



Be small, Think big




NEXT GENERATION TURBOMACHINERY

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ABOUT TNE



 Company Motto – “Be small, Think big”

**INNOVATION
PEOPLE
ENVIRONMENT
CO-PROSPERITY**



TNE Korea Co Ltd.

- *Product Design and Manufacturing*
- *Technology Innovation, R&D, and Engineering Services*
- *Sales and Customer Support in Asia*

TNE Global Inc.

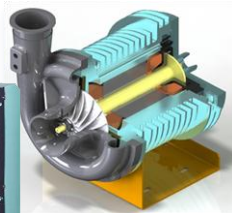
- *Sales and Customer Support in America, Europe and Middle East*
- *Development of Global Business Strategy*
- *Product Innovation*

TNE provides comprehensive energy solutions using disruptive turbo technology.

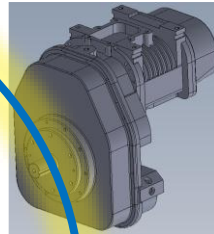
BUSINESS LINE



ENVIRONMENT AND ENERGY



Turbo Blower



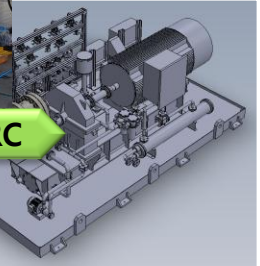
Screw Blower



MVR



Turbo Expander for ORC



Engineered Green Products

Sustainable Technology for Energy Recovery

Disruptive Technology for Energy Saving

AEROSPACE



ECS



ACM

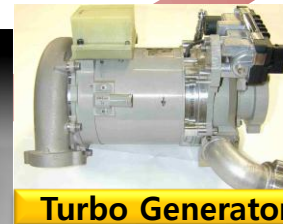
AUTOMOBILE



HEV

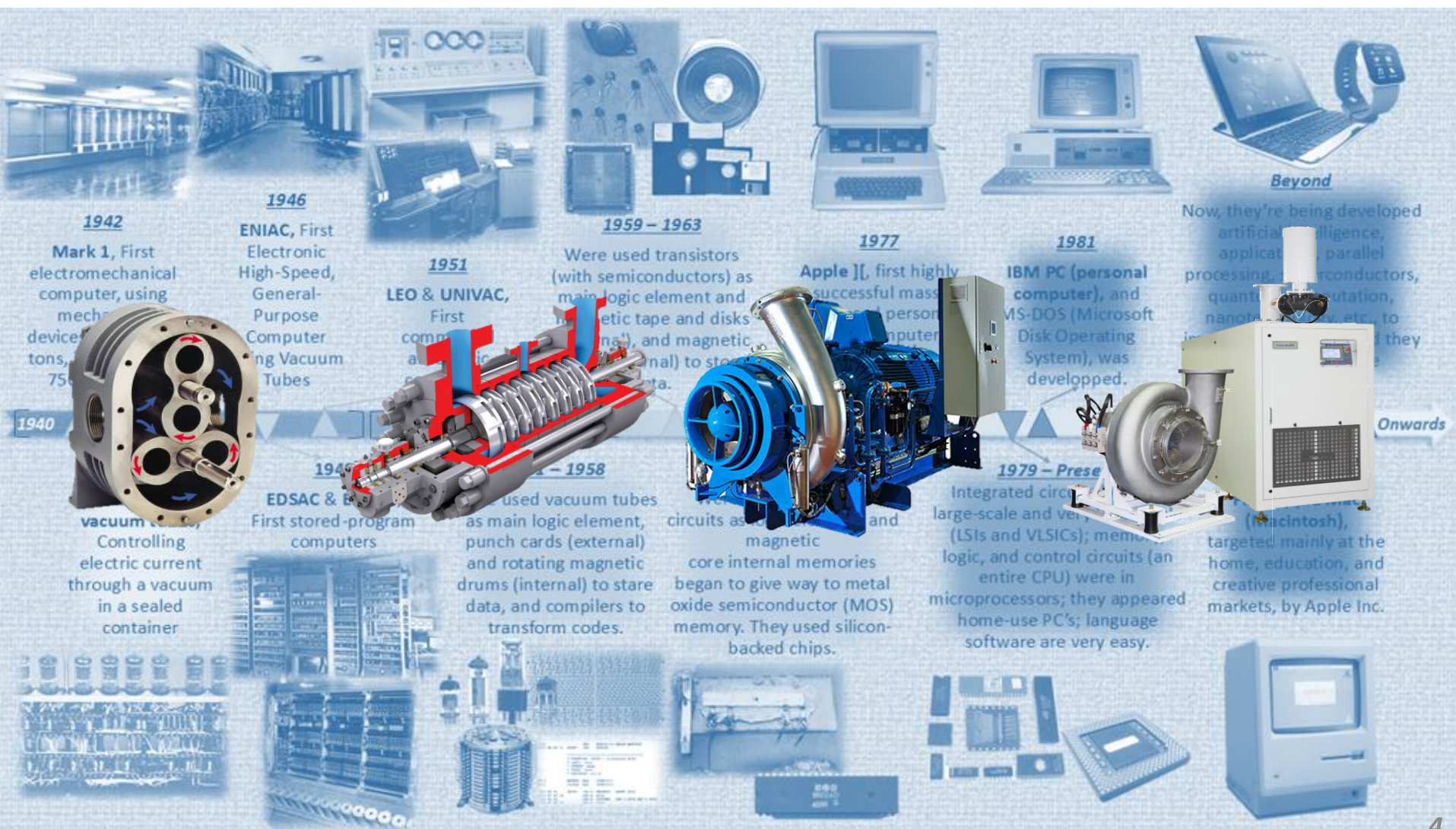


Electric Supercharger

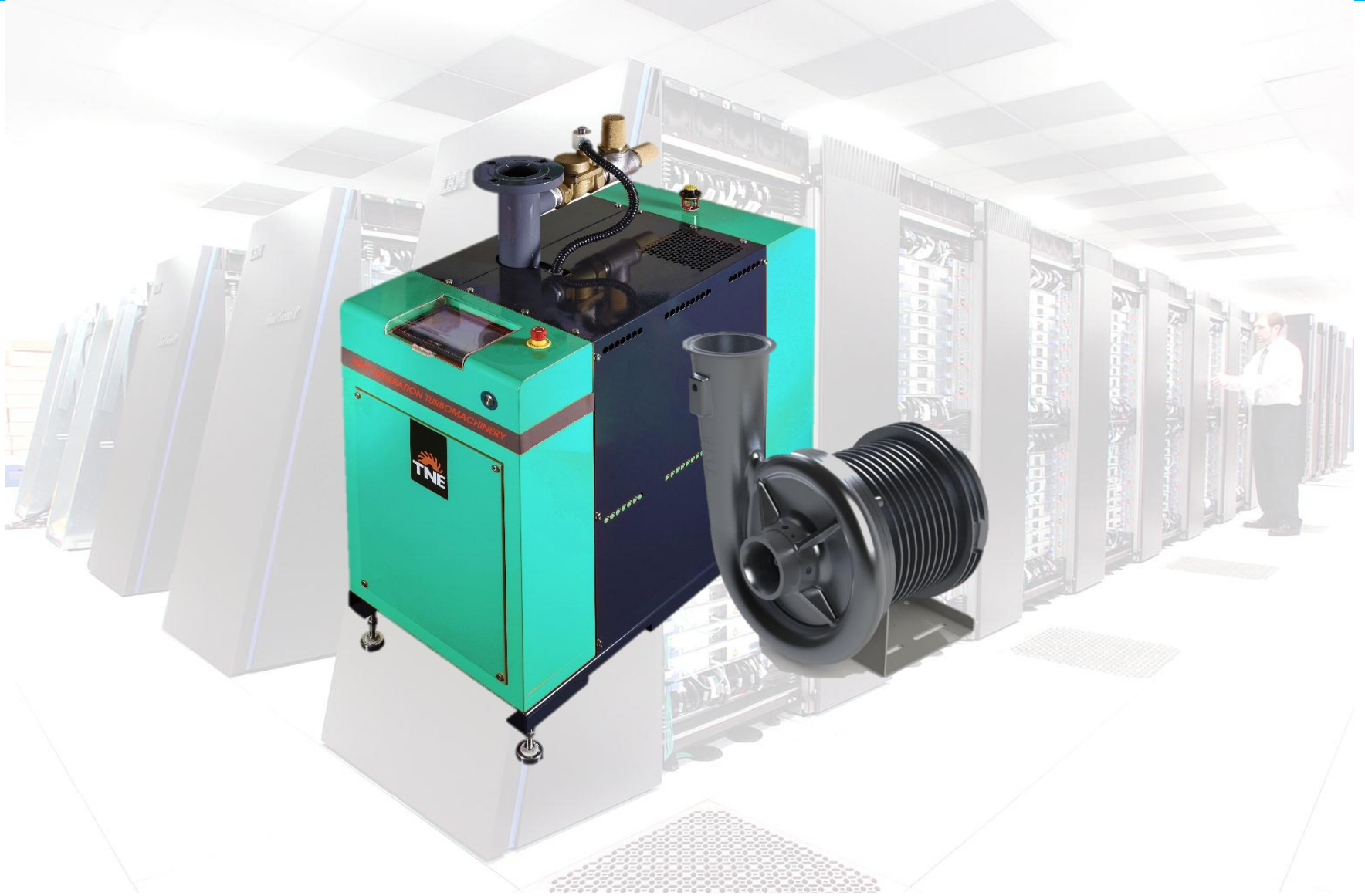


Turbo Generator

HISTORY OF BLOWER FOR WASTE WATER APPLICATION



NEXT GENERATION TURBO BLOWER

