

[TurboMax Blower - The New Standard of Turbo blower]

# TURBOMAX BLOWER INTRODUCTION

## 氣浮式鼓風機技術



今日水處理設備有限公司  
報告人：陳勝隆0933-185503

2020V1

# TurboMax 公司

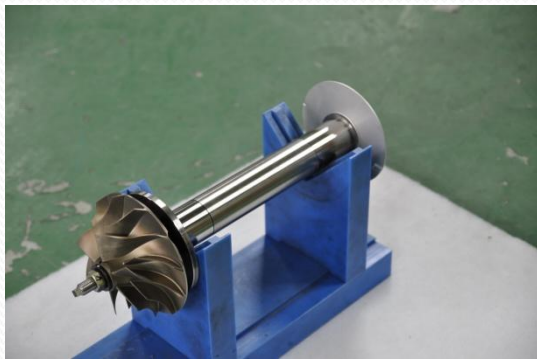
- 總部位於南韓中部的大田市附近
- 是一家擁有世界上先進的航空機械技術及開發能力的製造商
- TurboMax利用航空渦輪技術研發出世界頂尖的氣浮式高速離心式鼓風機
- 成功行銷世界各國
- 已銷售超過五千台(至2019年底)



# 產品之主要元件

採用

- 永磁高速同步馬達
  - 氣浮式軸承
  - 鋁合金葉輪
  - 智慧型變頻器
  - 觸控顯示螢幕
- …等多項核心技術生產高速渦輪鼓風機





# 核心技術及節電技術

- 採用氣浮式軸承(Air Bearing)，沒有摩擦，無振動，不需使用潤滑油脂
- 採用高效高速永磁同步馬達(Permanent Magnet Synchronous Motor)，氣浮式軸承與葉輪採直接連結(機械損失最低)
- 以變頻器控制轉速、風量、風壓、電功率等，達最適化輸出控制
- 採用高效葉輪(impeller)



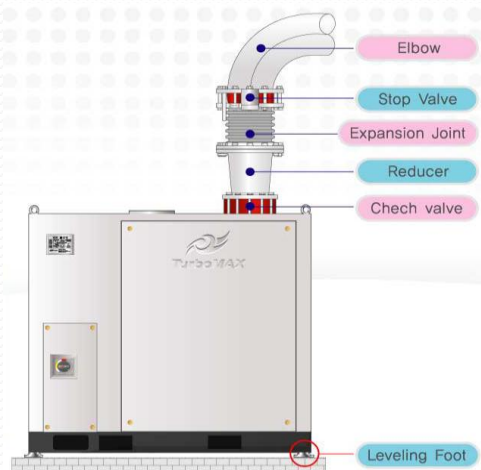
# 產品特色

- 節能省電：與傳統魯式鼓風機比較約可省電20%-40%
- 友善環境：無振動、噪音低(約65 ~ 82 分貝)、使用壽命長(超過二十年)
- 不需使用潤滑油(脂)潤滑
- 使用變頻控制及人機介面操作，具有多種自動操控模式及自我診斷功能
- 保養維護費用只有傳統鼓風機的10%左右(只需定期更換空氣吸入過濾網)



# 其他優點

- 出風溫度較低(約比傳統鼓風機低15~17℃，@ 0.5bar)，有利於曝氣池微生物生長
- 安裝時不需特別施做基礎台工程
- 體積較小，安裝所需空間小
- 與採購傳統鼓風機的價差回收年限：(另參計算檔案)



# 服務

- 可安排客戶派員至韓國原廠廠測
- 原廠可派員到廠指導安裝、試車
- 本公司派員到原廠受訓(維修)
- 原廠支援售後服務、維修





## TurboMAX氣浮式鼓風機實績(台灣)

表格更新日期: 2019.12.26.

項次	客戶名稱	安裝時間或狀態	型號	數量(台)	附註
1	強盛染整大園廠	2014.02	MAX100-C150	1	既有曝氣設備改善
2	正隆紙業后里廠	2014.05	MAX300-C080	6	新設曝氣設備
3	強盛染整大園廠	2015.06	MAX100-C200	1	既有曝氣設備改善
4	正隆紙業竹北廠	2015.10	MAX100-C060	2	新設曝氣設備
5	三鶯水資源回收中心	2017.06	MAX150-C070	4	新設曝氣設備
6	大恭化學大園廠	2017.09	MAX100-C100	1	既有曝氣設備改善
7	統一超食代土城廠	2017.09	RX30-C060	1	既有曝氣設備改善
8	耀華電子宜蘭廠	2018.04	RX40-C060	3	新設以及既有曝氣設備改善
9	耀華電子土城二廠	2018.07	RX50-C060	1	既有曝氣設備改善
10	中興紡織楊梅廠	2018.10	RX50-C060	1	既有曝氣設備改善
11	正隆紙業后里廠	2018.10	MAX300-C080	1	既有曝氣設備改善(備機安裝中)
12	大恭化學大園廠	2018.11	MAX100-C100	1	既有曝氣設備改善
13	中興紡織楊梅廠	2019.06	RX75-C060	1	既有曝氣設備改善
14	新光合纖中壢廠	2019.07	MAX50-C060	2	既有曝氣設備改善
15	長庚醫院土城分院	2019.08	RX10-C060	2	新設曝氣設備
16	長庚醫院土城分院	2019.08	RX20-C060	2	新設曝氣設備
17	南亞科3A廠	2019.08	MAX150-C150	1	既有曝氣設備改善
18	耀華電子土城一廠	交貨中	RX20-C060	1	新設曝氣設備
19	永光化學一廠	2019.12	MAX150-C060	2	既有曝氣設備改善
20	美光電子二廠	2019.12	MAX100-C060	3	既有曝氣設備改善
21	新力美科技(股)公司	2019.12	RX30-C060	1	既有曝氣設備改善
22	台塑石化仁武廠	交貨中	MAX100-C060	1	既有曝氣設備改善
23	苗栗礮間曝氣	交貨中	RX40-C060	3	新設曝氣設備
總數量(台)				42	





## Chapter 1

# Company Information

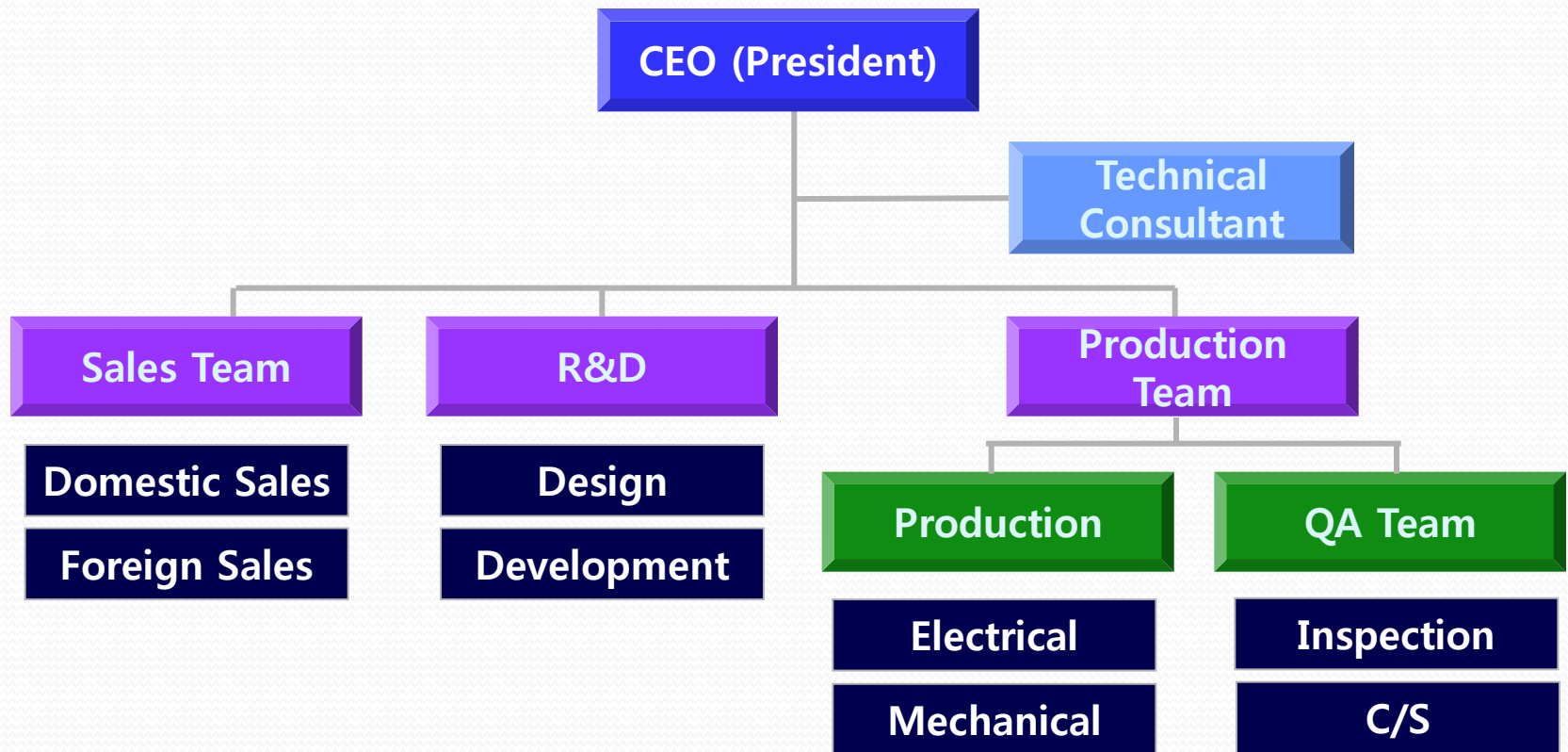
1. Company Status and Structure
2. Company History
3. CEO Introduction
4. Intellectual Property Rights and Status of Certifications
5. Administrative Performance

