seal ring, elevate temperature of bearing and equipment.

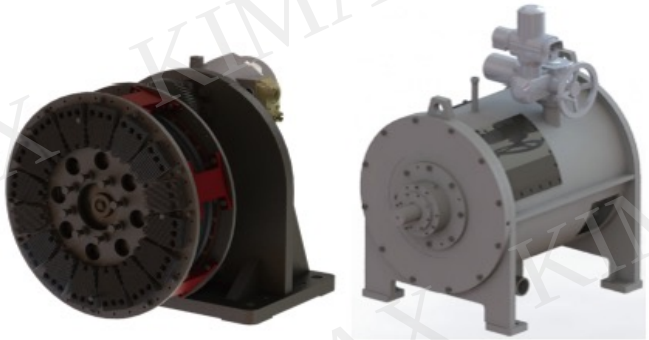
Product category of permanent magnet coupling

Permanent Magnet Coupling
(PMC)

Permanent Magnet Coupling-fixed Gap
(PMC-F)
(adjust air gap when machine is shut down)

Permanent Magnet Coupling-adjustable Gap
(PMC-A)
(adjust air gap online)

Replacement of traditional coupling and liquid coupling

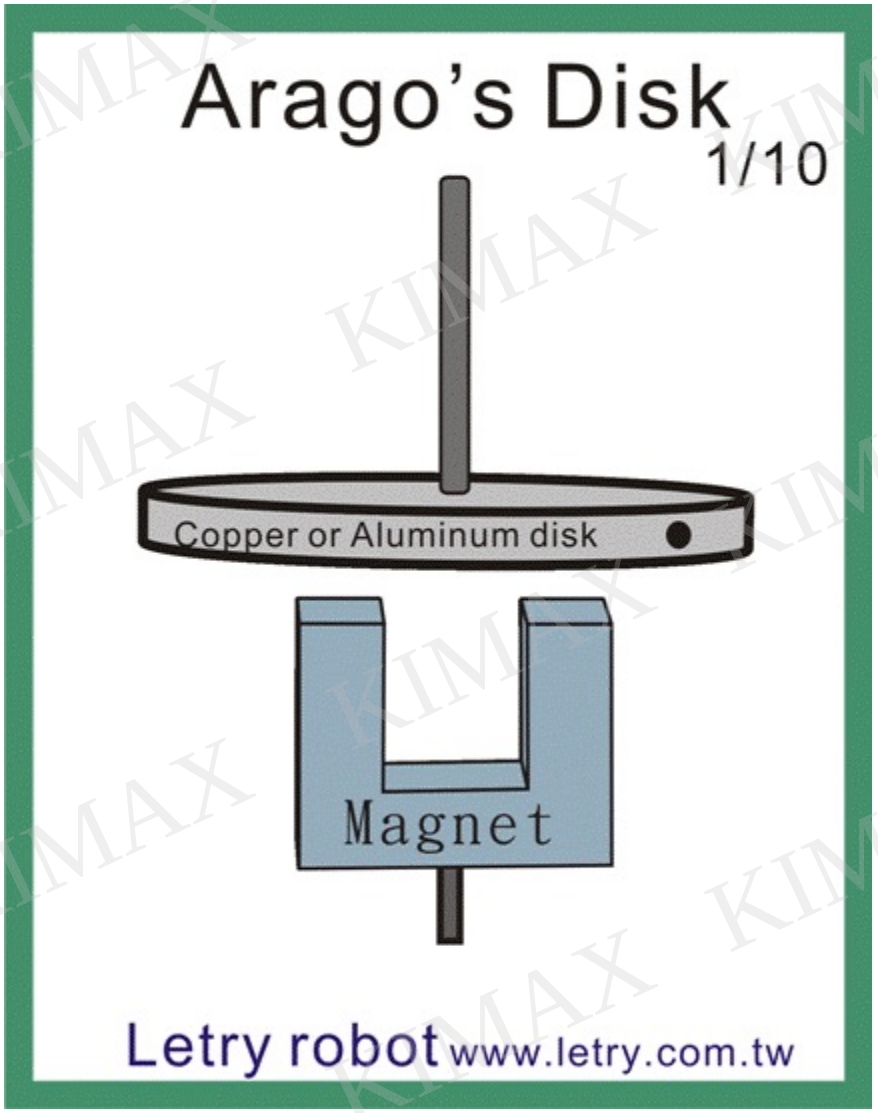


Replacement of variable-frequency drive and liquid coupling

Product Principle-Arago Principle

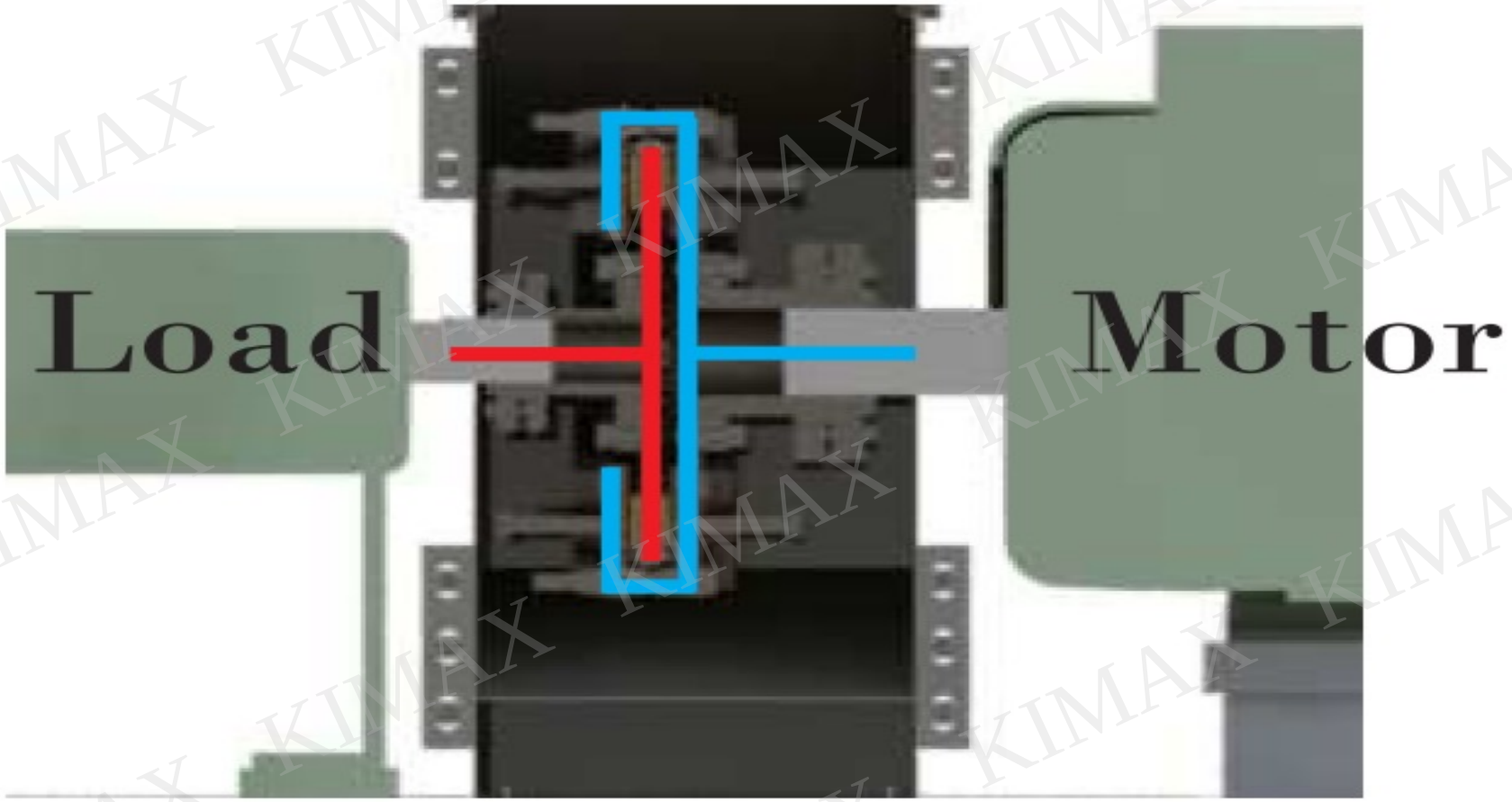
- In 1824, French physicist Arago found the magnet rotated when the copper disk under it was rotating

- Copper disk or aluminum disk may move relatively to the magnet due to eddy current formed between them.