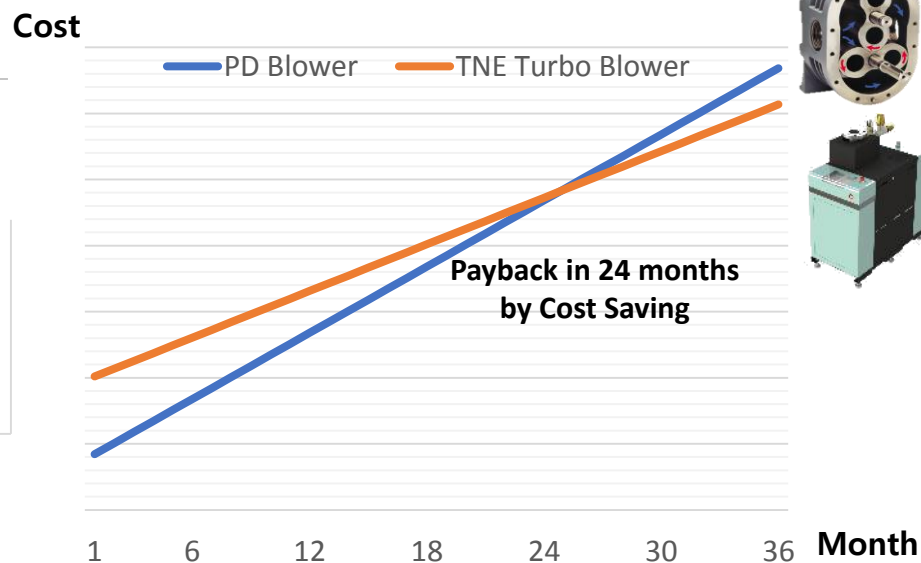
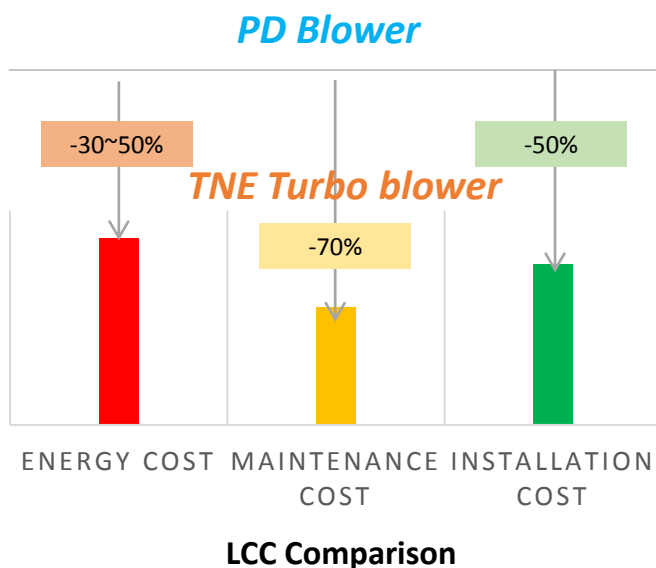


PRODUCT ENERGY SAVING ALTERNATIVE



MUCH LESS ENERGY CONSUMPTION THAN EXISTING PRODUCT

- Save 30% and more than the existing Positive Displacement (PD) Blower in all range



- ROI(Return On Investment) in the short term through the significant reduction of LCC(Life Cycle Cost) compared to conventional blowers

PRODUCT RANGE – SINGLE CORE

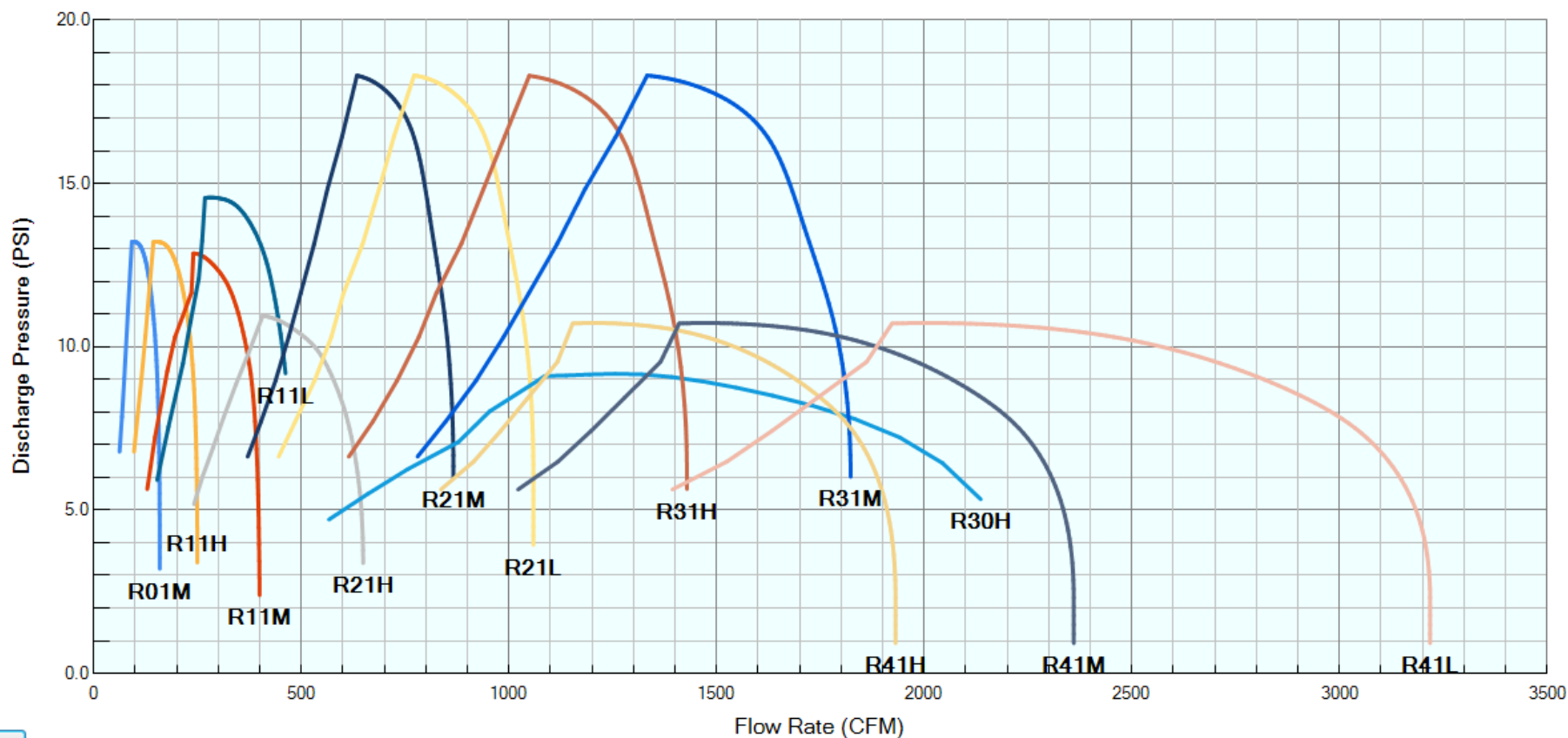


MODEL SINGLE CORE SITE REF.

Nmin Wm,des P in PR X

Pinlet = 14.696 kPa Tinlet = 68.00 deg C RH = 36 %

SELECTION CHART



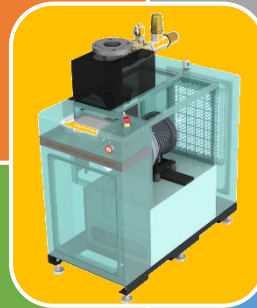
XY

PRODUCT CUSTOMER VALUE



COMPACT

- Small footprint and light-weight for flexible installation
- Quick and easy troubleshooting thanks to "Swap and Fix" components
- Expandable design by standard



AFFORDABLE

- Comparable efficiency at small size
- Cost-effective design for minimum capital investment
- Customizable budget by offering different options

ROBUST

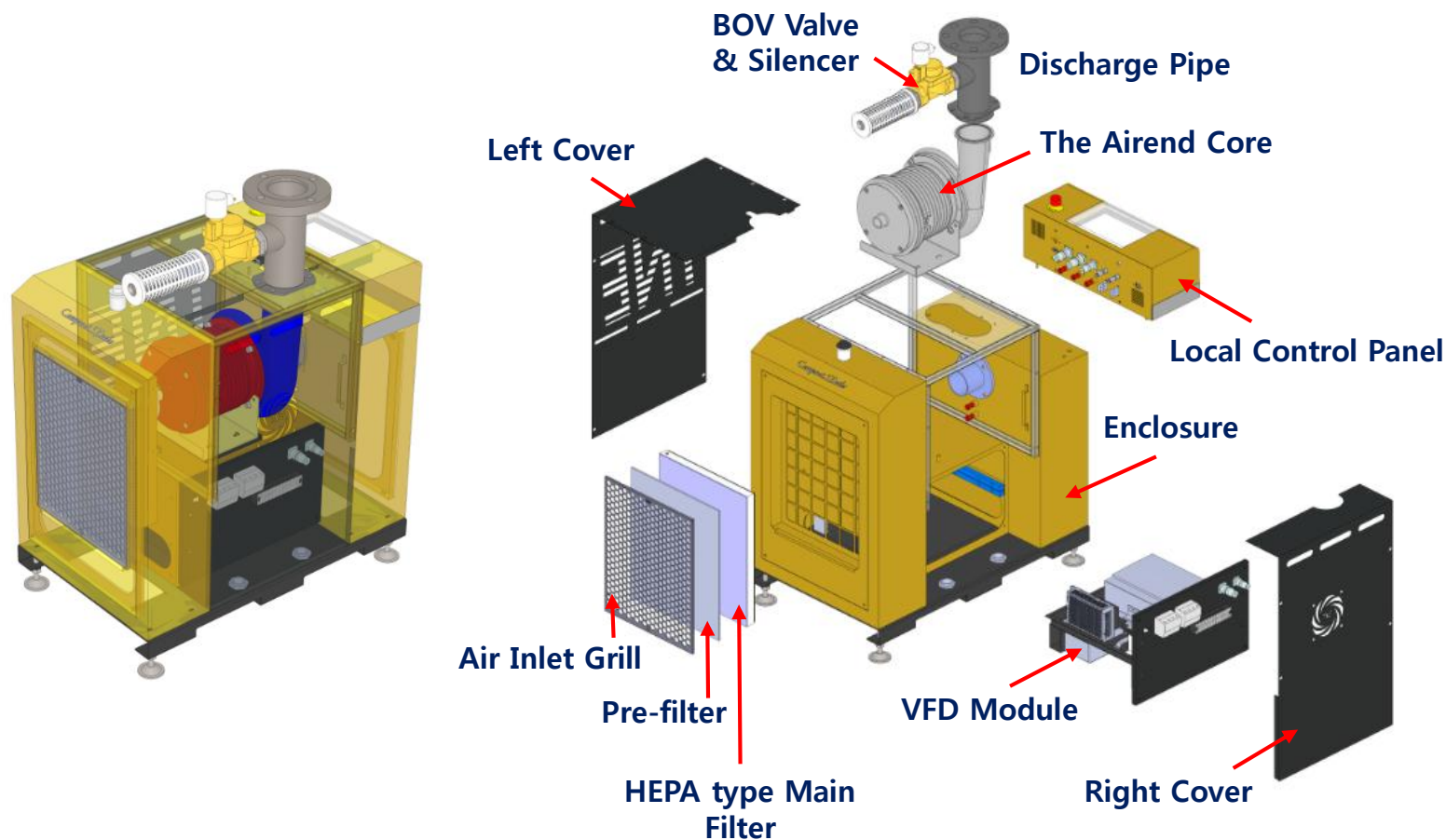
- *Designed for standardization and mass production*
- *Improved air-bearing reliability due to small size*
- *Control algorithm engineered for each application*