# Company Overview

<b>Name</b>	TurboMax Co., Ltd.
<b>Foundation</b>	Dec. 9 <sup>th</sup> , 2006
<b>President</b>	Ki-ho Lee
<b>Address</b>	394, Jugam-ri, Hyeondo-myeon, cheongwon-gun, Chungbuk, Republic of Korea
<b>Contact</b>	Tel. 043)275-6002~3 Fax. 043)275-6004
<b>Home page</b>	<a href="http://www.turbomax.co.kr">www.turbomax.co.kr</a>
<b>Product</b>	Air bearing Turbo Blower, Gas Turbine & Turbo Machine
<b>Employees</b>	30



# Company Organization



# Company History

2011

Developing the 500HP Turbo Blower  
UL Certification

2009

Completed development of the 400HP Turbo Blower  
CE Certification (TUV NORD)  
Relocated factory to Chungwon-Gun Choongchungbuk-Do

2008

Performed "SMART-UAV" assignment for Aerospace Research Institute  
Participated in Shanghai Intl' Water, Wastewater & Recycling Technology Expo  
Begun Export (2 MAX150 Model: China)  
Certified as a Venture Enterprise (KIBO)

2007

Registered Trademark "TurboMax"  
Developed 30~200HP Turbo Blower  
Converted to a Corporate body  
TurboMax Co., Ltd.

2006

ISO 9001/2001 Certification  
Founded TurboMax





## VISION

**Providing Low Carbon/ High Efficiency/  
Environmentally Friendly Clean Energy**

### **Factors**

Increased Energy  
Cost, Low Carbon  
Energy Policy

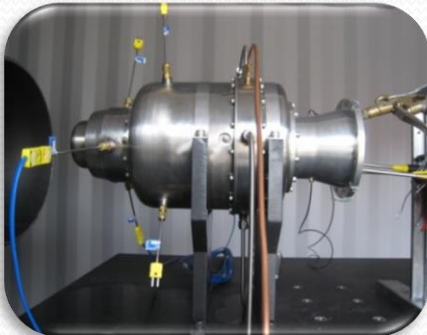
### **Needs**

Energy Reduction,  
Environmentally  
Friendly Product

### **Mission**

To provide high  
efficiency,  
Environmentally  
friendly Turbo  
Machines

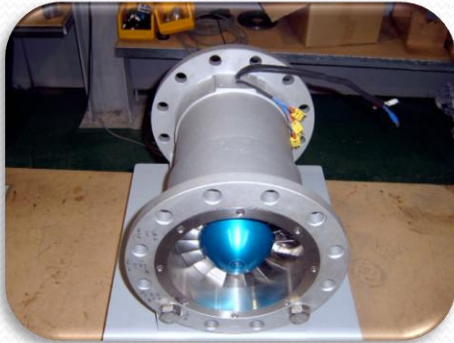
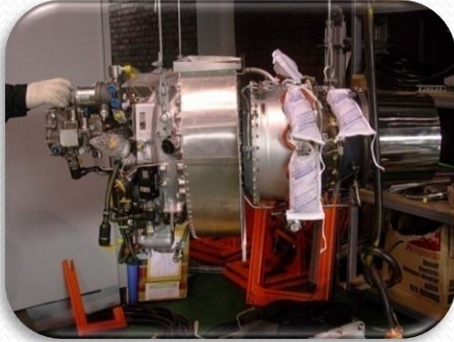
# CEO' s work experience in R&D Area



## [Mechanical Design for Gas Turbines/ Turbo machines – 15 years]

- Designed detailed engine parts in the Samsung Techwin Engine Research Institute / 6.5 years
- Designed detailed fixed/ exhaust component for 1.2MW industrial engine compressors
- Modified & developed turbo jet engine for unmanned vehicle, Engine exterior and mount, Hydraulic system for Engine interior installation and related components
- Performed business assignment for Government nominated institute (Ministry of Science and Technology): Developed, Produced prototype, assembled Wide chord fan stage test Rig
- Developed reverse Brayton extremely low temperature freezer superconductivity system. (Ministry of Science and Technology 21C frontier)
- Developed and delivered the turbine generating system for unmanned airships. (KARI): Design system Hardware, Purchased engine and components and performed Assembly and Testing.
- Developed and delivered aviation engine operating room (Sacheon KAPC)
- Tested STX turbocharger performance (Changwon ENPACO)
- Developed Turbo Blower: Designed Hardware for ~400HP Turbo Blower

# Major performed assignments



## ○ Major developed assignments

- Developed low pressure turbo blower (under 1kgf/cm<sup>2</sup>) : 30~300hp, Jan. 2007 ~ present
- 120krpm/15kw class super high speed motor development assignment: KEMCO participating enterprise Oct. 2007 ~ present (3 years)
- Developed high pressure Turbo Blower (over 1kgf/cm<sup>2</sup>): Jun. 2008 ~

## ○ Other assignments

- Designed and produced Smart –UAV engine accessories: Korea Aerospace Research Institute
- Designed and produced ORC Turbine generator: OO turbo machine Inc., KIER
- Designed and produced 110kw class gas turbine generator: OO turbo machine Inc., KEPRI
- Designed and produced 300hp high pressure turbo compressor: KAES (Currently processing)
- Designed and produced Air Cycle Machine: OO turbo machine Inc., ADD (Currently processing)

# Intellectual Property Rights and Status of Certifications

## [Intellectual Property Rights]

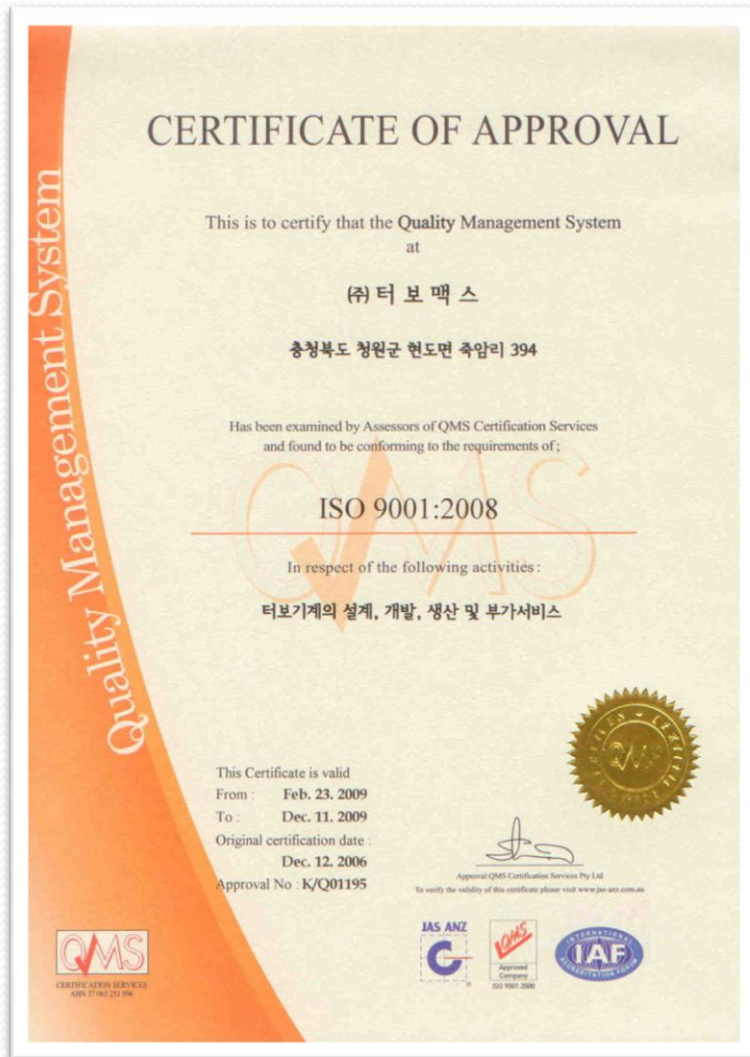
Type of industrial property	Design name	Registration (Application) Number	Registration (Applied) Date	Right Holder
Registered Trademark	TurboMax	40-0719100	07. 30. 2007.	Ki ho, Lee
Patent	Turbo Machine	10-0675821	01. 23. 2007	Ki ho, Lee
Patent	Blower	10-0781298	11. 26. 2007	TurboMax Co., Ltd
Patent	Turbo Machine	10-0870887	11.21. 2008	TurboMax Co., Ltd