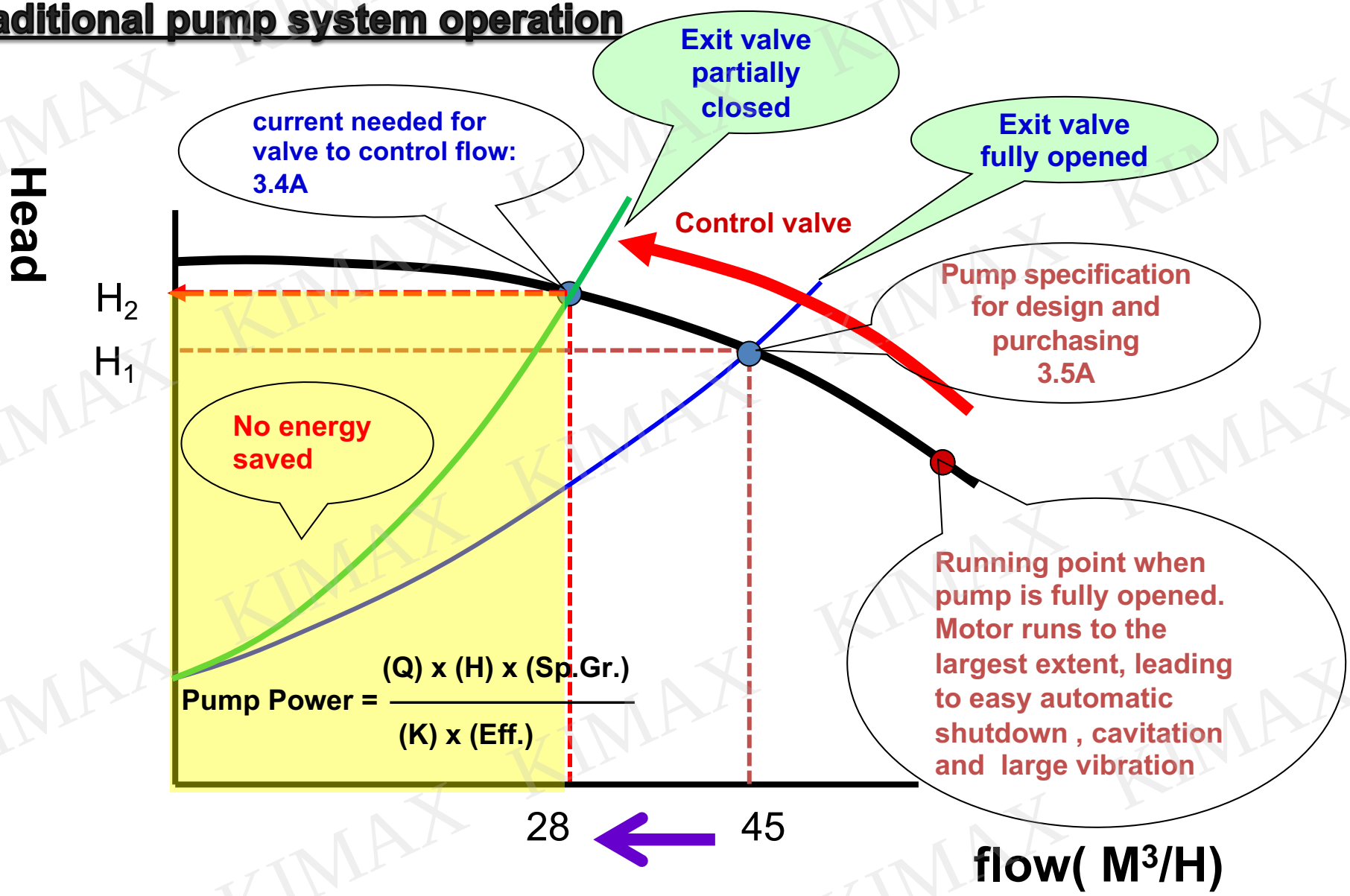


Product Principle-Air Gap

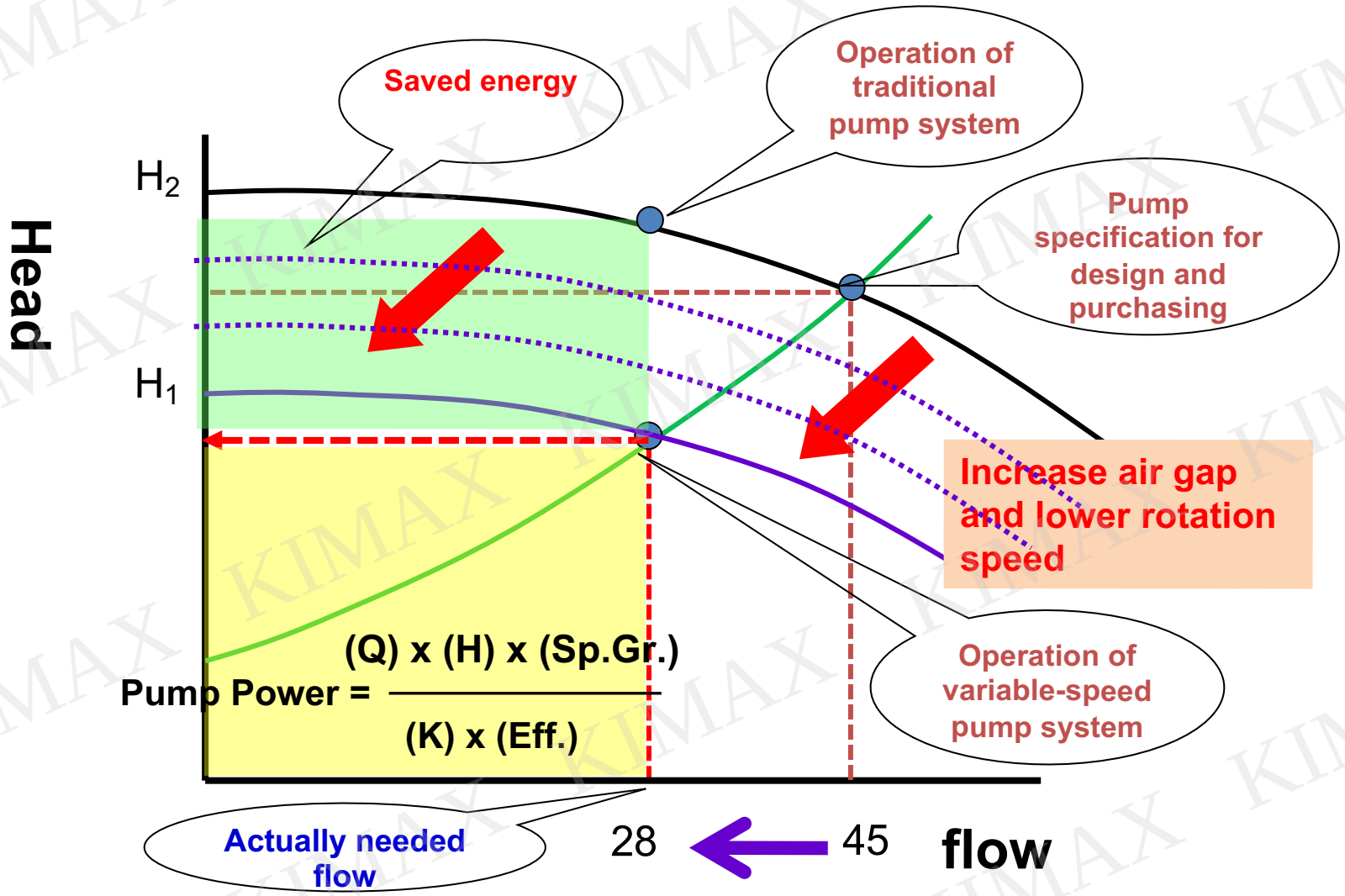
Permanent magnet coupling-fixed gap is a revolutionary transmission by driving torque through air gap. No mechanical connection between motor and loaded equipment rotating axis is required. Motor rotation drives the driving disk part which causes magnetic induction lines cut together with driven disk part such that driving disk moves relatively to driven part and therefore torque transmission between motor and load is achieved.



Traditional pump system operation



Product Principle-Pump System +PMC-F Energy Saving Operation



Product Features

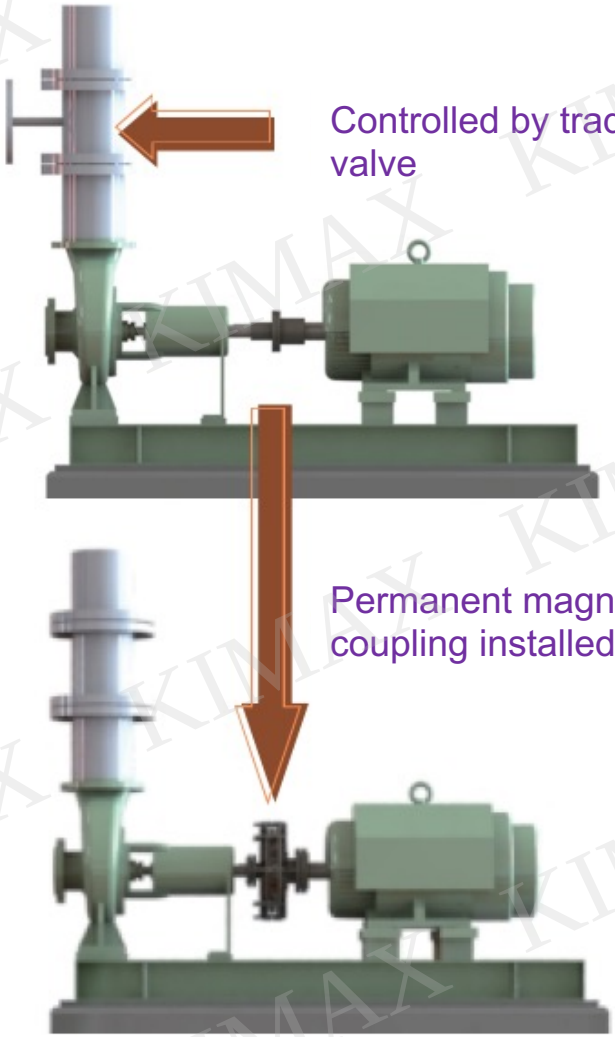
- Obvious energy saving effect. Rotation speed can be changed by adjusting air gap, leading to an energy saving rate of 5% to 50%.
- It can be served as starting buffer by reducing start current of motor and elongate the service life of equipment.
- Large tolerance for centering error during installation can greatly shorten the time used for centering alignment during installation.
- Overload protection function improves reliability of the whole motor driving system.
- Long service life, with a designed life of over 25 years.
- Good vibration reducing effect, no torque transmission caused by mechanical rigid connection.
- Simple structure, adaptive to various hostile environments, produces no pollutants, and in compliance with standards for green product.
- Small, easy for installation, can be used by simply modifying existing equipment or used in newly constructed system.
- No harmonic wave (not affecting motor and grid security), no EMI(electromagnetic wave interference)