ECO-FRIENDLY

- *Oil-free air bearing*
- *Low vibration and low noise*
- *Min. Maintenance=> less waste*

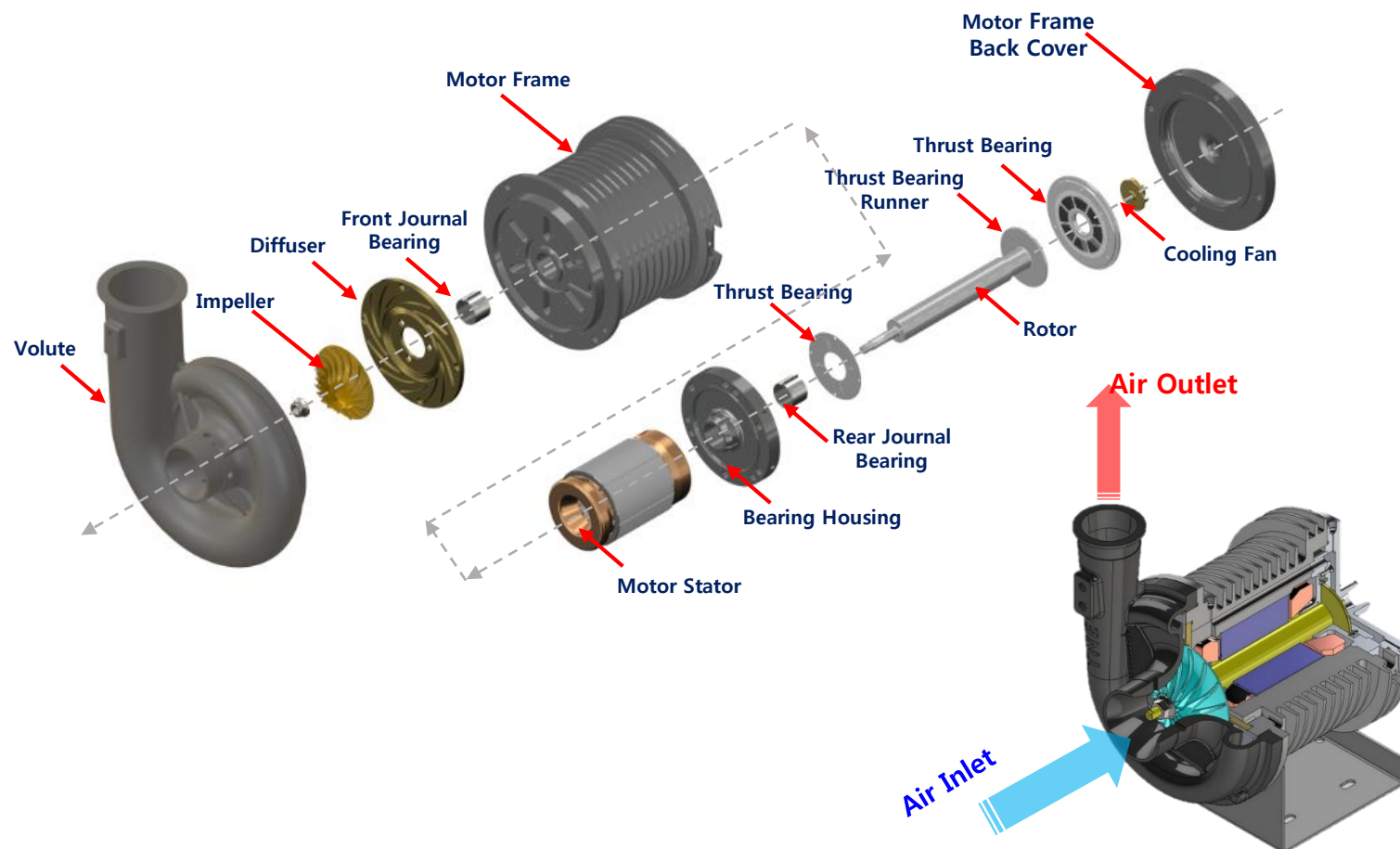
PRODUCT

AIR BEARING TURBO BLOWER



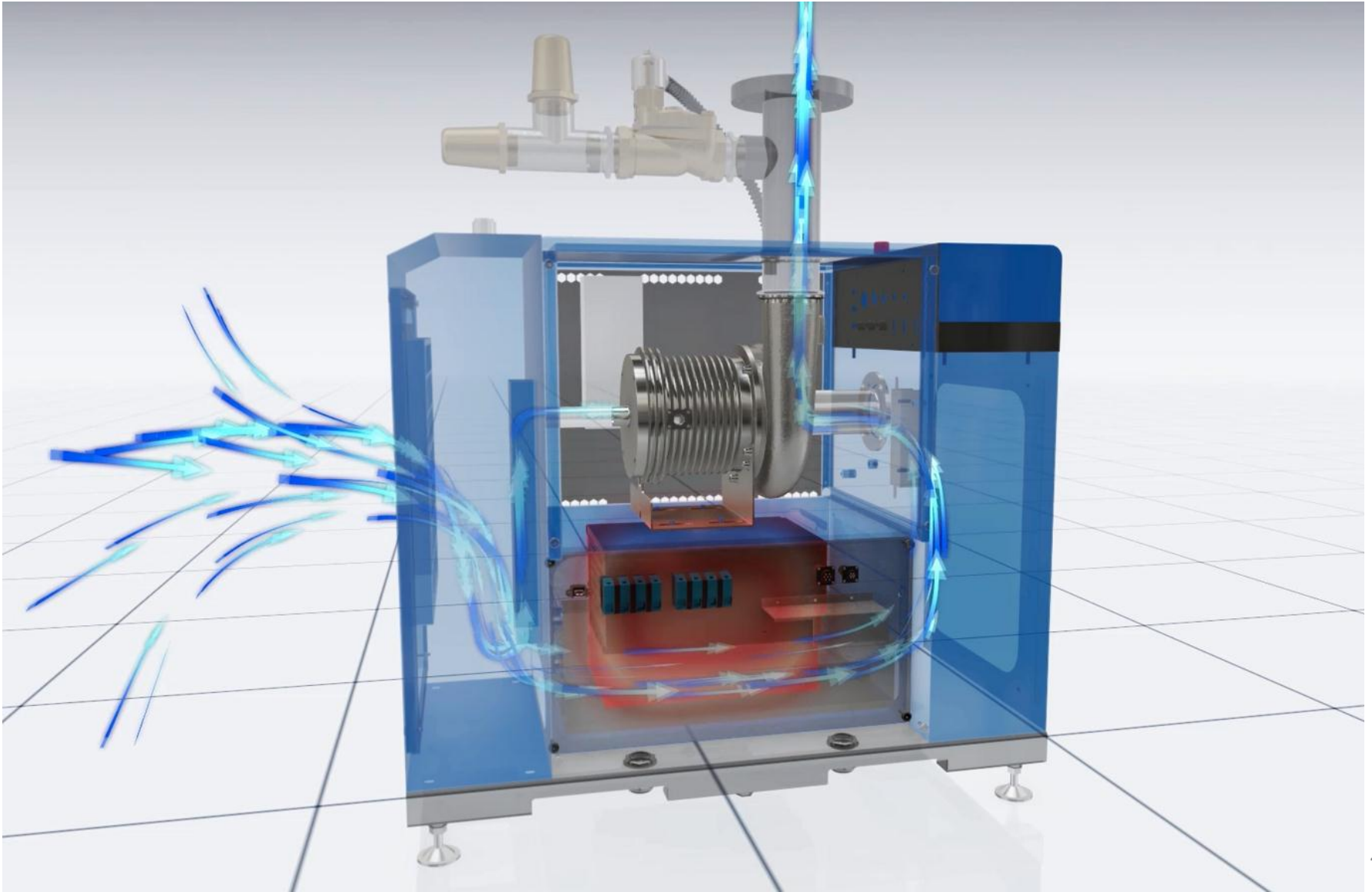
PRODUCT

AIR BEARING TURBO BLOWER



PRODUCT

AIR BEARING TURBO BLOWER

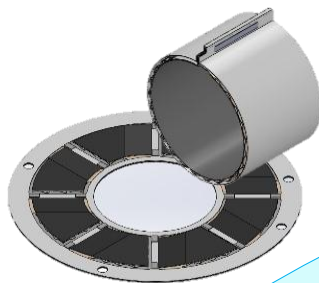


TECHNOLOGY

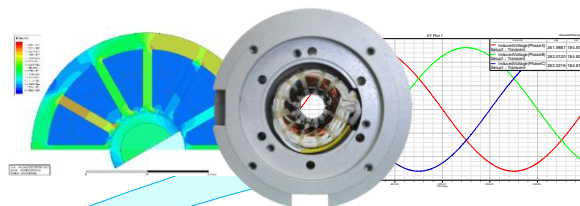
MINT (Made IN Turbo)