## [Certifications Obtained]

Certification Article	Certification Number	Certificate Authority	Date Approved
ISO9001:2008	K/Q01195	QMS	12.12. 2006
Venture Enterprise	20090104125	KIBO	05.11. 2008
CE	K1747/E09	TUV	08.06. 2009
UL	10CA47301	UL	02.08.2011



# Intellectual Property Rights and Status of Certifications



# Intellectual Property Rights and Status of Certifications



# 'CE' Certifications - EMC & Machinery

**TUV NORD**

**Certificate  
of conformity with the following  
European Directives**

Registered No.:  
**K1747/E09**

**Electromagnetic Compatibility Directive 2004/108/EC**

Reference of applicant	Date of application	File reference	Test report No.	Date of issue	Expiry date
-	08.06.2009	KP-09-234	K2981/E09	30.06.2009	29.06.2014

This is to certify that the following products comply to the essential requirements (Annex 1) of the above mentioned European Directive and the following standards, taking into account the German national deviations:


**Product:** Turbo Blowers

**Type designation:** MAX y (y = 30, 50, 75, 100, 150, 200, 300)

**Applicant:** TurboMAX. Co., Ltd.  
394 Jugam-ri, Hyeondo-myeon, Cheongwon-gun,  
Chungbuk 363-823, Korea

**Standard(s):** EN 61800-3:2004

This Certificate of conformity is based on the evaluation of samples of the product. It does not imply an assessment of the production and it does not permit the use of a mark of conformity or of a safety mark of the TÜV NORD CERT. The holder of this certificate may use this Certificate together with his EC-Declaration of Conformity.

  
Certification Body for Product Safety

TUV NORD Korea Ltd.  
Tel. +82-2-6000-4222  
Fax +82-2-6000-4223  
E-mail: product@tuvnord.or.kr

**TUV NORD**

**Certificate  
of conformity with the following  
European Directives**

Registered No.:  
**K1480/M09**

**Machinery Directive 98/37/EC**

Reference of applicant	Date of application	File reference	Test report No.	Date of issue	Expiry Date
-	15.01.2009	KP-09-014	K2625/M09	11.02.2009	29.12.2009

This is to certify that the following products comply to the essential requirements (Annex 1) of the above mentioned European Directive and the following standards, taking into account the German national deviations:

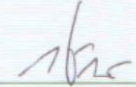
**Product:** Turbo Blowers

**Type designation:** MAX y (y = 30, 50, 75, 100, 150, 200, 300)

**Applicant:** TurboMAX. Co., Ltd.  
394 Jugam-ri, Hyeondo-myeon, Cheongwon-gun,  
Chungbuk 363-823, Korea

**Standard(s):** prEN 14461:2002  
EN ISO 12100-2:2003  
EN 60204-1:2006

This Certificate of conformity is based on the evaluation of samples of the product. It does not imply an assessment of the production and it does not permit the use of a mark of conformity or of a safety mark of the TÜV NORD CERT. The holder of this certificate may use this Certificate together with his EC-Declaration of Conformity.

  
Certification Body for Product Safety

TUV NORD Korea Ltd.  
Tel. +82-2-6000-4222  
Fax +82-2-6000-4223  
E-mail: product@tuvnord.or.kr





## Chapter 2

# Turbo Blower **MAX** Series

1. Introduction
2. Turbo Blower Features
3. Applied core technology
4. Specifications





# Product Summary

**High Efficiency,  
Reliability,  
Durability**

Step1



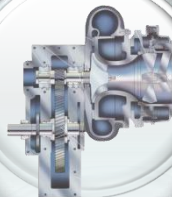
P. D

Step2



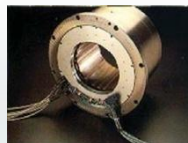
Multi-Stage

Step3



Multi-gear  
Turbo Blower

Step4



Magnetic Bearing  
Turbo Blower

Step5



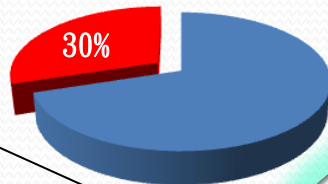
Air Bearing  
Turbo Blower

The Turbo Blower is a device generating compressed air using an applied air bearing, impeller, high speed motor, inverter and controller connected to a robust centrifugal turbine located directly on a permanent magnet **Synchronous** motor driven by the inverter.

# Feature of Turbo Blower

## Energy reduced 20~40% compared to existing products

- Applied Air Bearing
- Applied high efficiency motor and inverter
- Direct connection : Minimizes mechanical loss



## Excellent Design

- High efficiency Impeller
- Applied High Speed Motor
- Air Bearing
- Inverter



## Easy Installation

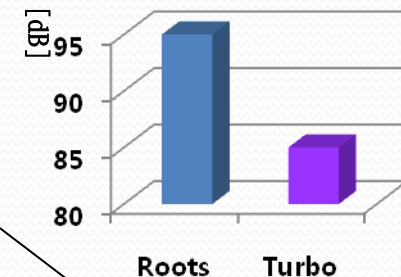
- No need for foundation construction
- Compact size
- Easy Leveling operation



**TurboMAX**  
**Turbo Blower**

## No oil, No vibration, Low noise

- Low noise (under 80dB)
- Oil Free lubricating system
- Environment friendly/ Provides a clean operating environment



# Product Structures

## Mechanical



BOV  
(Blow-off Valve)



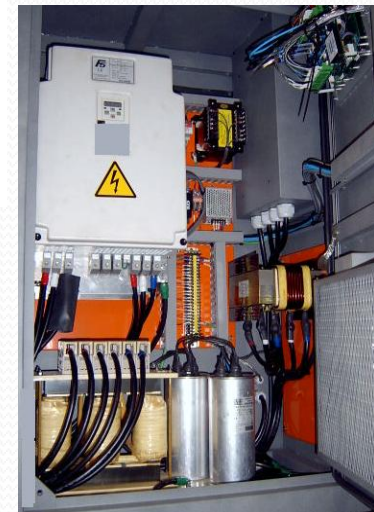
Main Body



## Control



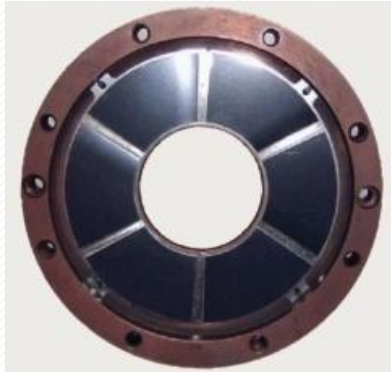
Controller



Electrical panel



# Applied Core Technology



[Air  
Bearing]



[Impeller]



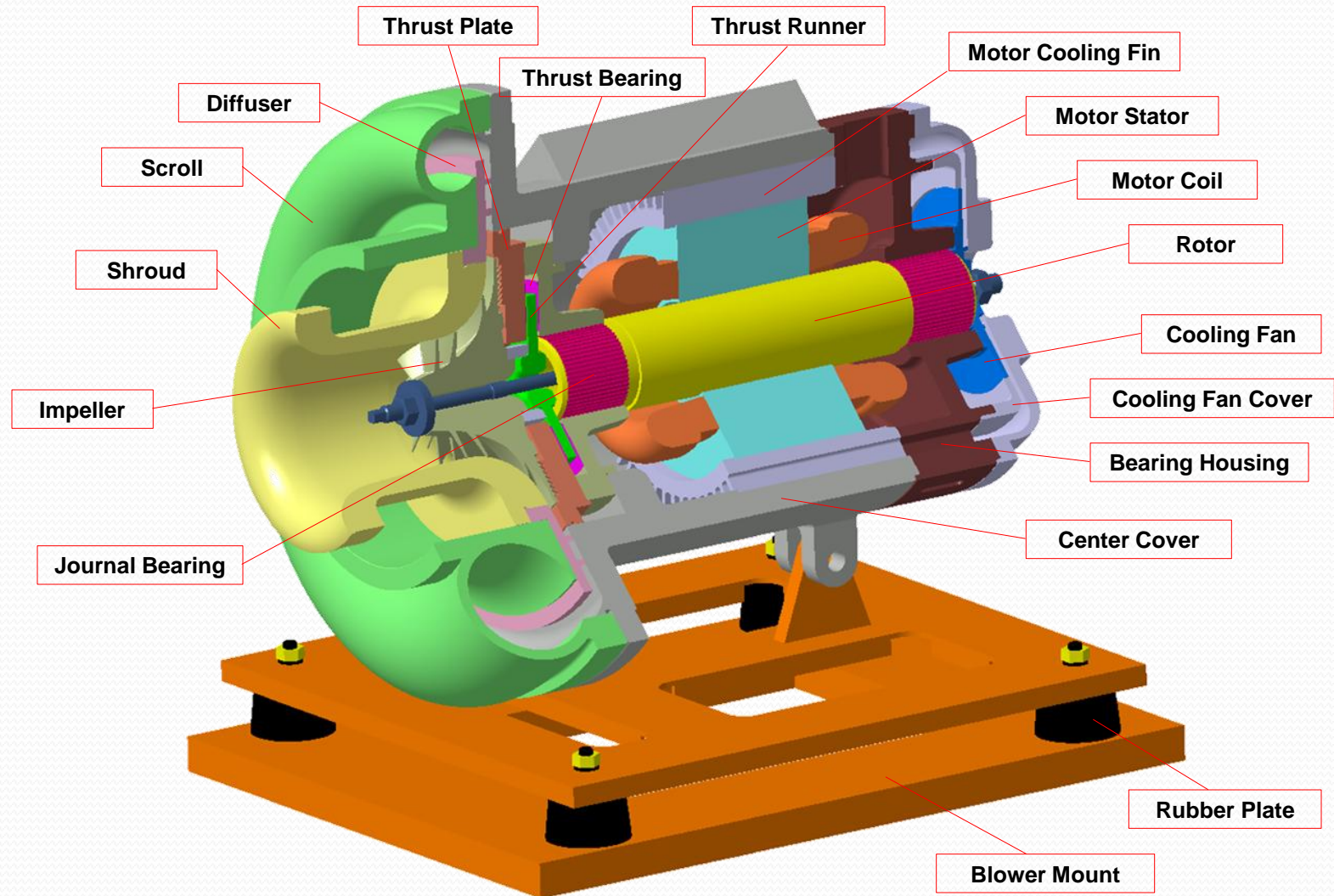
[Controller]