Product Applications

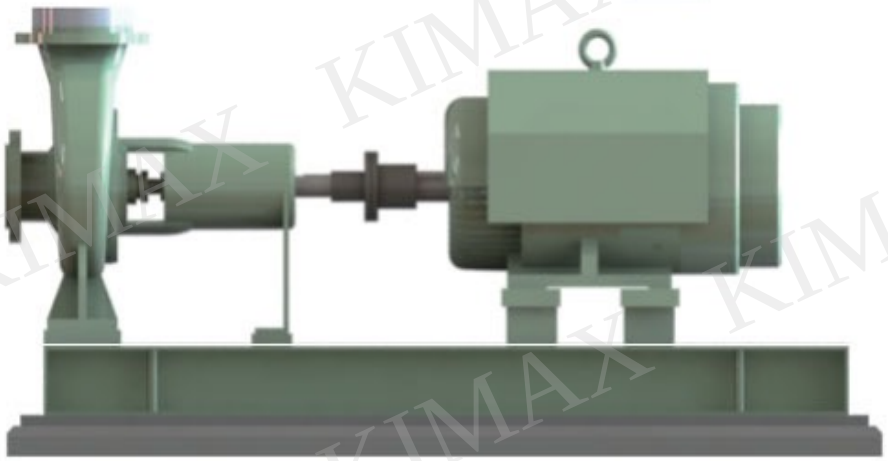
Applicable to centrifugal pump, centrifugal fan, centrifuge, belt conveyor and different variable-torque and constant-torque equipment.

Ideal applications:

- centrifugal pump, fan and high or medium voltage motor system
- energy saving
- high requirement for harmonic wave or electromagnetic waves according to environment
- high reliability requirement
- speed adjustment and control requirement
- hostile environment (dust and unavoidable vibration)
- periodical blockage
- pulse-type load
- expansion caused by heat and contraction by cold leads to difficult alignment.



Installation of Permanent Magnet Coupling



Connected by coupling originally
(output rotation speed=load rotation speed)

PMC-F used
(adjustment of air gap under shutdown changes rotation speed of load)

PMC-A used
(online adjustment of air gap changes rotation speed of load)

Product applications- PMC-F

1. Existing users of constant speed liquid coupling(energy saving)
2. Maintaining a certain opening degree for valve or fan inlet used in water pump or fan (energy saving)
3. Valve/ baffle often needs to be adjusted but the original pump set equipment is too large or the process demand becomes smaller. In this case, continuously variable transmission of coupling could be used to lower pump set power and then fine-tune by using original valve/baffle.(energy saving)
4. Equipment whose load only changes with seasons (energy saving)
5. Equipment whose rotation speed only needs to be changed for several times and shutdown is permitted within a year (energy saving)
6. Problems of vibration and frequent damage of rigid coupling caused by centering misalignment(reliability)
7. Equipment whose torque needs to be limited or for which blockage often occurs(protection)
8. Various belt conveyors (protection)

Practical Applications

Adani Power Ltd. Mundra, Gujarat, India

Installation Dates: 25/09/2019-27/09/2019

	Pre-Installation Data	After Installing PMC
Motor Speed	1480 RPM	1330 RPM
Voltage	11000Volts	11000Volts
Motor Actual Power	240kW	200kW
Current	13.85A	11.7A
Pressure	5.2kg/cm2	4.4kg/cm2

Total Electricity Saving: 16.67% per year

Practical Applications

Adani Power Ltd. Mundra, Gujarat, India

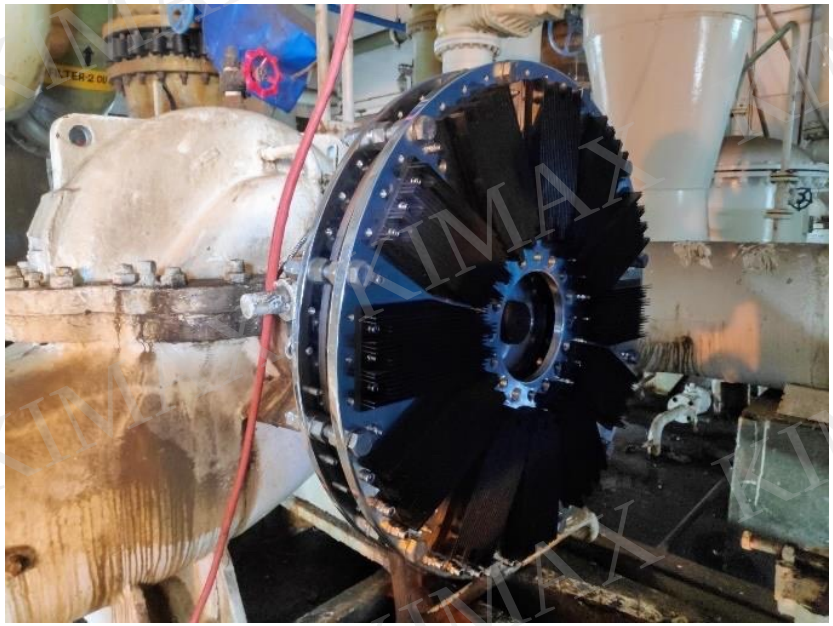
1. Remove Protection cover and screw of the flange.

2. Remove the traditional coupling and unscrew the motor.
3. Move the motor with the help of pulley/crane.
4. Remove the traditional coupling's flange.

Practical Applications

Adani Power Ltd. Mundra, Gujarat, India

5. Install Motor's flange.
6. Install pump's flange along with the PM Coupling.
7. The Motor is pivoted into place and aligned.

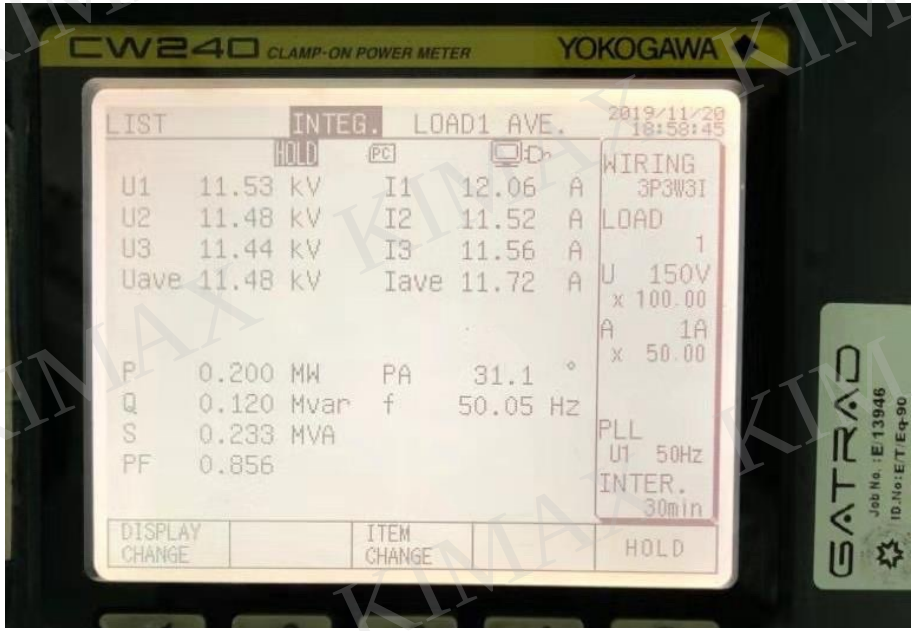


Practical Applications

Adani Power Ltd. Mundra, Gujarat, India

8. The Motor is pivoted into place and aligned.

9. After adjustment of gap, PMC installation is completed. Put the coupling protection cover and it is ready to operate.



Practical Applications

Honda motorcycles, Tapukara, Rajasthan, India

Installation Dates: 15/11/2019

	Pre-Installation Data	After Installing PMC
Motor Speed	1480 RPM	1345 RPM
Voltage	415Volts	415Volts
Motor Actual Power	22 kW	18.9kW
Current	21A	18.2A
Pressure	4 kg/cm2	3.2 kg/cm2