Patented Robust Air Bearing



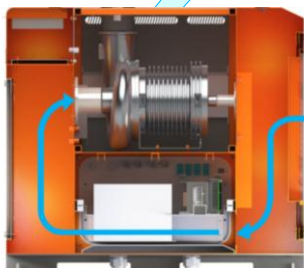
High Speed PMSM/ VFD



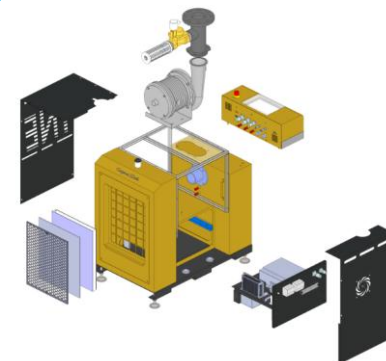
High-efficiency Compact Airend



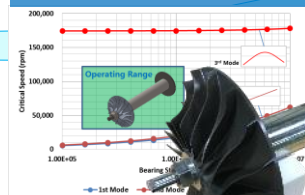
Patented Cooling And Dust Proofing



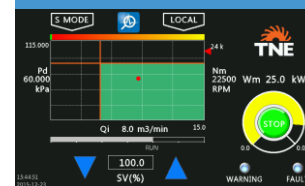
Modular Design and Easy Fix



High Speed Rotor Dynamics



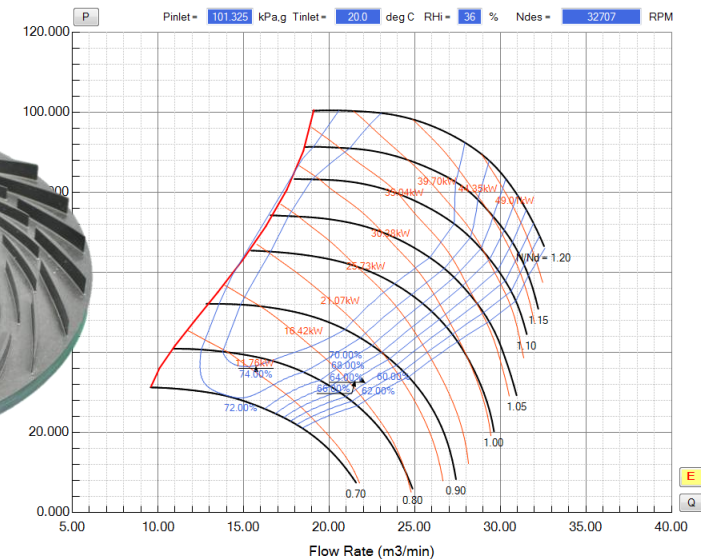
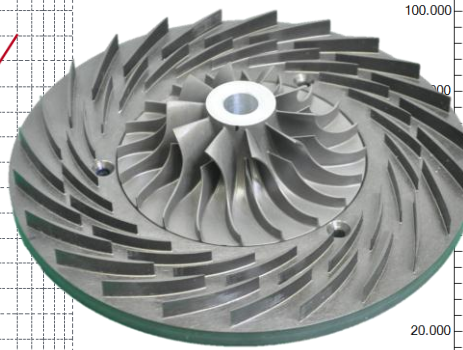
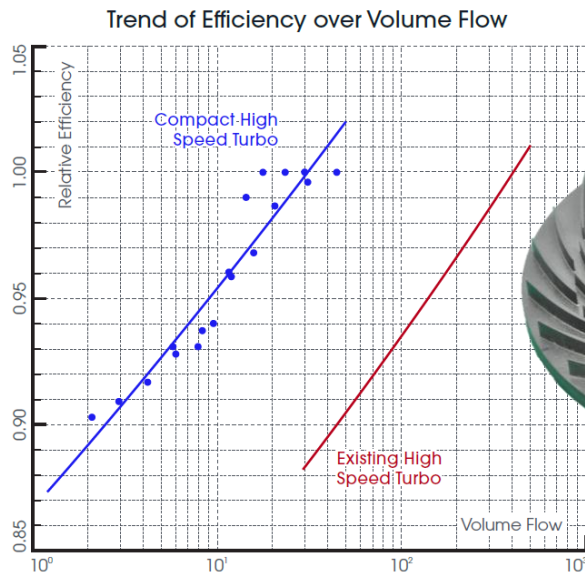
Engineered Control and UI



COMPACT HIGH EFFICIENCY AIREND

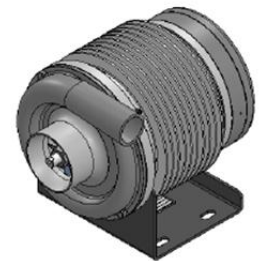
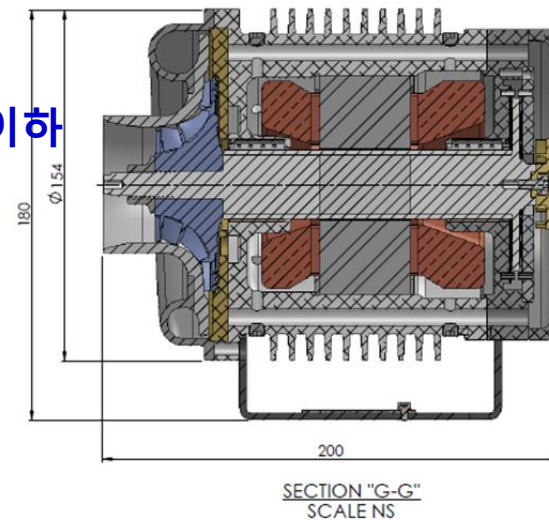
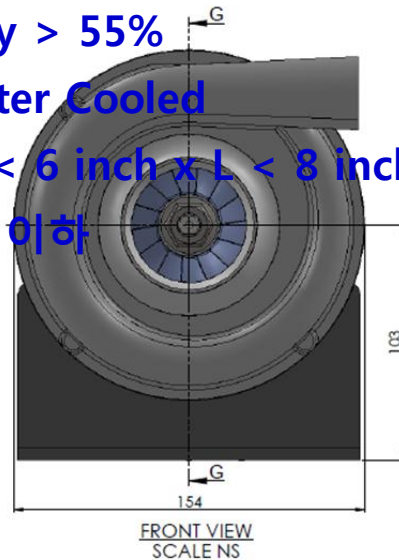


- Unrivalled efficiency in the same class, comparable to the efficiency of medium/large size Turbo Blower
- Full 3-D back-swept impeller design for wide operating range
- Single/Dual vaned diffuser and volute optimized for maximum efficiency with wide operating range and maximum flow control
- Wide range of part speed with no efficiency drop



AIREND FOR MOBILE APPLICATION

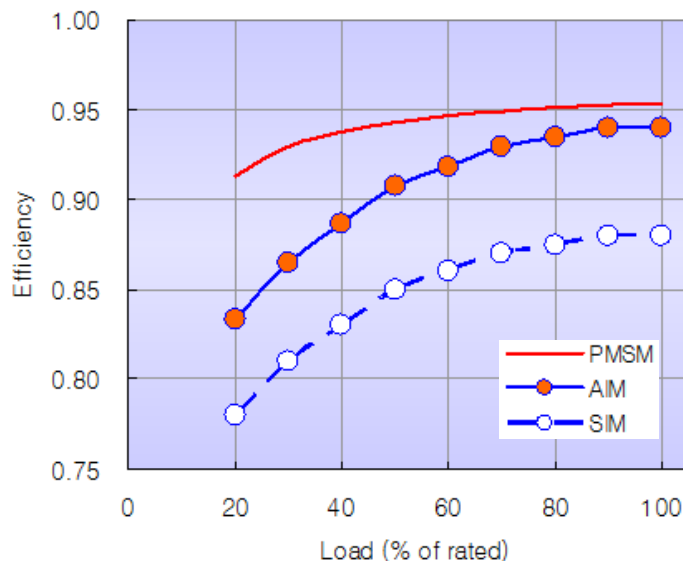
- Compact Air Bearing High Speed Turbo
- Working Pressure : 15 PSIG
- Volume Flow : 120 CFM
- Motor Output Power : 8 kW
- RPM : 100,000 RPM
- Input Voltage : 250 ~ 450V @ 50/60 Hz
- System Efficiency > 55%
- Air Cooled / Water Cooled
- Dimensions : D < 6 inch x L < 8 inch 이하
- Weight < 35 lb 이하



ISOMETRIC VIEW
SCALE NS

HIGH SPEED PMSM

- High efficiency *Air-Cooled Permanent-Magnet Synchronous Motor*
- Ultra-high speed, up to 100,000RPM for high pressure Turbo Blower application, up to 250kPa,g (35 PSIG)
- Rotor integrated permanent magnet
- Combination with air-end module in consideration of operating ambient conditions
- Wide range of part speed with no efficiency drop