[High Speed Motor]

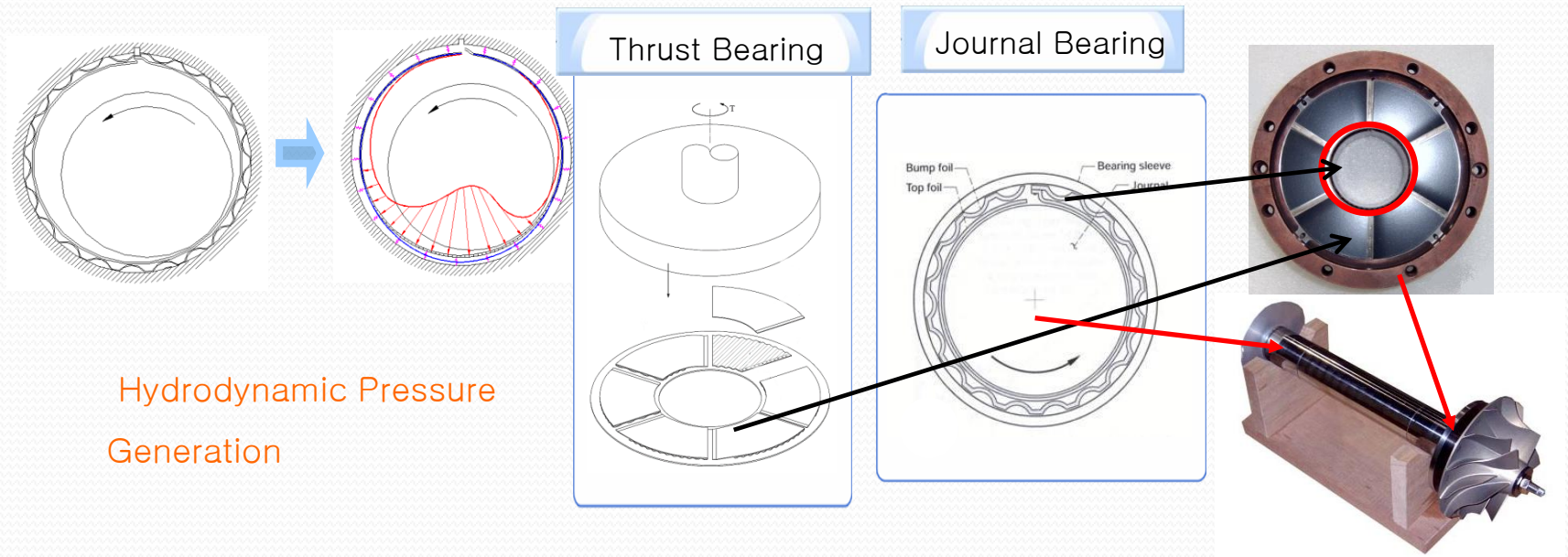


# Machine Structure(Anatomy)

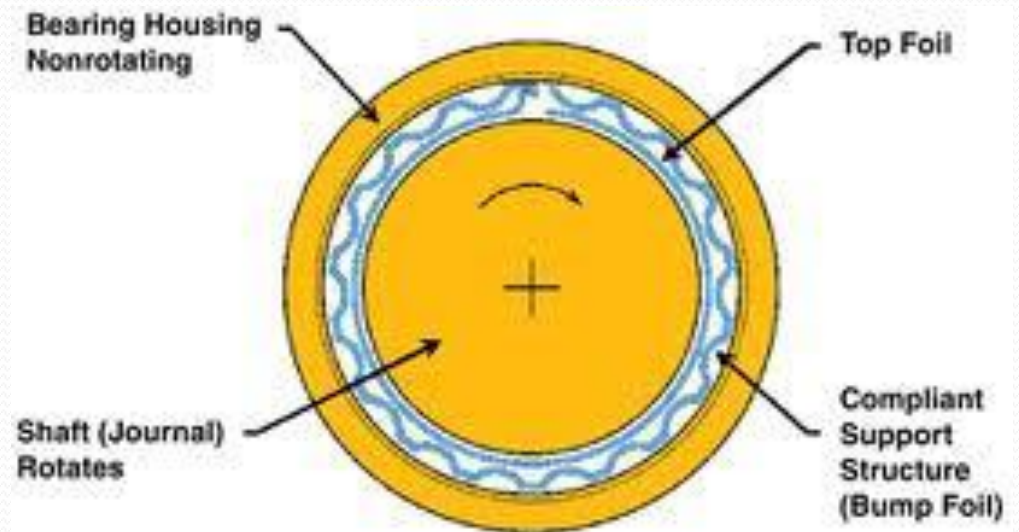
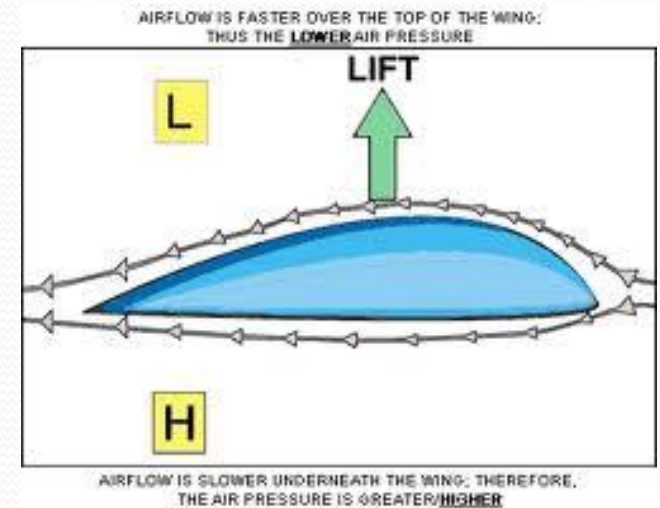
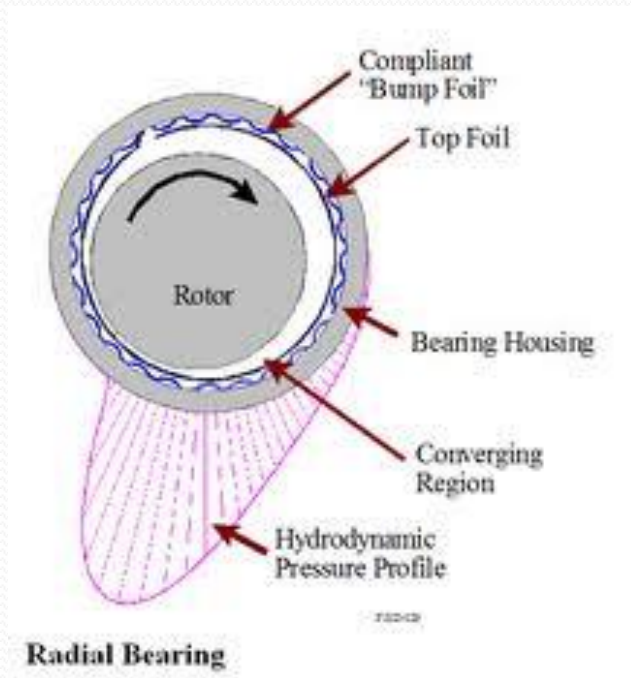


# Core Technology (Air Bearing)

- An air curtain generated by the rotor's revolution serves as a non-contact bearing extending the life of the shaft.
- A non-contact oil free device with no need of additions such as a lubricant supply, rendering the structure simple.
- **Verified credibility: ECS/ACM application for aviation engines.**
- Life span of approximately **50 years** (semi-permanent), Completed a **20,000** iteration On/Off test.