Total Electricity Saving: 14% per year

Practical Applications

Honda motorcycles, Tapukara, Rajasthan, India

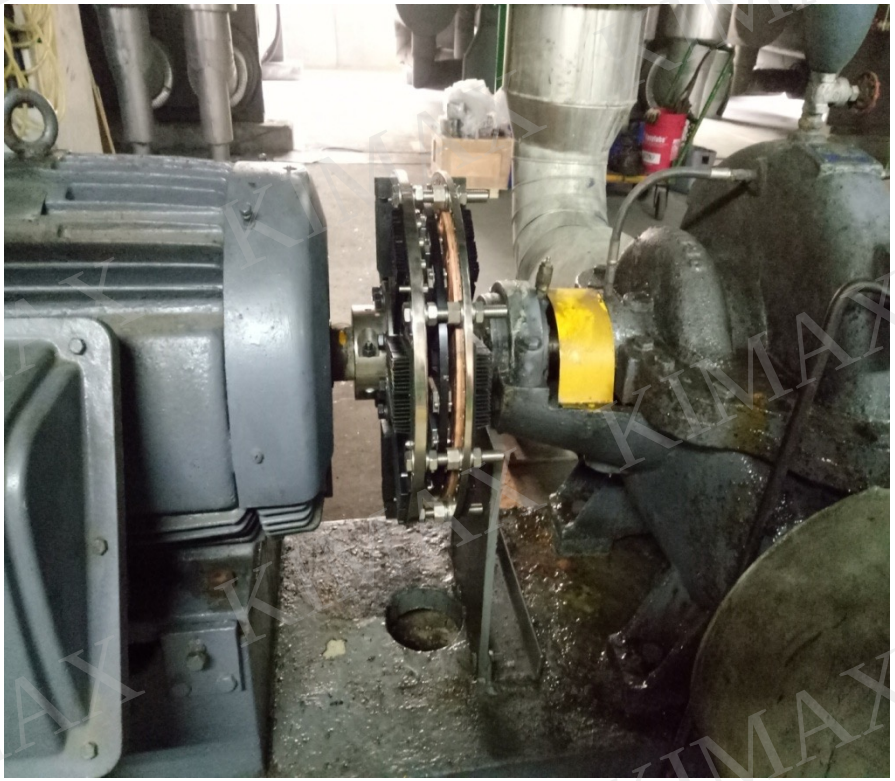
PMC on site

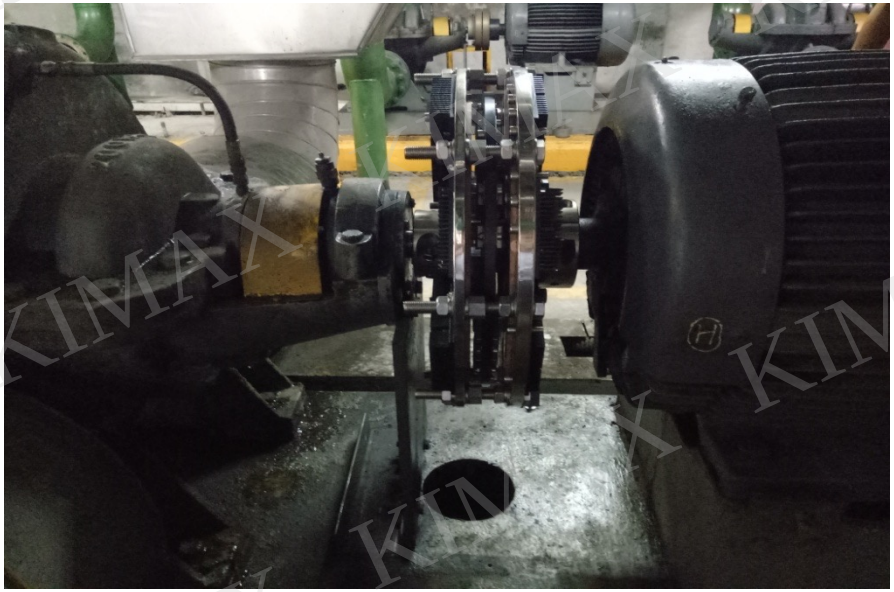
Practical Applications

Cooling Pump in Plastic Chemical Plant (Taiwan)

Two pumps for use and two for reserve

- Motor: 75kW x 380V x 4P
- Speed decreased by 13%
- Energy saving rate(14%)
- Power fee saved：USD 14,500/Year





Quoted case of Adani (Waiting for approval)

Case	Tower number	Estimated energy saving rate	Sales Progress
Adani Power Ltd. Mundra, Gujarat, India	1 Pump	16.67%	Order, Installed on site.
APL, Mundra- ACW 160kW/990rpm	1 Pump	12%	Waiting for the budget 2021, also for the approval from Adani team
APL, Rajasthan – CCCW Pump 600kW	2 Pumps	15%	Told by Adani that we will get the PO after budget allocation
APL, Tirora, Maharashtra – Water Pump – 75kW	1 Pump	20%	Submitted the offer but not much interest shown by APL, Maharashtra
APL, Raipur, Chhattisgarh, 240kW/11KV	1	14%	High noise 100dB, asked Adani to check if it is acceptable. Awaiting their reply
APL, Mundra, HP Pump – 1100kW/11kV	20 Set	100% Motor power consumption	Less pressure, Told Adani to do the pressure test to check if pressure can be increased further, but denied.

Quoted case of Adani (Waiting for approval)

Adani, Mundra- ACW

Basic Data:

Motor power	160kw	Annual usage hours	8,600 Hr
Motor speed	990 RPM	price	INR 3.5/kwh
Voltage	415V	IN/out Open%	100%
Rated current	267A	Actual current	188A
Rated flow		Actual flow	--
Rated pressure	1.76	Actual pressure	3.2bar
Demand pressure min	--	Demand flow	--

Quoted case of Adani (Waiting for approval)

Adani Power Limited-ACW

Energy saving calculation:

Pre-installation data		Reduce speed	Reduce speed	Reduce speed
		6.46%	8.59%	10.51%
Rotating speed (RPM)	990	925	905	886
Flow rate (m3/h)				
Pressure (bar)	3.2	2.79	2.67	2.56
Actual Power (Kw)	112.66	98.35	94.14	90.23
Loss of efficiency	5%	103.53	99.10	94.98
Energy saving rate		8.11%	12.04%	15.69%

Quoted case of Adani (Waiting for approval)

Adani power Rajasthan Ltd

Basic Data:

Motor power	600kw	Annual usage hours	8,760 Hr
Motor speed	990 RPM	price	INR 3/kwh
Voltage	6600V	IN/out Open%	100%
Rated current	66A	Actual current	59A
Rated flow	3360	Actual flow	
Rated pressure	7.7	Actual pressure	
Demand pressure	6.1	Demand flow	3000

Quoted case of Adani (Waiting for approval)

Adani power Rajasthan Ltd

Energy saving calculation:

Pre-installation data		Reduce speed	Reduce speed	Reduce speed
		6.46%	7.58%	10.10%
Rotating speed (RPM)	990	926	915	890
Flow rate (m3/h)	3360	3142.79	3105.45	3020.61
Pressure (bar)	7.7	6.74	6.58	6.22
Actual Power (Kw)	536.36	469.26	458.17	433.48
Loss of efficiency	5%	493.95	482.29	456.29
Energy saving rate		8%	10%	15%

Quoted case of Adani (Waiting for approval)

Adani Power Raipur Energen limited

Basic Data:

Motor power	240kw	Annual usage hours	8,400 Hr
Motor speed	960 RPM	price	INR 3/kwh
Voltage	3300V	IN/out Open%	100%
Rated current	55.5A	Actual current	45A
Rated flow	2048	Actual flow	1960
Rated pressure	-	Actual pressure	-
Demand pressure min	--	Demand flow	1650

Quoted case of Adani (Waiting for approval)

Adani Power Raipur Energen limited

Energy saving calculation:

Pre-installation data		Reduce speed	Reduce speed	Reduce speed
		7.50%	10.10%	15.83%
Rotating speed (RPM)	960	888	863	808
Flow rate (m3/h)	1960	1813	1761	1650
Pressure (bar)	-	-	-	-
Actual Power (Kw)	194.59	166.50	157.26	137.85
Loss of efficiency	5%	175.26	165.53	145.11
Energy saving rate		10%	15%	25.43%

Quoted case of Adani (Waiting for approval)

Adani Power Mundra Limited

Basic Data:

Motor power	1100kw	Annual usage hours	7,200 Hr.
Motor speed	2900 RPM	price	USD0.05/kwh
Voltage	11KV	IN/out Open%	--
Rated current	69A	Actual current	52A
Rated flow	698m³/ h	Actual flow	--
Rated pressure	--	Actual pressure	--
Demand pressure min	--	Demand flow	--

Quoted case of Adani (Waiting for approval)