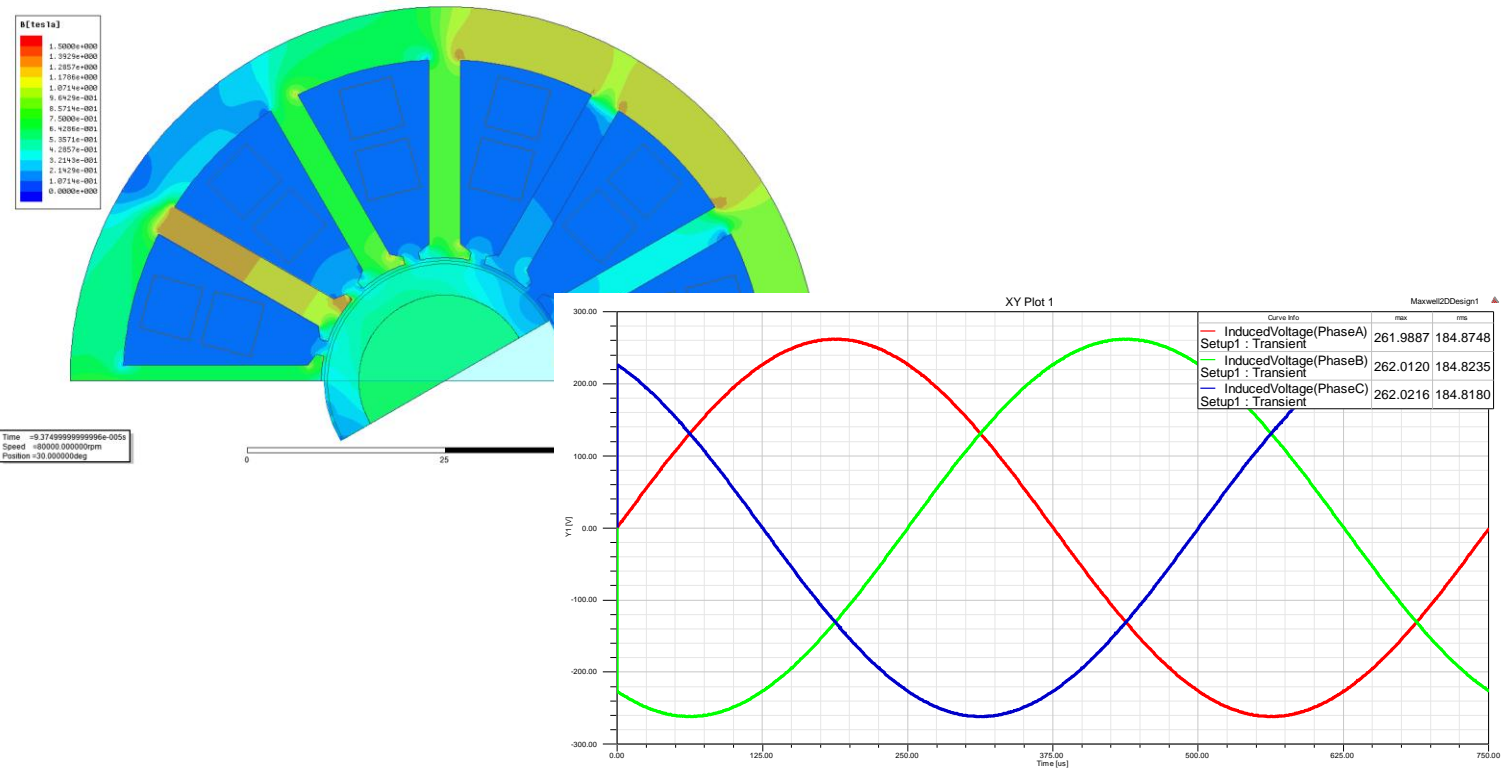
PMSM
AIM
SIM

Permanent Magnet Synchronous Motor
Advanced Induction Motor (Energy-Efficient Induction Motor)
Standard Induction Motor (Standard-Efficient Induction Motor)

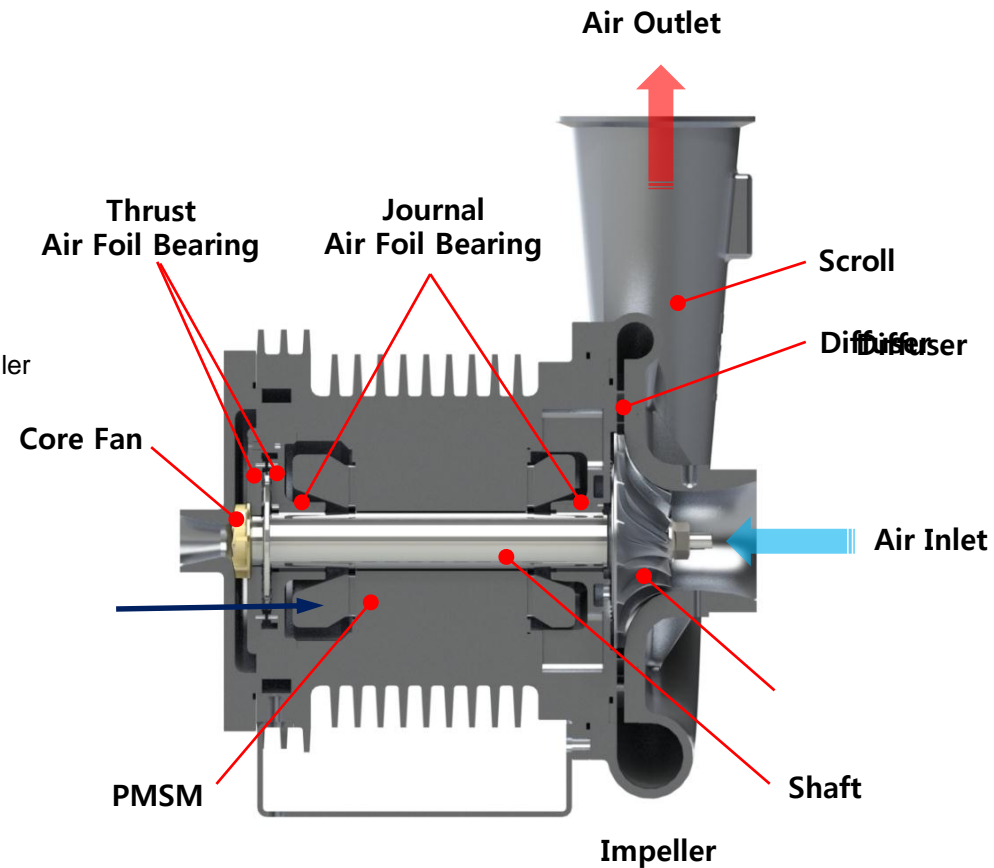
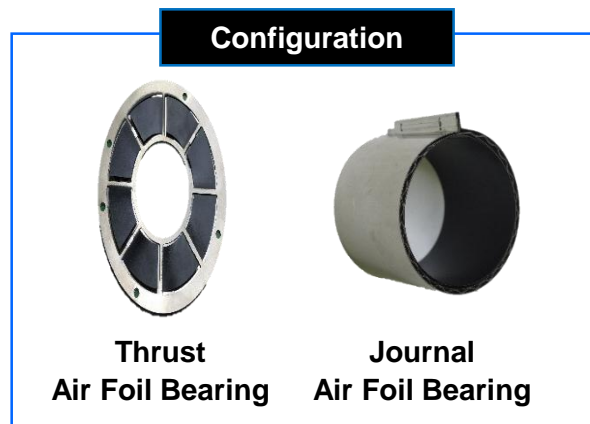
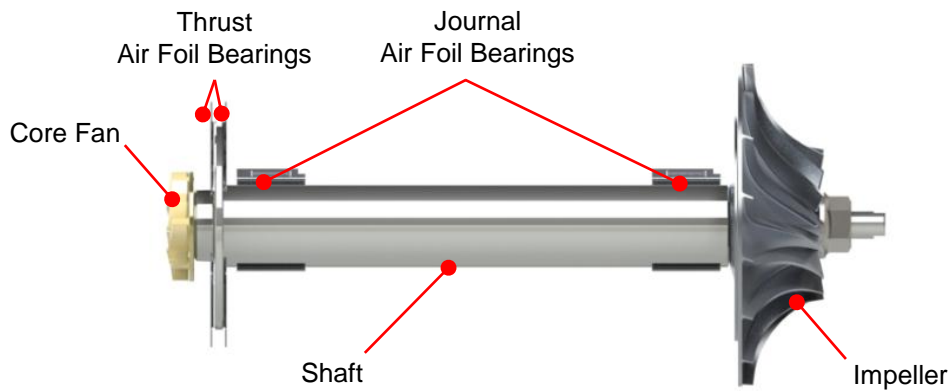