# Air foil bearing



## Core Technology (Impeller)

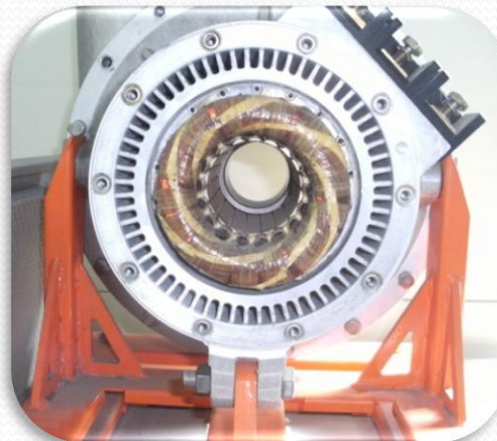
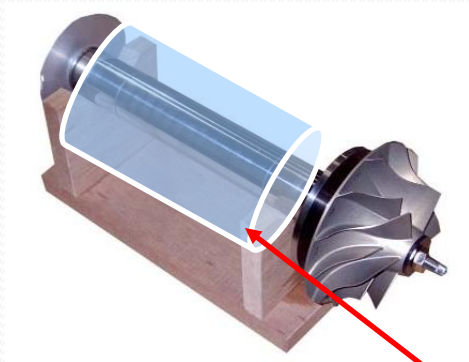
- Produced by machining
- Can be used as a high efficiency compressor, as tolerance remains under  $1/1000$  mm no matter what the size.
- Surface is clean and smooth. High efficiency can be achieved compared to casted impellers
- Can be used under high pressure with good strength.
- Designed for optimized speed at the highest efficiency point.
- Impeller and Shaft are directly connected. Power transmission efficiency is 100%.
- A range of raw materials can be used (Ti, STS, Al, and others)



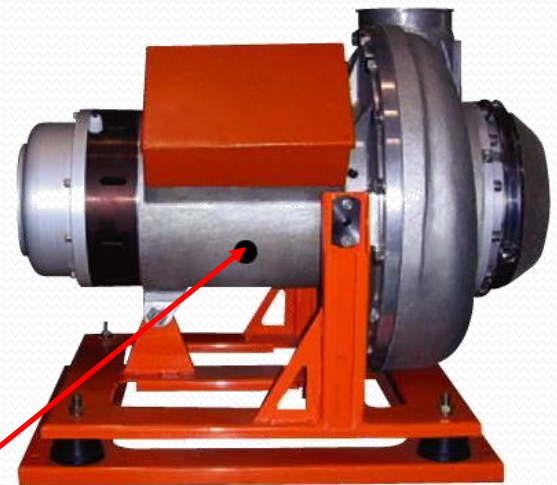


## Core Technology (High Speed Motor)

- Permanent Magnet Synchronous Motor : PMSM
- Can generate high power with compact size
- **Precise speed control available**
- Motor and Impeller are directly connected removing causes of malfunction for high efficiency



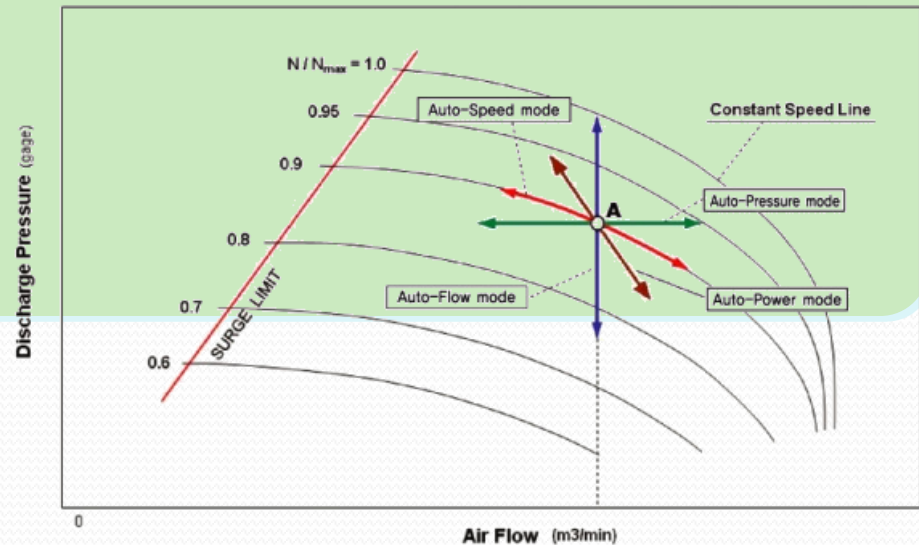
High Speed Motor



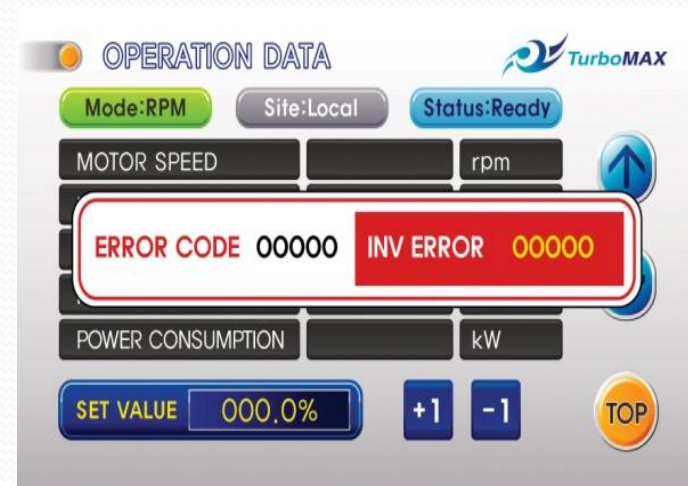


# Core Technology (Controller)

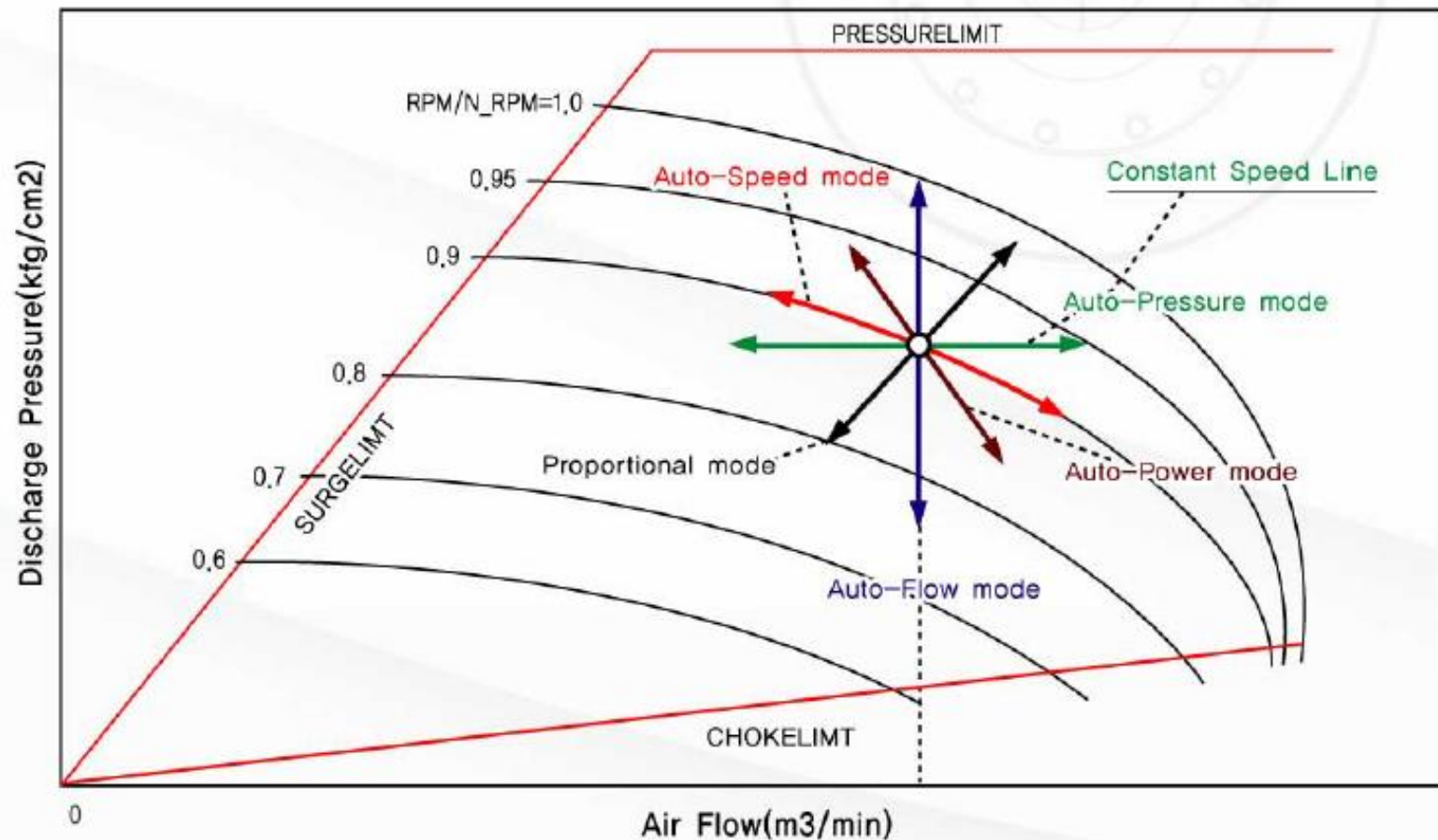
- Direct control of **flow/ pressure** possible through rpm and torque adjustment using high speed motor and inverter. Digital remote control and monitoring is optional.
- Auto Flow Mode
- Auto Power Mode
- Auto RPM Mode
- DO-Link Mode
- Failure Check & Reset