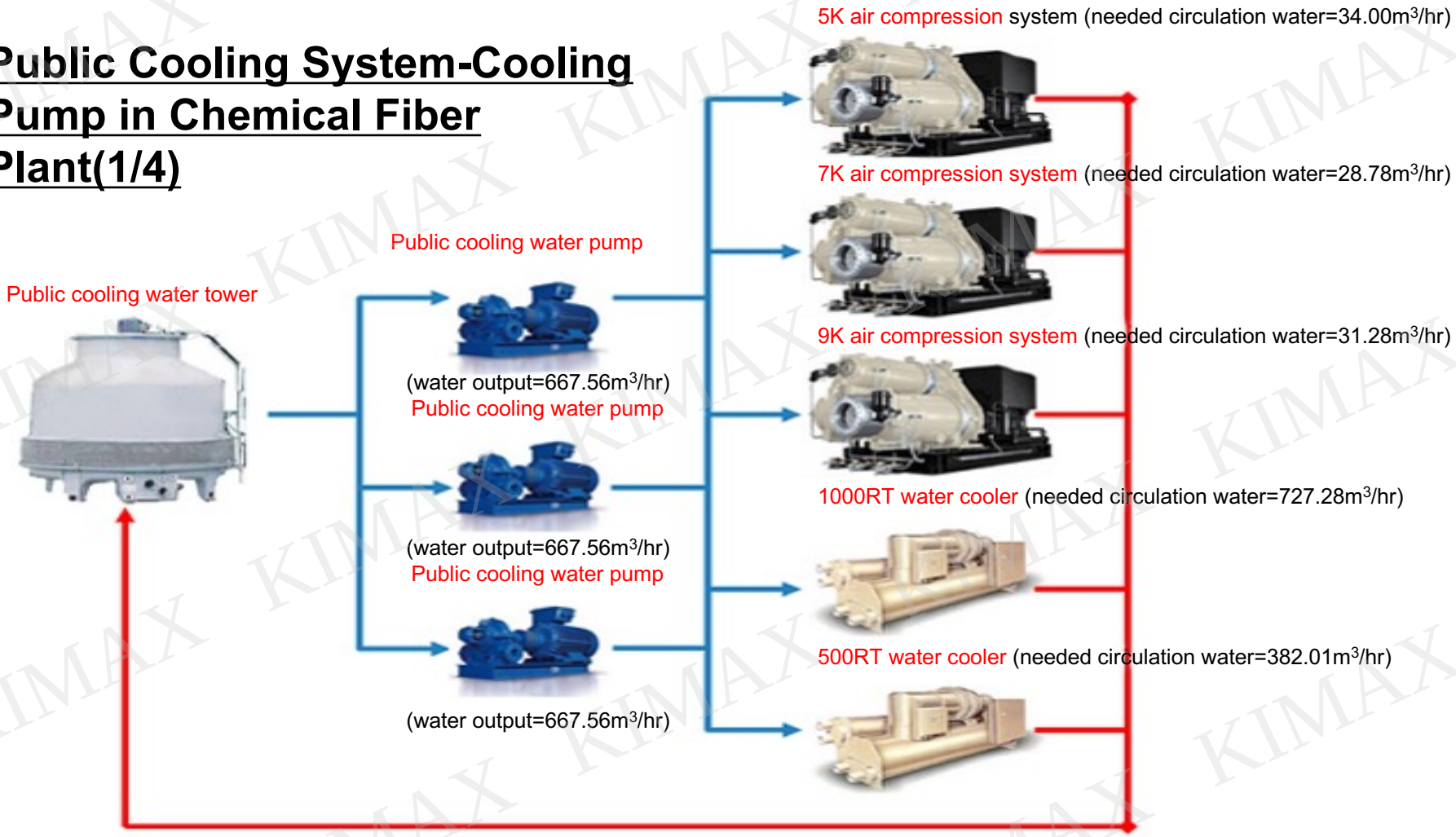
Adani Power Mundra Limited

Energy saving calculation:

Parameters	Pre- installation Data	Reduce speed 5%	Reduce speed 8.3%
Rotating Speed(RPM)	2900	2755	2659
Flow Rate(CFM)	698	663.1	640
Energy Saving Rate		**9.76%**	**15.92%**
Energy Saving Rate after considering Loss of Efficiency (10%)		**8.78%**	**14.32%**
Actual Operating Current(A)	52	47.43	44.56
Motor Power(KW)	832.2	759.13	713.05
Electricity Cost Savings per year(USD)		26304	**42804**

Practical Applications

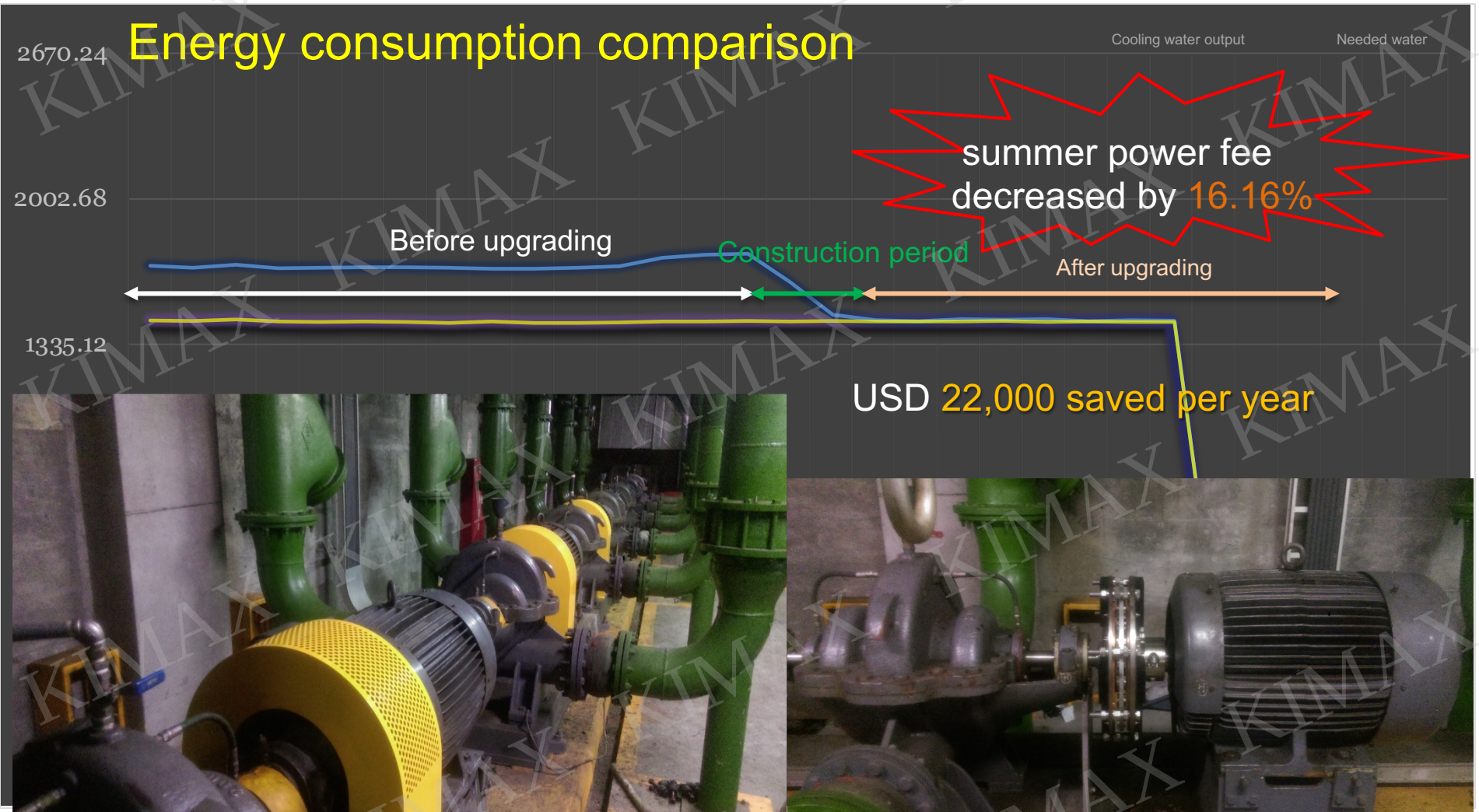
Public Cooling System-Cooling Pump in Chemical Fiber Plant(1/4)



Public Cooling System-Cooling Pump in Chemical Fiber Plant(2/4)