HIGH SPEED PMSM

Flux Density Distribution at Rated Condition



OIL-LESS AIR BEARING



INNOVATION

AIR BEARING FOR MASS PRODUCTION

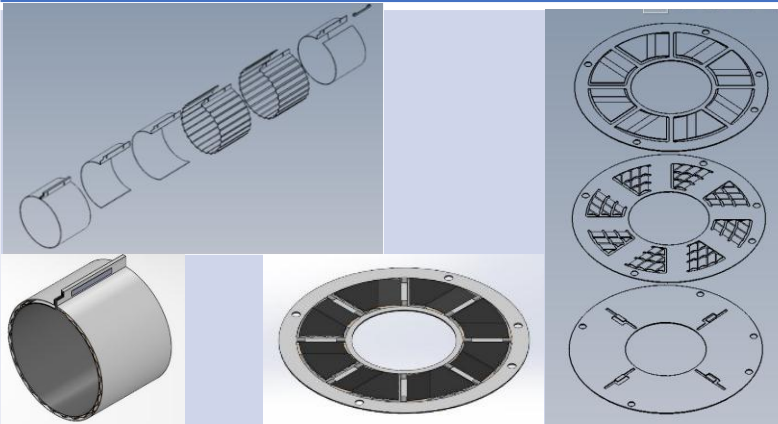
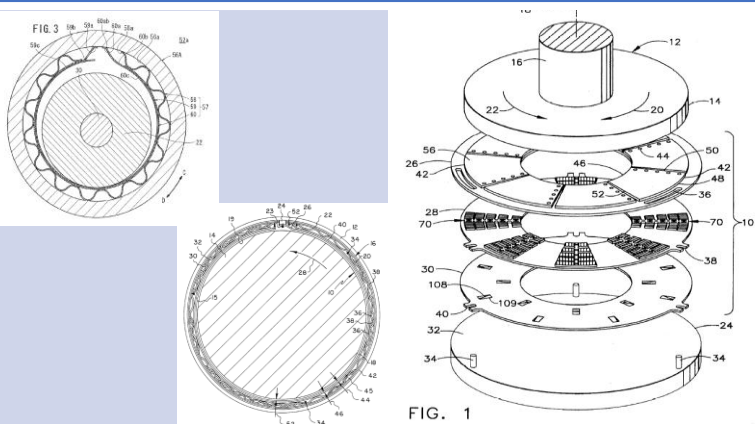


- Robust rotor design supporting the optimum aerodynamic performance
- Oil-free bearing perfect for clean air supply
- **Patented bearing design for consistent production quality and total preparatory inspection**
- **Mechanical Assembly without Welding**
- Improved load capacity and stability make zero-load discharge condition not a factor
- Pre-installation bearing inspection at component level for high level of quality control

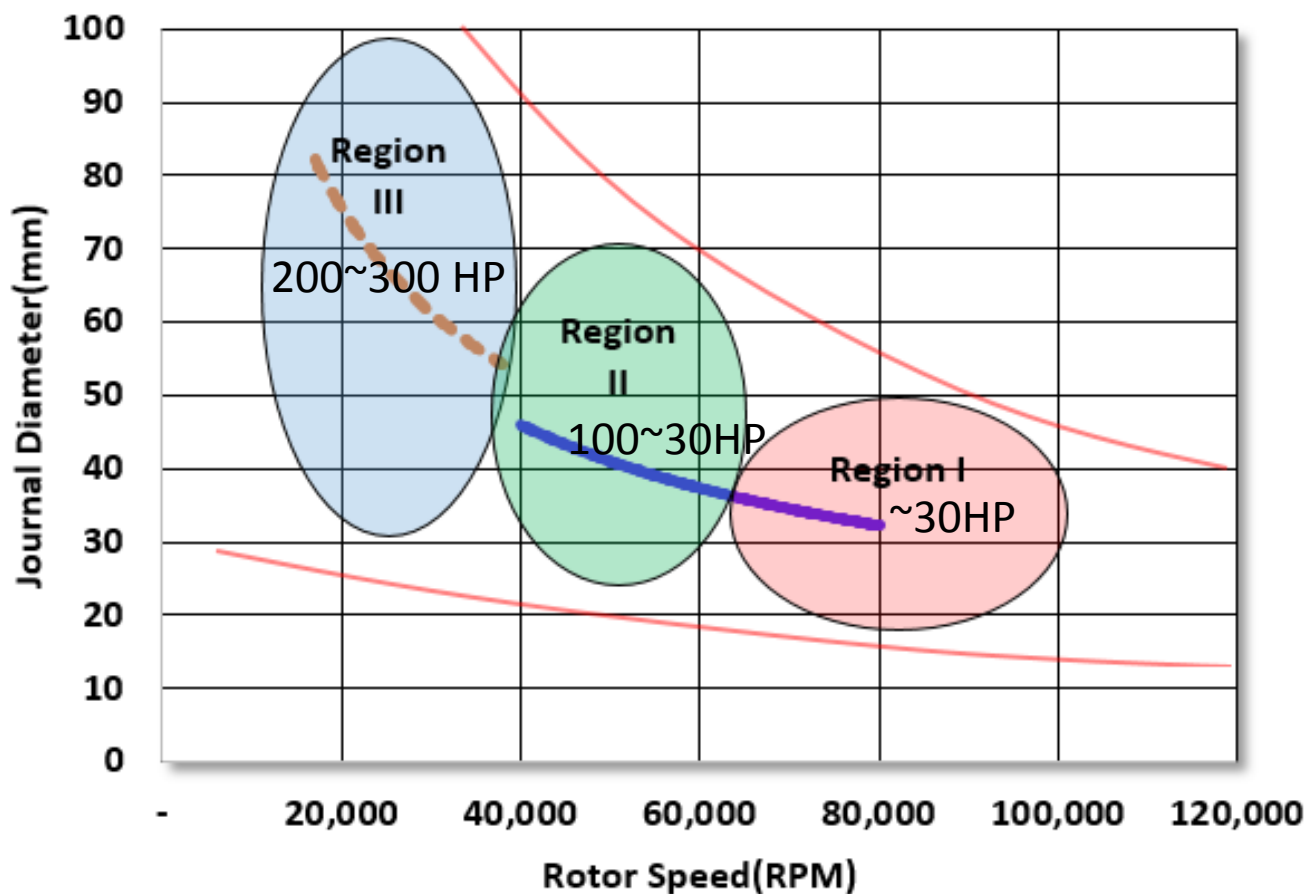


INNOVATION

AIR BEARING FOR MASS PRODUCTION

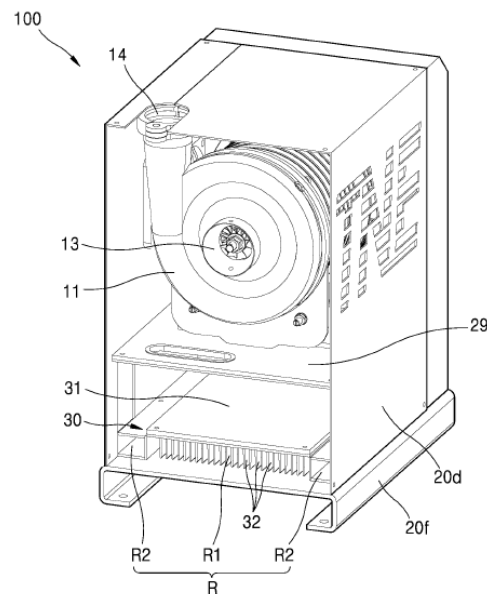
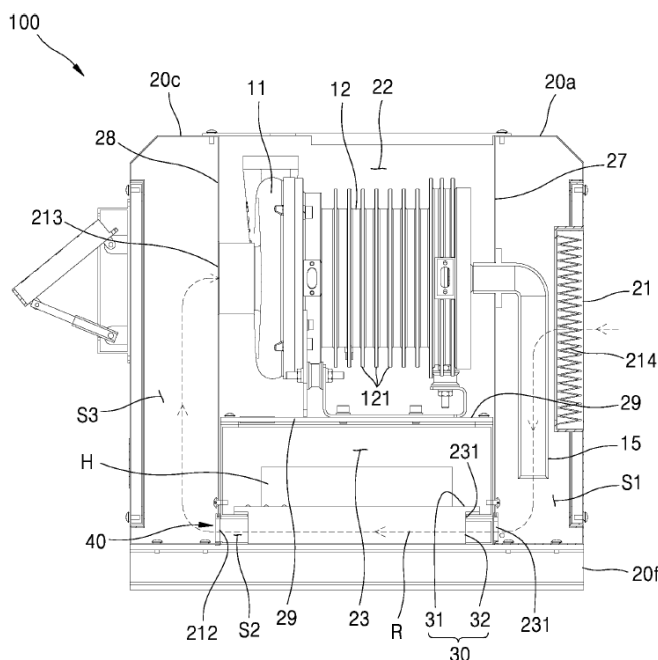
항목	TNE Air Bearing	Existing Air Bearing
Shape		
Structure	<ul style="list-style-type: none"> • <u>Mecahnical Assembly</u> • <u>Bump parts by stamping only</u> • <u>Independent bearing assembly</u> • <u>Simple bearing housing</u> 	<ul style="list-style-type: none"> • Welding/ Pin or Key in the assembly • Hand made bump parts • Assemble inside of bearing housing • Complicated bearing housing
Pros & Cons	<ul style="list-style-type: none"> • <u>Designed for mass production</u> • <u>Low manufacturing cost</u> • <u>Quality control at bearing assembly level</u> • <u>Consistent quality by robot manufacturing</u> • <u>High initial cost for stamping</u> 	<ul style="list-style-type: none"> • Order made design • High labor cost • Quality verification at the final product level • Quality depends on the skillset of the worker • Low initial cost