# Operation Data & Self Diagnostic

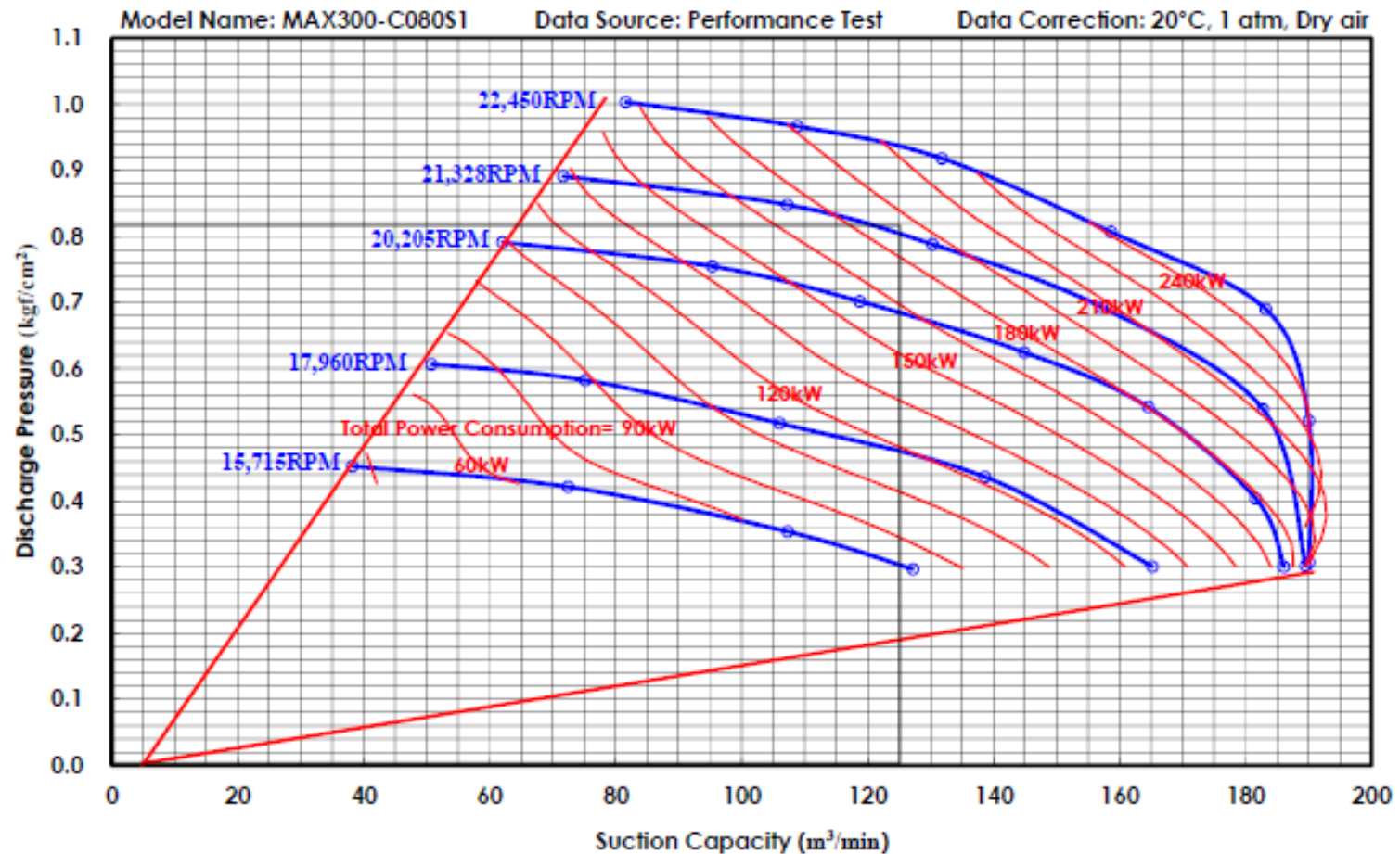


# Performance Curve



# Performance Map

TURBOBLOWER PERFORMANCE MAP



# Specifications

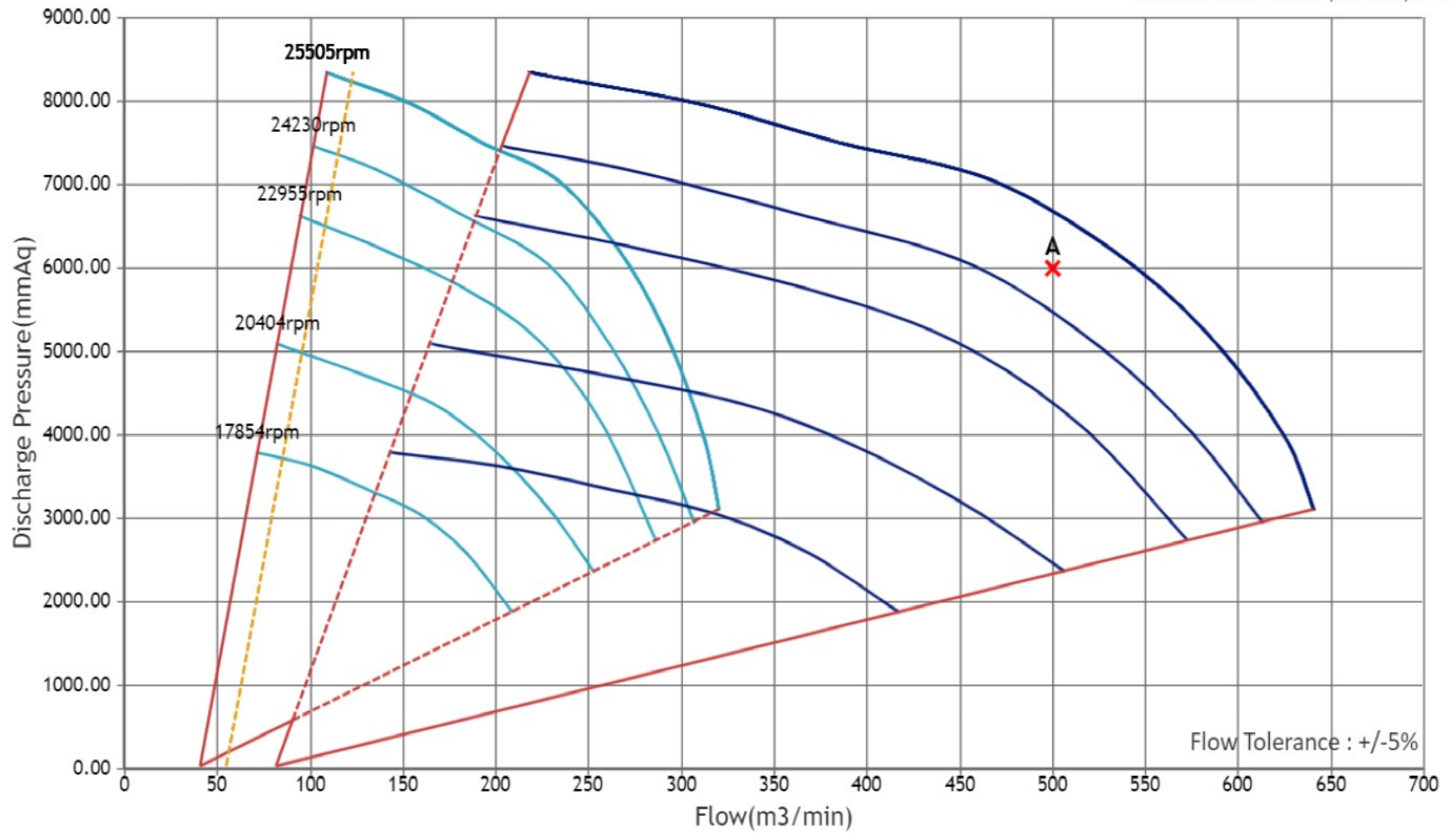
Dis. Pressure (kgf/cm <sup>2</sup> G)		MAX20	MAX30	MAX50	MAX75	MAX100	MAX150	MAX200	MAX250	MAX300	MAX400	MAX500
		Air Flow [m <sup>3</sup> /min] - 1atm, 20°C, Air Flow Tolerance : ±5%										
0.3		18	26	47	76	107	130	174	243	258	348	440
0.4		16	23	43	68	86	122	164	217	242	328	414
0.5		14	20	38	55	74	113	148	195	225	296	376
0.6		12	18	33	49	66	104	132	160	200	264	336
0.7				26	44	58	92	116	145	180	232	308
0.8				23	40	54	82	108	135	162	216	282
0.9					37	50	69	92	114	137	184	
1.0					31	42	62	86	104	125	172	
1.1						38	57	78		114	156	
1.2						37	56	75		112	150	
1.3						35	53	70		106		
1.5						32	48	64		96		
2.0						27				81		
Nominal RPM		40,000	40,000	40,000	32,000	32,000	26,000	32,000	26,000	26,000	26,000	24,000
Dis Dia(mm)		150	150	150	200	200	250	300	350	400	400	500
Weight(kg)		250	250	250	415	550	750	900	1100	1200	1350	1500
크기 (mm)	W	700	700	700	800	850	850	900	1100	1100	1200	1250
	L	1050	1050	1050	1200	1300	1700	1750	1750	1750	1900	2200
	H	1000	1000	1000	1350	1600	1600	1700	2000	2000	2000	2000