			Equipment condition before upgrading			Equipment condition after upgrading			System difference			Note
			Ordinary coupling			Permanent magnet coupling Air gap 6.2→7.2						After PMC is installed into existing public cooling water pump, then the original full load working condition is accounted as the air gap adjustment basis by considering loads in different seasons as well as process equipment running coefficient.
			Motor speed 1785RPM			Speed difference between motor and water pump(each speed shown as below)						
			Pump speed 1785RPM									
			Average inlet pressure 2.4 kg			Average inlet pressure 2.4kg						
			Average outlet pressure 4.46kg			Average outlet pressure 4.3kg						
Cooling water pump		Average inlet pressure	2.4kg			2.4kg			-	constant		Motor speed 1787.3RPM
		Average outlet pressure	4.59kg			4.42kg			↓	0.17kg		Pump speed 1608.2RPM
		current	117A			100.8A			↓	16.2kg		Speed difference 179.1
		vibration	V	H	A	V	H	A	V	H	A	Vibration of motor and pump have decreased obviously
		Motor	2.4	2.3	1.8	1.6	2.2	0.8	0.8	0.1	1.0	
		pump	2.4	2	2.5	1.2	1.7	0.9	1.2	0.3	1.6	
		Average inlet pressure	2.4kg			2.4kg			-	constant		Motor speed 1787.3RPM
		Average outlet pressure	4.4kg			4.2kg			↓	0.2kg		Pump speed 1608.2RPM
		current	112.4A			96.9A			↓	15.5kg		Speed difference 178.8
		vibration	V	H	A	V	H	A	V	H	A	Vibration of motor and pump has decreased obviously
		Motor	2.6	2	2	0.8	1.1	0.6	1.8	0.9	1.4	
		pump	2.6	2.2	2.1	0.9	1.5	0.7	1.7	0.7	1.4	
		Average inlet pressure	2.4kg			2.4kg			-	constant		Motor speed 1787.6RPM
		Average outlet pressure	4.4kg			4.2kg			↓	0.2kg		Pump speed 1589.4RPM
		current	114.2A			94.5A			↓	19.7kg		Speed difference 189.2
		vibration	V	H	A	V	H	A	V	H	A	Vibration of motor and pump has decreased obviously
		Motor	2.4	2	2.1	0.9	1.1	0.6	1.5	0.9	1.5	
		pump	2.5	2.2	2.9	1.2	2.2	0.9	1.3	0.0	2.0	

Public Cooling System-Cooling Pump in Chemical Fiber Plant(3/4)



Public Cooling System-Cooling Pump in Chemical Fiber Plant(4/4)

Equipment name		Cooling water pumps						Water chiller units				Air compressors					
SN		PC-01E		PC-01F		PC-01G		CR-03		CR0-4		AC-01A		AC-01B		AC-03B	
date		current	KWh	current	KWh	current	KWh	KWh	%	KWh	%	current	KWh	current	KWh	current	KWh
Jul 1	Before upgrading	117.8	69.7	112.6	66.8	114.3	67.7	625.0	92.3	640.0	93.1	72.3	10.7	69.6	10.1	79.2	8.5
Jul 2		116.9	69.2	112.1	66.4	114.0	67.5	632.0	92.2	631.0	93.0	72.3	10.3	69.4	9.6	78.9	8.3
Jul 3		117.8	69.7	112.7	66.7	115.1	68.1	656.0	92.7	665.0	93.3	72.8	10.5	74.3	10.1	79.3	8.3
Jul 4		116.8	69.2	111.9	66.2	113.8	67.4	641.0	91.9	654.0	92.8	72.0	10.6	68.9	9.7	78.8	8.4
Jul 5		116.7	69.1	111.8	66.2	114.4	67.7	620.0	91.6	624.0	92.7	72.1	10.1	65.0	9.3	78.3	8.1
Jul 6		117.2	69.4	112.2	66.4	114.1	67.6	635.0	91.8	635.0	92.8	71.6	10.6	71.9	10.1	78.1	8.5
Jul 7		116.9	69.2	111.9	66.2	114.4	67.7	634.0	91.8	645.0	92.7	71.5	10.6	69.2	10.1	78.4	8.4
Jul 8		116.8	69.2	111.8	66.2	114.4	67.7	605.0	91.4	629.0	92.5	69.7	10.1	69.7	9.3	79.5	7.8
Jul 9		116.5	69.0	111.5	66.0	114.1	67.6	618.0	91.8	565.0	92.8	66.5	9.8	63.4	9.1	70.3	7.5
Jul 10		116.3	68.9	111.7	66.1	114.0	67.5	547.0	91.2	565.0	92.5	68.1	10.0	66.2	9.6	77.0	8.3
Jul 11		116.7	69.1	112.1	66.4	114.4	67.7	573.0	91.3	580.0	92.4	68.4	10.2	67.2	9.6	77.8	8.4
Jul 12		117.0	69.3	113.9	67.4	113.6	67.3	587.0	91.4	622.0	92.7	69.2	10.1	68.2	9.6	77.8	8.2
Construction period	average.current	117.0	69.2	112.2	66.4	114.2	67.6	614.4	91.8	621.3	92.8	70.5	10.3	68.6	9.7	77.8	8.2
	Load difference	±9.62KWh		±9.34kwh		±10.29Kwh		±24.75Kwh		±50.58KWh		±10.17kwh		±0.16kwh		±0.20kwh	
	Average current	100.8	59.6	96.9	57.1		57.3	589.7	92.1	570.7	92.4	68.9	10.1	67.7	9.5	75.7	8.0
Jul 19	After upgrading	100.5	60.1	96.3	57.5		57.9	605.0	92.3	583.0	92.5	69.9	10.5	68.3	9.7	70.6	7.5
Jul 20		101.2	58.4	97.3	56.0		56.0	611.0	92.3	587.0	92.5	70.1	10.8	63.4	9.2	78.1	8.3
Jul 21		100.9	59.5	97.4	57.2		57.2	601.0	92.4	583.0	92.6	70.3	10.6	64.8	9.2	74.3	7.8
Jul 22		100.7	59.5	97.7	57.2		57.2	589.0	92.1	569.8	92.4	69.9	10.6	65.5	9.2	74.2	7.8
Jul 23		100.5	60.4	96.5	57.8		58.2	600.0	92.2	577.2	92.4	70.0	10.3	69.3	9.1	78.2	7.7
Jul 24		100.8	60.9	96.7	58.3		58.5	571.0	92.0	549.0	92.3	69.8	10.8	70.2	9.9	76.6	9.0
Jul 25		100.5	59.8	96.6	57.2		57.6	580.0	92.1	571.0	92.4	69.4	10.7	69.8	10.1	76.1	8.1
Jul 26		100.6	58.7	96.6	56.1		56.5	571.0	91.9	560.0	92.3	67.8	10.7	70.1	9.8	75.8	8.0
Jul 27		100.6	59.2	96.6	56.6		57.0	579.0	92.0	556.0	92.2	62.5				77.7	
Jul 28																	
Jul 29																	
Jul 30																	
Jul 31																	

USD 22,000 saved per year

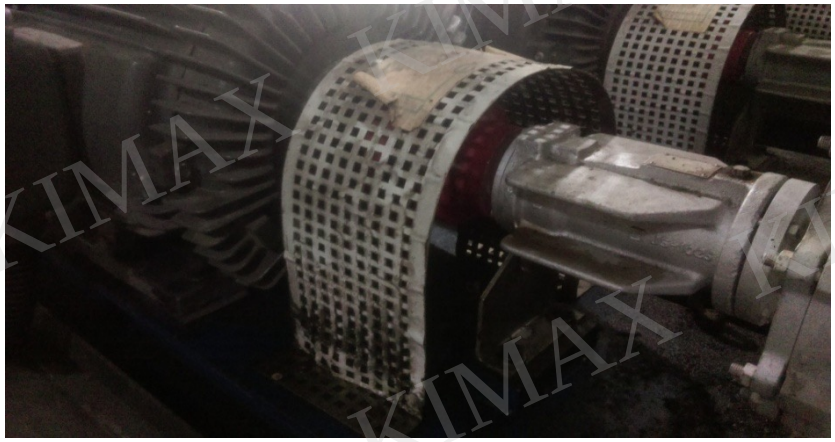
Practical Applications

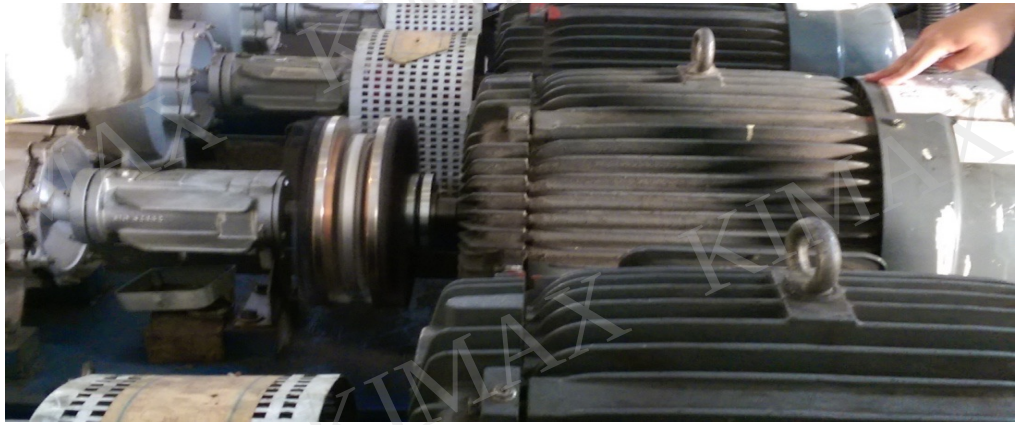
	Min.	Max.	Ave.
Energy saving rate	11.5%	15.6%	13.6%
Vibration decrease rate	12.2%	71.6%	42%

Energy-saving Type PMC-F Used in Chemical Plant

Original thermal coal pump equipment needs to have three vibration overhaul per year to avoid work safety accidents caused by oil leakage. After being upgraded by permanent magnet coupling, it can reduce vibration, lower centering error, lower maintenance cost and elongate service life on top of energy saving.