IMPROVEMENT PERFORMANCE AND STABILITY

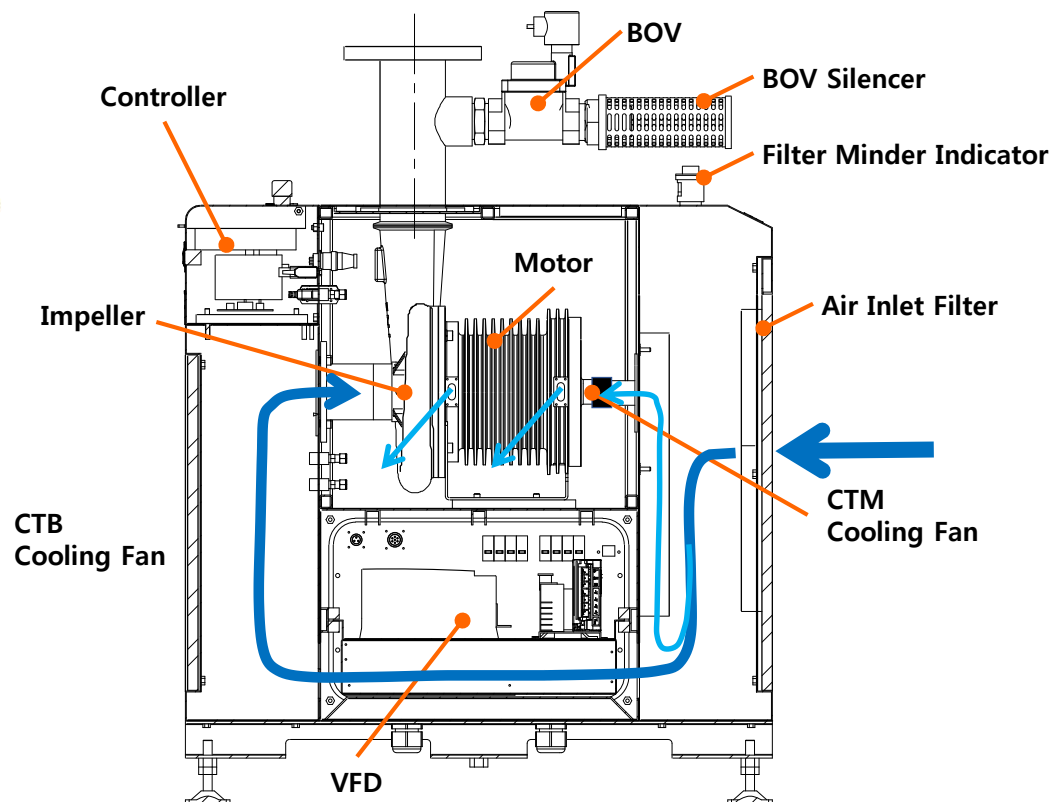
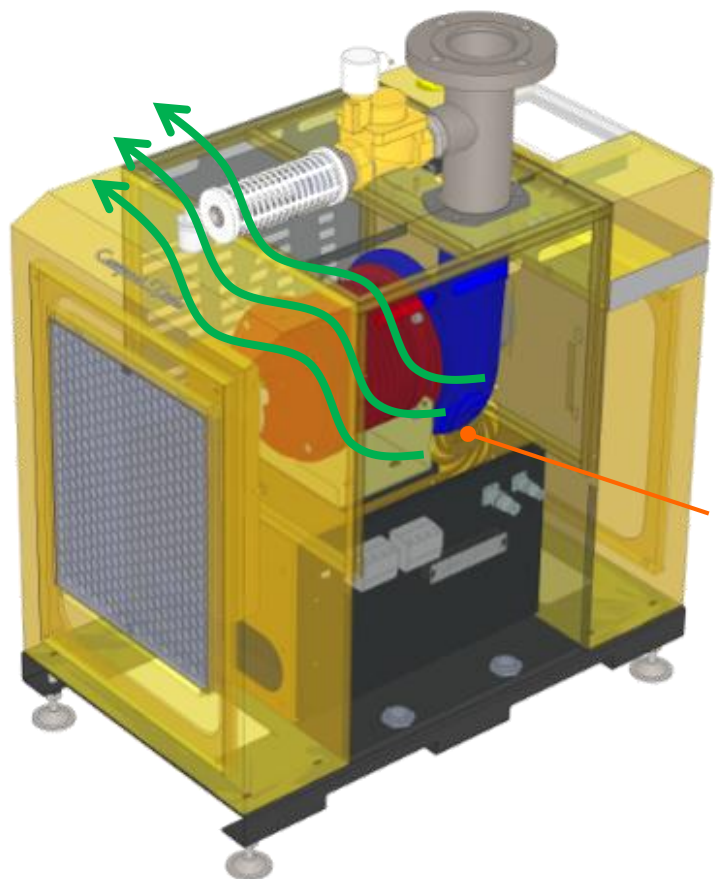


IMPROVEMENT PATENTED COOLING SYSTEM

- Patented air-cooling system for the complete sealing of blower core
- Internal dust removal system (optional)
- IP52/IP54 or equivalent grade enclosure for dust protection and outdoor



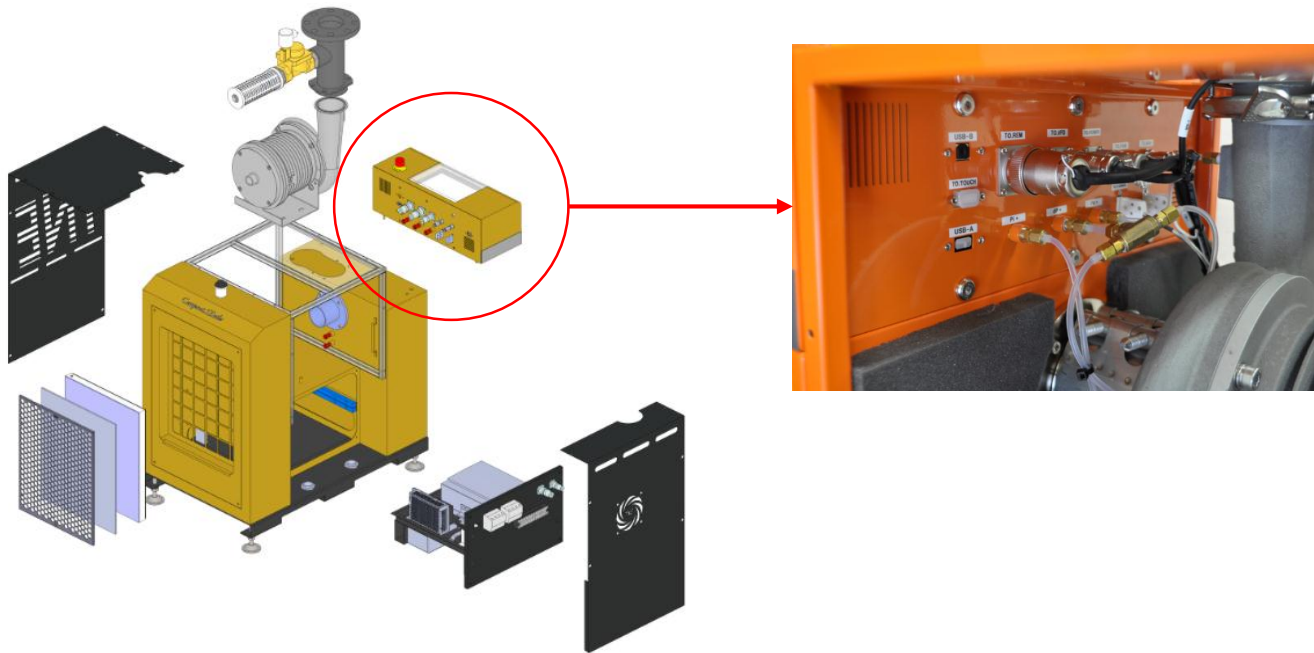
IMPROVEMENT PATENTED COOLING SYSTEM



- ← Main Air Flow
- ← Internal Motor/Bearing Cooling Flow
- ← External Motor Cooling Flow

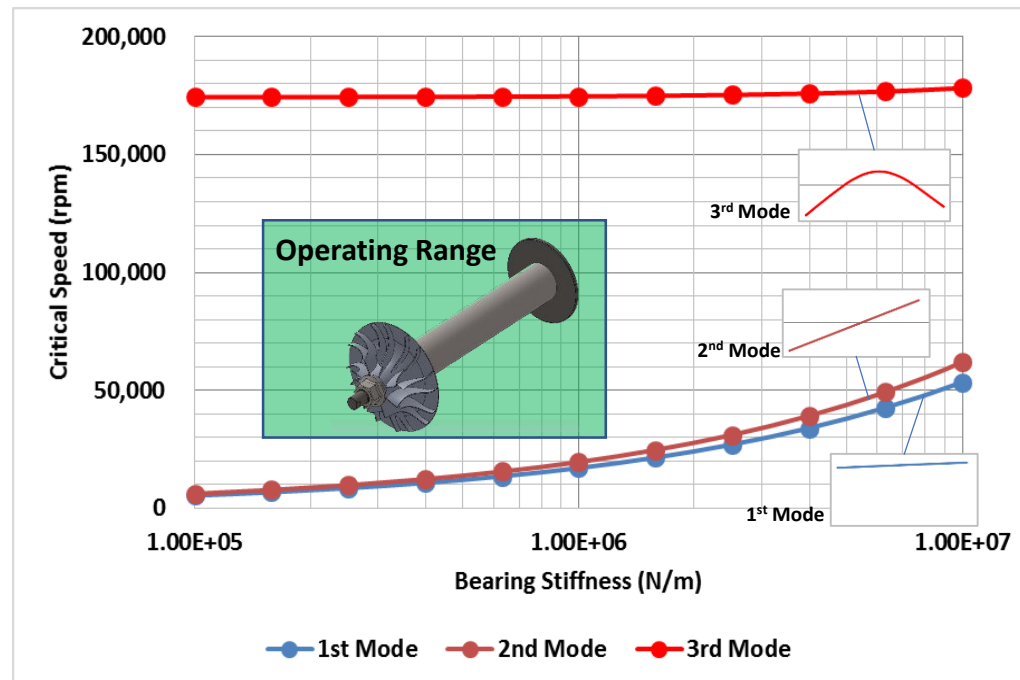
IMPROVEMENT MODULAR DESIGN

- Quick and Easy connection between components
- “Swap & Fix” components for quick and easy troubleshooting on site
- Lightweight and compact size component for easy logistics and replacement