# MAX800D-C060

Discharge Pressure vs. Flow

Actual condition : 20.0°C, 1.00atm, 60%



# Applications



Wastewater  
Treatment  
Plant

Municipal  
Sewage  
Treatment  
Plant



Livestock Farming,  
Night Soil  
Treatment Plant



Air Supply  
for  
Aeration Tank



# Applications

## China - Hanwhaseong STP



## Korea - Cheongju STP





## Applications - Combined Operation

Combine **TurboMAX Blower** and **Roots Blower**



Combine Different Two Models

TurboMAX  
Model : **MAX100**



TurboMAX  
Model : **MAX50**



# 台灣典型應用案例簡介

- 案例廠為國內大型電子廠，目前廢水處理程序曝氣池設置鼓風機，供應曝氣池適當之空氣量，以維持微生物的好氧性分解能力。廠內目前設有1 台 40HP 魯式鼓風機(改善前)及 1 台 40HP 氣浮式鼓風機(民國 107 年新設置)，平常僅開啟 1 台鼓風機使用。針對 2 台不同鼓風機應用在曝氣池之耗能情形進行比較：
- 完工時間：民國107 年
- 效益評估：  
2 台鼓風機規格分別如下所示，因在不同的水池曝氣狀況下，其效益不同，以下分別說明量測評估方式。

# 台灣典型應用案例簡介

- 分析情境1：以整廠現況之水池曝氣閥固定開度作為計算基礎，檢測 2 台鼓風機的風速及運轉功率，並以風速及出風口截面積計算鼓風機排風量，相關檢測數據如下：

形設備式	出風口 截面積 (m <sup>2</sup> )	平均風速 (m/s)	風量 (m <sup>3</sup> /min)	耗電量 (kW)	電壓 (V)	電流 (A)	功率因數 (%)
魯式	0.034	14.96	30.5	34.2	370	61.9	86
氣浮式	0.034	9.42	19.2	18.2	372	28.6	99

- A. 節能量：140,160 kWh/年(因整年度不停機以 8,760 小時/年計算)  
(34.2 kW -18.2 kW)× 8,760 小時/年=140,160 kWh/年
- B. 節能率：約 46.8%
- C. 節能效益：約 42 萬元/年(以電價3 元/度、140,160 度/年計算)
- D. 減碳量：約 74.7 公噸CO<sub>2</sub>e/年  
(以經濟部能源局公告之107 年電力排放係數0.533 kg CO<sub>2</sub>e/kWh 計算)

# 台灣典型應用案例簡介

- 分析情境2：若調整水池曝氣閥約至相同排氣量下，檢測2 台鼓風機的風速及運轉功率，並以風速及出風口截面積計算鼓風機排風量，相關檢測數據如下：

形設備式	出風口 截面積 (m <sup>2</sup> )	平均風速 (m/s)	風量 (m <sup>3</sup> /min)	耗電量 (kW)	電壓 (V)	電流 (A)	功率因數 (%)
魯式	0.034	13.48	27.5	41.3	370	75	86
氣浮式	0.034	13.40	27.3	31.3	372	49	99

- A. 節能量：87,600 kWh/年(因整年度不停機以8,760 小時/年計算)  
(41.3 kW -31.3kW)× 8,760 小時/年=87,600 kWh/年
- B. 節能率：約 24.2%
- C. 節能效益：約 26.2 萬元/年(以電價3 元/度、87,600 度/年計算)
- D. 減碳量：約 46.7 公噸CO<sub>2</sub>e/年  
(以經濟部能源局公告之107 年電力排放係數0.533 kg CO<sub>2</sub>e/kWh 計算)

# 台灣典型應用案例簡介



改善前(魯式鼓風機)



改善後(氣浮式鼓風機)

案例廠改善前及改善後照片



# Installation Example: Project and Purpose

## project

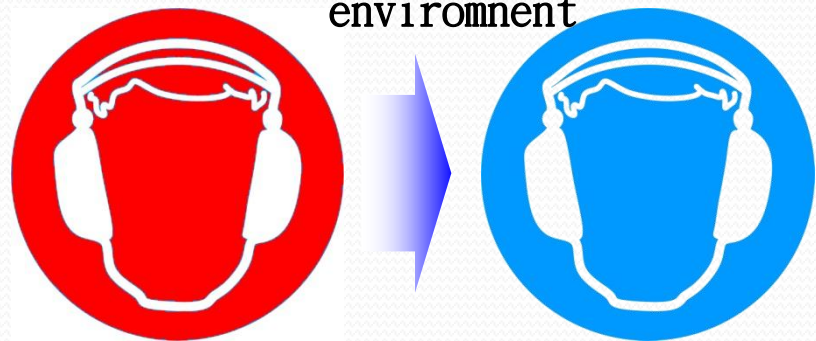
- Project : Daegu Textile WWTP Blower Replacement
- When : 2010.10. 01 ~ 2011. 02.30(150days)
- What : Replacement of Roots Blowers to Turbo Blowers

## Purpose

Cost Savings thru  
efficient product



Better working  
environment



# Proposal

## ROOTS BLOWER

Low Efficient  
High Noise & Vibration

16 qty of 95kW blowers  
(55m<sup>3</sup>/min \* 0.6bar)

12 units Working  
4 units Stand-by

## TURBO BLOWER

High Efficient  
Low Noise & No Vibration

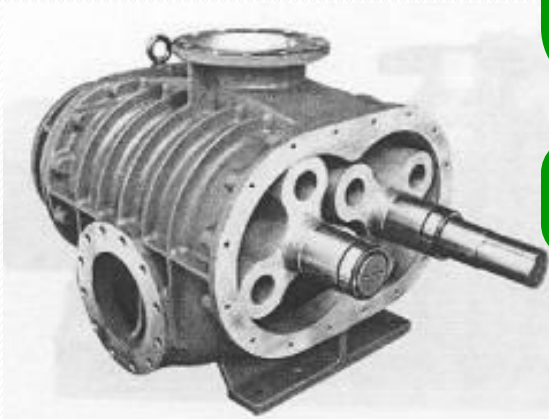
6 qty of 110kW blowers  
(105m<sup>3</sup>/min \* 0.6bar)

6 TB Working  
4 Roots Stand-by

# IMPROVEMENT

# OVER 30%

# Problems of Roots Blowers



Deteriorating Efficiency : increasing energy cost

lobes gap getting larger by wear and tear  
resulting air leakage and loss

Increasing maintenance category and cost

High Noise (120dB) and Vibration

Miscellaneous

- High temp in Blower room(summer time < 40°C)
- Oil leak - Greasy environment
- Waste powder and air thru wearing V-Belt