Rated speed(RPM)	Speed after upgrading(RPM)	Speed decrease(%)	Electricity saved per year
3560	3180	10.7%	48209
Rated flowm3/h)	New air flow (m3/h)	Energy saved(A)	Electricity price(USD/kW-Hr)
260		10.9	0.08
Rated pressure (m)	Pressure difference of thermal coal boiler(kg)	Energy saving rate(%)	Electricity fee saved per year USD
60	2.2	13.6%	4,150
Original current(A)	New current(A)	Running hours per year(hr)	CO2 Emission reduction per year (ton)
80.4	69.5	8400	30757



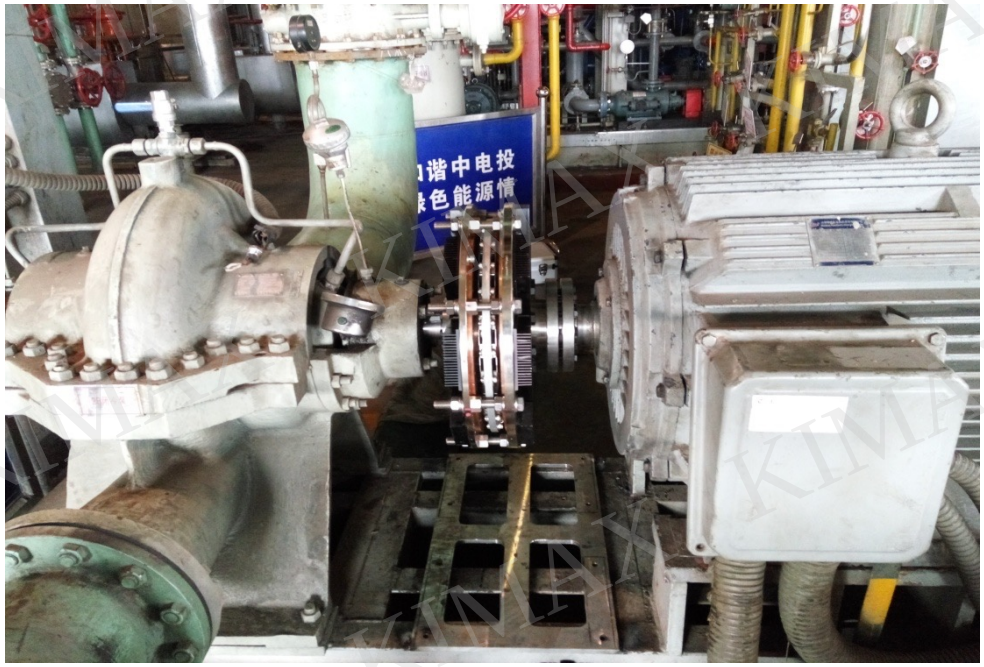


Practical Applications

Closed Cooling Water Pump in Thermal Power Plant(SPIC)

- Motor132kw x0.38KV x4P
- Energy saving rate:(25%)
- Electricity fee saved : USD 16,600 /year

	Current(A)	Speed(RPM)	Running hours per year(hr)	Total electricity used (10,000KWh)
Before upgrading	180	1480	8200	77.7
After upgrading	134	1333	8200	57.8



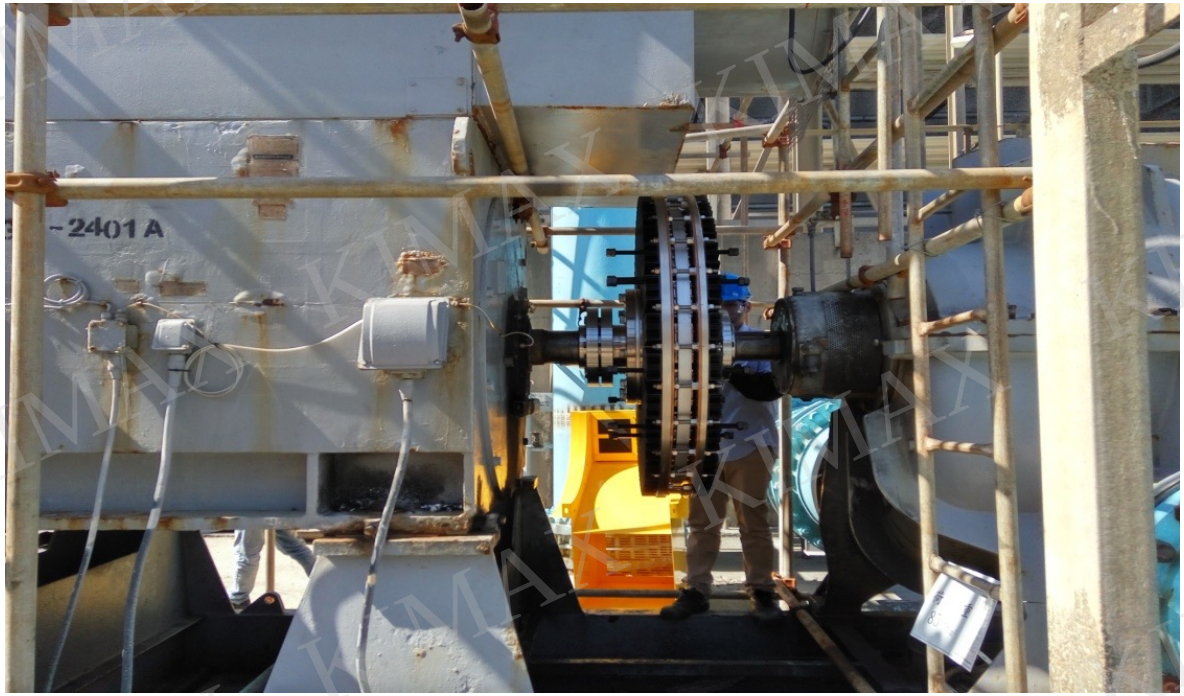
Practical Applications

Cooling Water Pump in Petrochemical Plant

- Motor: 1300kw x3.3KV
- Energy saving rate:(10%)
- Yearly electricity fee saved:

  USD 78,000/year

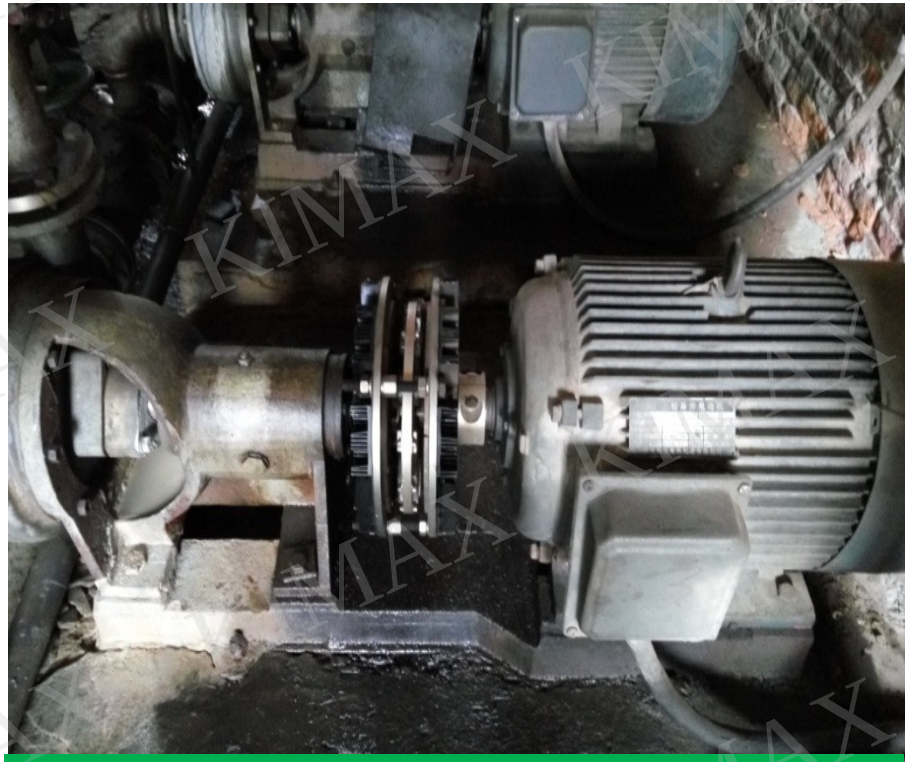
	current(A)	speed(RPM)	Running hours per year(hr)	Total electricity used (10,000KWh)
Before upgrading	246.7	710	8200	925
After upgrading	222	675	8200	832



Practical Applications

• Chemical fertilizer plant

•Motor 90kW x 380V x 4P
•Energy saving rate(40%)　Yearly electricity fee saved：USD 20160/year



• Chemical fertilizer plant

•Motor 90kW x 380V x 4P
•Energy saving rate(40%)　Yearly electricity fee saved：USD 20160/year

Practical Applications

- Paper plant

•Motor 110kW x 380V x 6P
•Energy saving rate(10%)　Yearly electricity fee saved：USD 5800/year

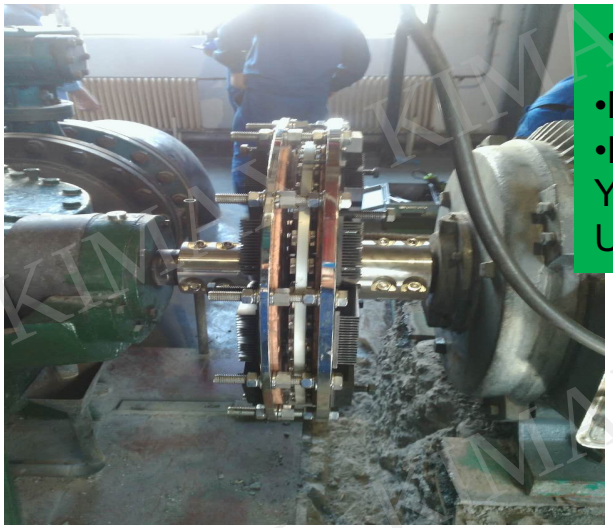
- Chemical plant

•Motor 75kW x 380V x 4P
•Energy saving rate(15%)　Yearly electricity fee saved：USD 6000/year

Practical Applications

• Power plant

•Motor 111kW x 380V x 6P
•Energy saving rate(18%)　Yearly electricity fee saved：USD 10600/year



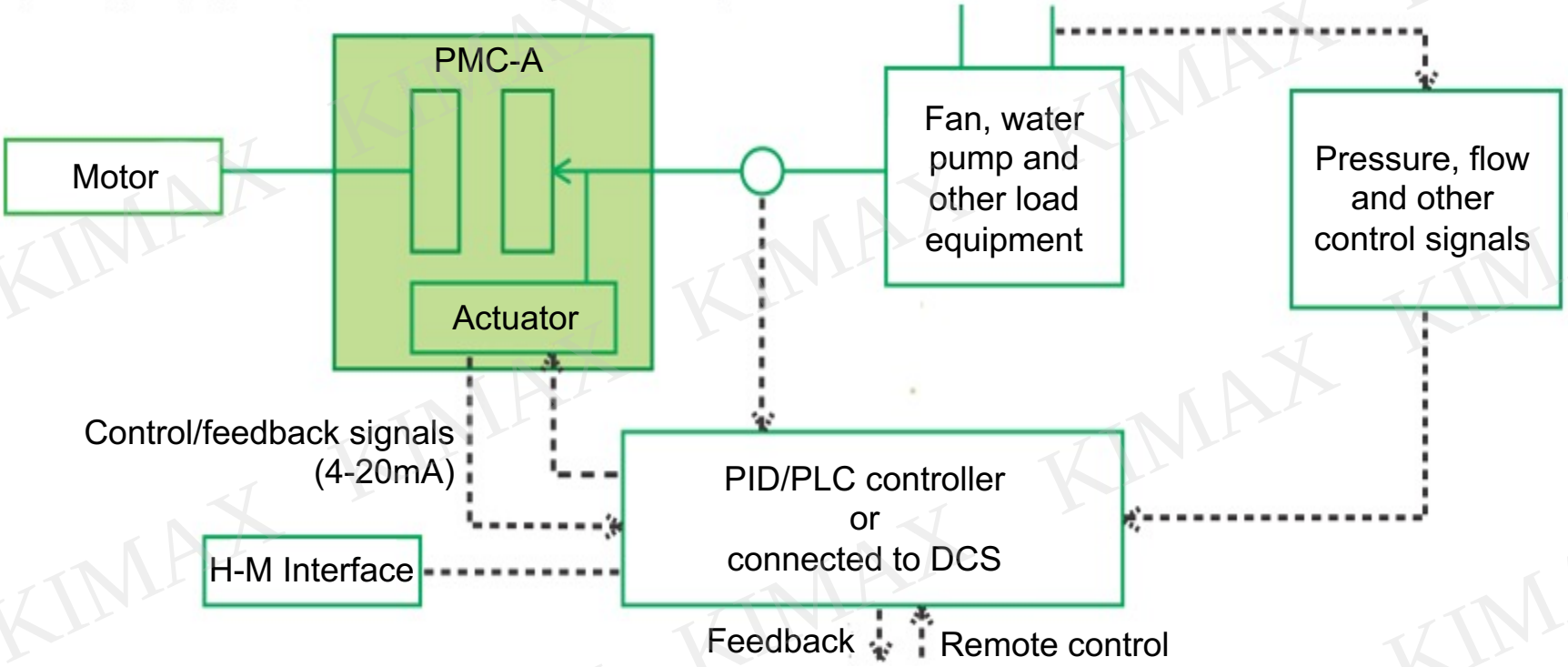
• Power plant

•Motor 132kW x 380V x 4P
•Energy saving rate(22%)
Yearly electricity fee saved：USD 15300/year

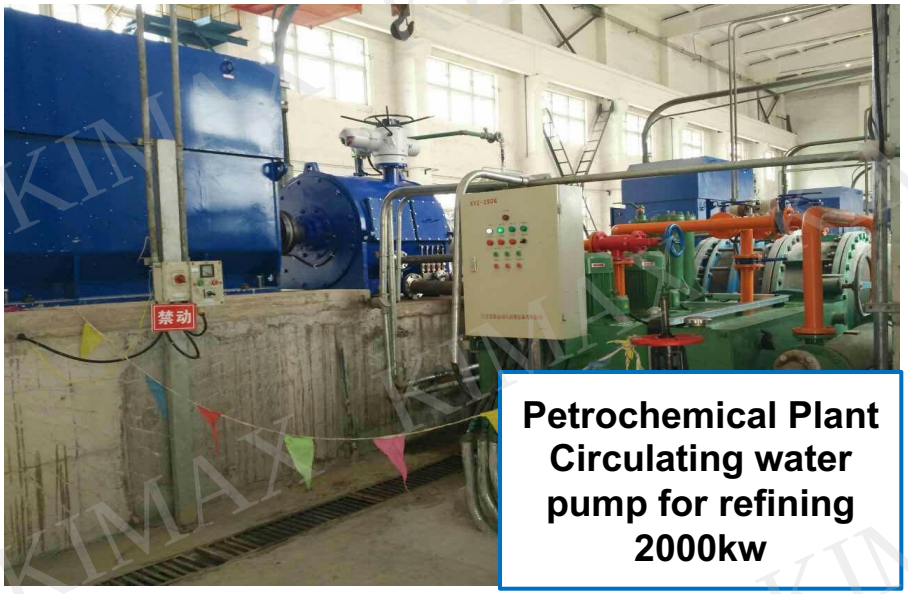
• Power plant

•Motor 132kW x 380V x 2P
•Energy saving rate(15%)　Yearly electricity fee saved：USD 10560/year

Product Application-PMC-A

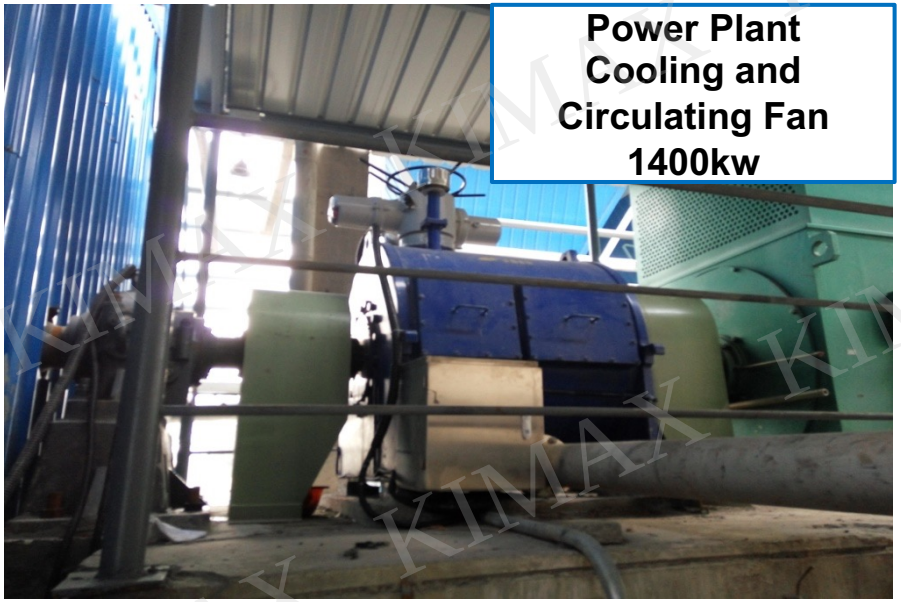


Practical Applications(Liquid cooling of PMC-A)



Petrochemical Plant
Circulating water pump for refining
2000kw

Power Plant
Condensation pump
2000kw



Power Plant
Cooling and
Circulating Fan
1400kw

Petrochemical Plant
Cooling and
Circulating Fan
800kw

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