# The condition of Operation in Year 2010

## Existing Blower Operation

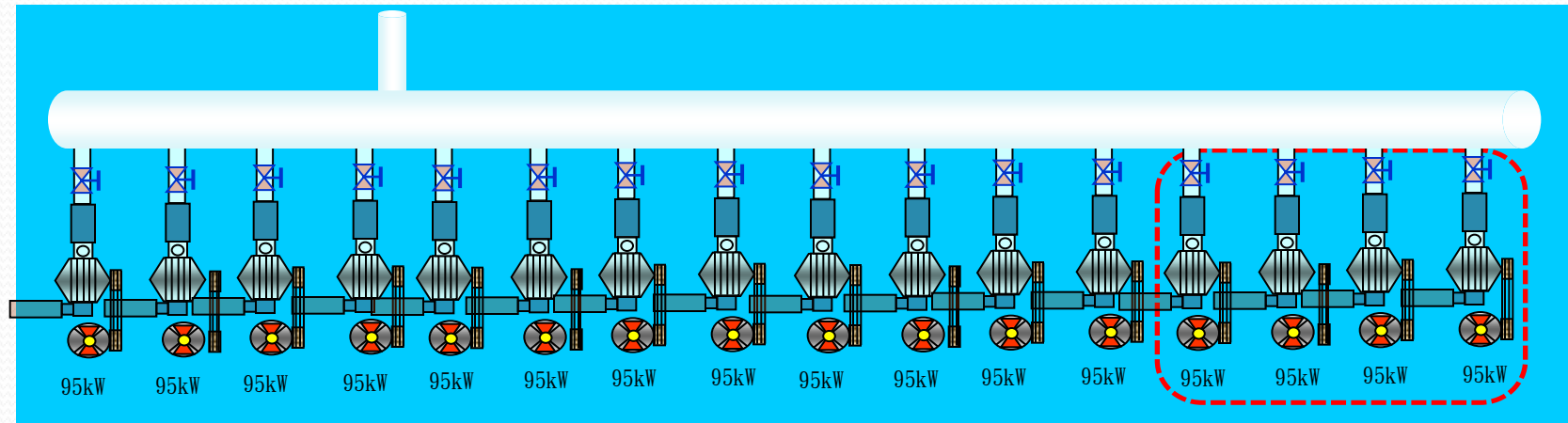
Type : Roots Blower

55m<sup>3</sup>/min\* 0.6bar\* 55kW \* 16 units

12 units Working / 4 units Stand-by

Noise : 120db - measured at Entrance

High Vibration, High cost of over-haul



12 Units Working

4Units Stand-by



# Replacement Blower (March 2011~)

## Replacement

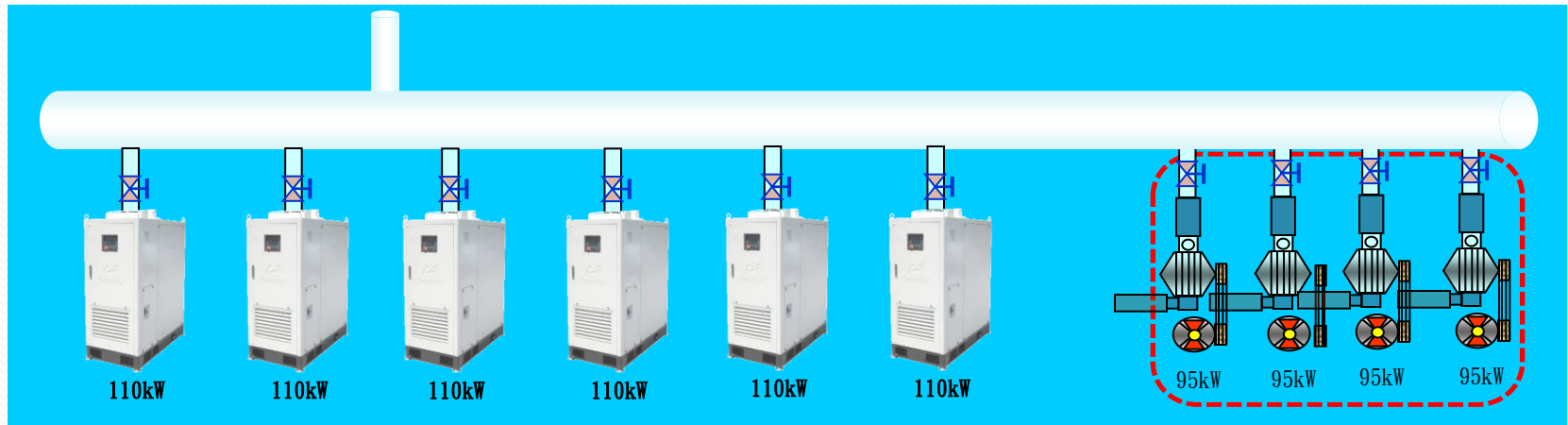
Type : Turbo Blower

105m<sup>3</sup>/min\* 0.6bar\* 110kW \* 6 Units

6 TB Working / 4 Roots Stand-by

Noise : < 85db - measured at Entrance

Energy Savings realized, No vibration



6 Units Working

4Units Stand-by

# Effect of Energy Savings(Power cost)

## Power cost savings thru TB

catagory	unit	Existing	Improvement	remarks
blower		ROOTS(95kW)*16Units	TURBO(110kW)*6Units	
#Working /Total	대	12/16	6/6 + 4(s)	Stand-by 4 units
nameplate flow (per unit)	m <sup>3</sup> /min	55	105	
Operation flow (per unit)	m <sup>3</sup> /min	45	90	Measured
total flow	m <sup>3</sup> /min	540	540	
Operation pressure	mmAq	5,800	5,800	measured
Power consumption (per unit)	kW	79.5	103.7	
total power consumption	kW	954	622.2	331.8kW (Energy Saving: 35%)
Yearly power cost	USD	659,404.8	430,064.64	Korea Power Cost = \$0.08 / kWh
Yearly energy savings	USD	229,340.16		

※ yearly energy cost = Power Cost \* Power Consumption(kW) \* 24h\* 360days operation

# Cost Savings thru low maintenance

## Yearly **maintenance** cost savings

catagory	unit	Existing	Improvement	remarks
blowers		ROOTS	TURBO	
flow	m <sup>3</sup> /min	55	105	Name plate
pressure	mmAq	6, 000	6, 000	Name plate
Motor power	kW	95	110	
Descriptions of maintenance		Bearing Oil Seal Over haul Etc.	Periodic filter change	
quantity	units	16	6	
Cost per unit	USD	1, 500	200	
Total cost	USD	24, 000	1, 200	
<b>Total Savings</b>	<b>USD</b>	<b>22, 800</b>		

※ general condition and could change per application

# Power Savings Evidence

※ Daegu Textile Energy Bill and Power Usage(2011. month 1-month 7)

전 력 사 용 량 검 토(2011년)

월	폐수량 (m³)	슬러지량 (톤)	COD	BOD	색도	전력량 (kWh)	전력량/폐수량×COD÷1,000 (kWh)
1	347,509	2,351.19	579	1,134	1,025	707,400	3.516
2	318,174	2,385.37	709	1,011	1,076	639,408	2.834
3	417,406	3,163.85	800	1,211	1,152	775,056	2.321
4	413,409	3,210.05	820	1,311	1,177	773,712	2.282
5	404,721	3,068.95	797	1,256	1,068	742,488	2.302
6	410,598	1,960.65	804	1,305	999	788,880	2.390
7	409,560	1,848.05	642	1,385	1,025	811,680	3.087
8							
9							
10							
11							
12							

전력사용량검토(m³당)

월	2010년 전력량/폐수량×COD÷1,000 (kWh)	2011년 전력량/폐수량×COD÷1,000 (kWh)	증감율
1	3.132	3.516	12.26%
2	3.143	2.834	-9.83%
3	2.892	2.321	-19.74%
4	3.003	2.282	-24.01%
5	3.024	2.302	-23.88%
6	3.280	2.390	-27.13%
7	4.093	3.087	-24.58%

Before

After

- Electricity Bill for the plant showing Power consumption/m3 wastewater for the entire plant
- Blower power savings are more



# Total Replacement Effect

1. Cost Effect : US\$252,140.16 /Year

catagory	Existing(Roots)	Improvement(TB)	Savings	Remarks
maintenance	100%	>10%	22,800 USD	<input checked="" type="checkbox"/> 90% Savings
Power Consumption	100	60~70	229,340.16 USD	<input checked="" type="checkbox"/> 35% Savings

## 2. Auxiliary Effects

catagory	Existing(Roots)	Improvement(TB)	difference	remarks
noise	> 120dB (jet engine)	< 85dB (market place)	35dB	<input checked="" type="checkbox"/> 35dB less
Vibration	Very high	none		
Life of machine	7~10years (rapid deterioration of efficiency after 2-3 years operation)	Over 15 years (semi-permanent)	Added capital investment, O&M cost	<input checked="" type="checkbox"/> longevity



# O&M and Service Response

## A/S Items

Category	Service types	Content	Response time
Major	Bearing damage	Due to thrust/journal bearing damage, blower is inoperable. The bearing damage caused rotor damage and need to be replaced. Air-end return, repair and reinstall	Within 2 days
	Inverter damage	Inverter damage or Capacitor in the Sine Filter damaged. Replace Inverter or Capacitor at the site	Within 1~2 days
Minor	Controller error	Replace the components of controller	1 day
	Blow-off valve damage	Replace hardened or tear diaphragm rubber in the blow off valve. OR replace the damaged solenoid valve at the site.	1 day
	Air leakage	Loosening of the rubber band of the discharge pipe or vent pipe. Tightening or replace the rubber band at the site.	1 day
	Damage to Electrical components	Replace the fuse or relay at the site	1 day

## ***Response to Operation & Maintenance, After service calls***

### **Operation and maintenance**

- **Managing the Inlet Air Filter**
- **Periodical Preventive maintenance**
- **Training of O&M, Troubleshooting Manual to the operators**

### **A/S Response**

- **Maintain the stock of replacement components :  
Shortening of the A/S Response Time**
- **Maintain the A/S personnel : standby personnel**



# Thank You!

## Q & A