ROBUST ROTOR DYNAMICS

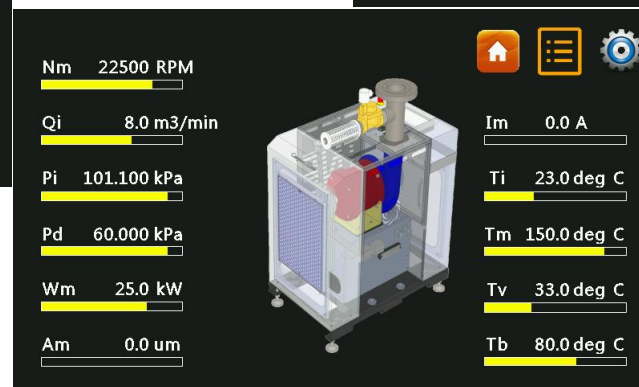
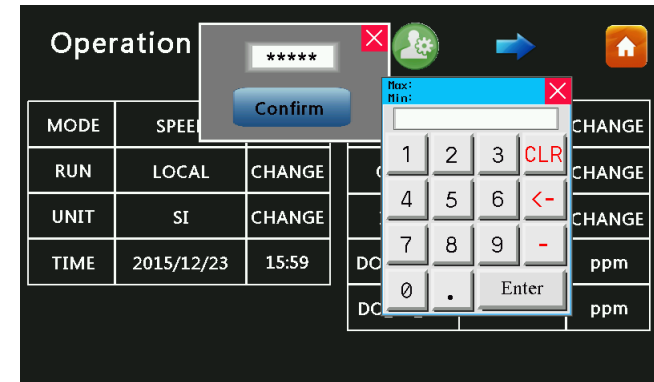
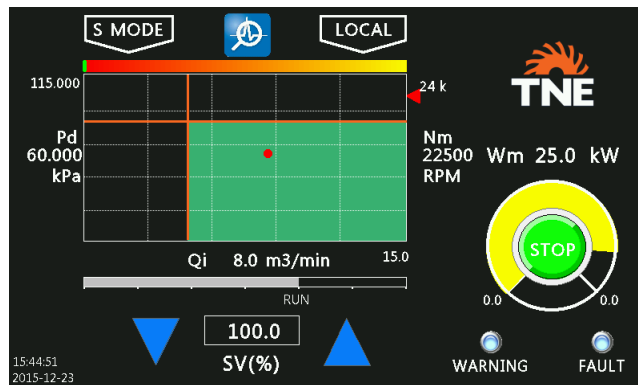
- Robust rotor design supporting the optimum aerodynamic performance
- Direct-drive by high speed PMSM (max. 100,000 RPM)
- Rotor integrated air bearing design
- Dynamic stability over wide range of operating speed



ENGINEERED LOCAL CONTROL PANEL



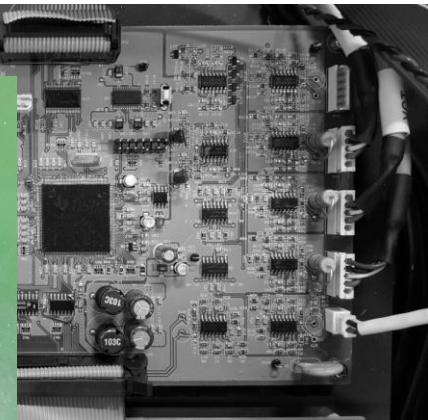
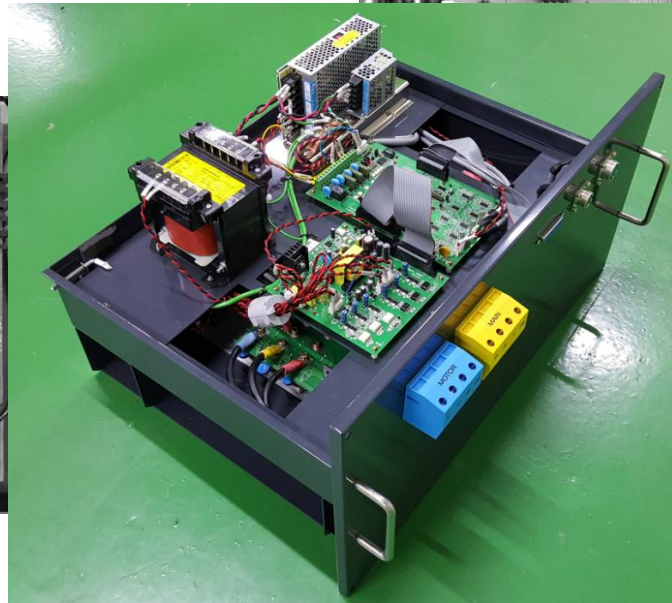
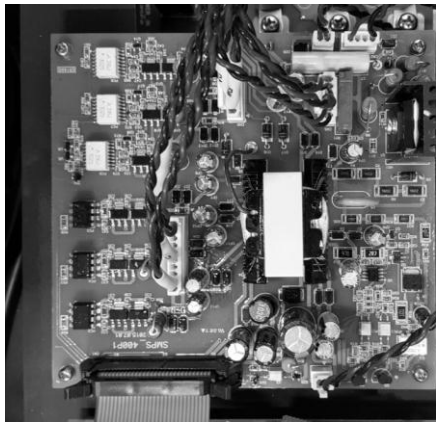
- 7-inch Touch Screen with MCU or PLC
- Modular Design for Easy Troubleshooting
- Remote Control by Speed Command and DO
- Communication via RS485
- Substantial Options for Full Customization



ULTRA HIGH SPEED MOTOR CONTROLLER



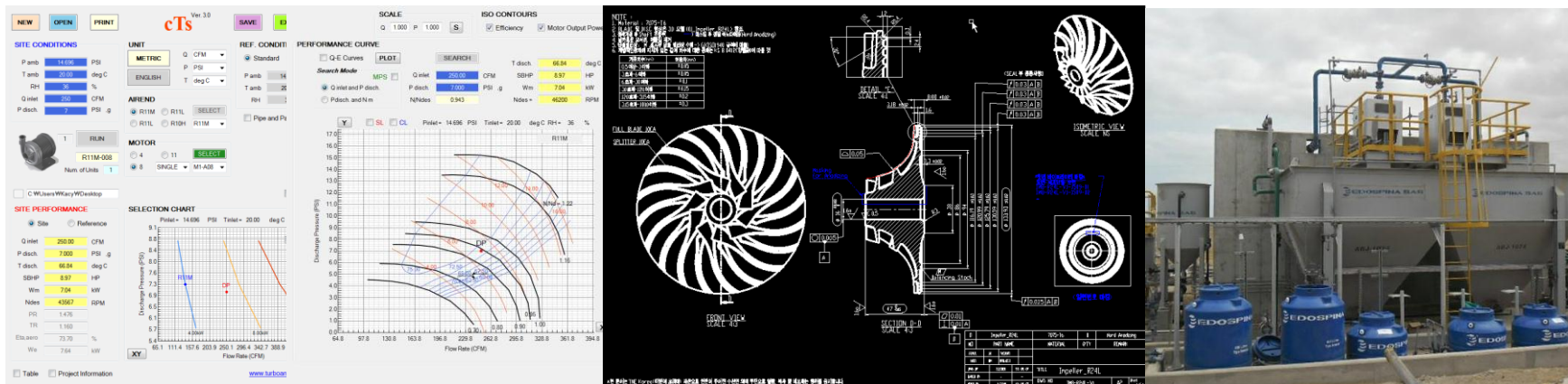
- Variable frequency driver allows variable operation mode to operate relevant flow rate and discharge pressure
- Modular design: Easy swap and troubleshooting
- Closed-loop vector control for the reliable starting of PMSM at various site power conditions



ENGINEERING SUPPORT



- Experience solid engineering team at TNE supports the application of the Compact High Speed Turbo Blower to the best interest of the customer
- Diagnostics and recommendation for the good fix of field issues caused by improper use of blower system
- Finding of root causes of field trouble by accessing the fundamentals of the core technology for the Compact High Speed Turbo Blower
- Seamless work from design, production, test and shipment for the maximum performance and excellent quality of product
- TEST Practice complies with ISO, ASME PTC10 and PTC13 standard



ENGINEERING FOR WATER & WASTE WATER APPLICATION



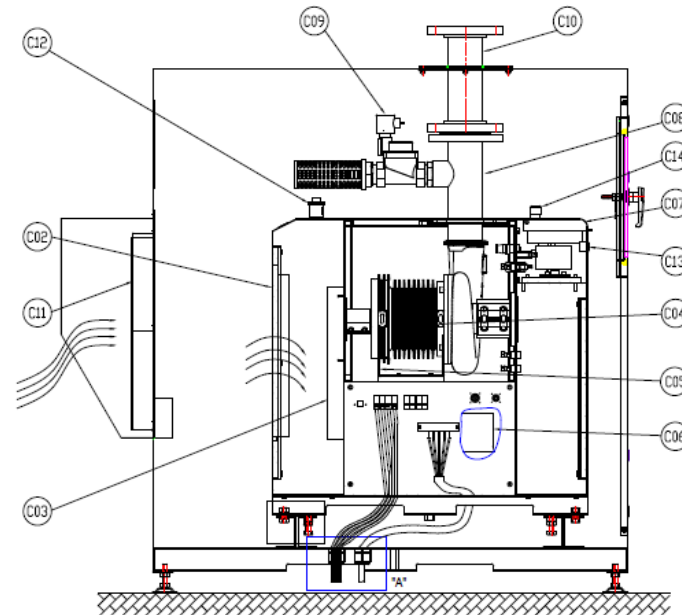
- Comply with frequent start and stop application such as filter backwash process in the waste water application.
- Fully open discharge operation; no minimum pressure limit
- Secure outdoor installation with stainless steel enclosure for rust proof which also meet with IP54 and IP56 standards
- Constant speed/Constant pressure/Constant DO
- Programmable start and stop cycle with time schedule
- Auto restart after the shutdown by site power cut-off
- Variable frequency driver allows variable operation mode to operate relevant flow rate and discharge pressure
- Trouble free operation at high altitude



OUTDOOR INSTALLATION



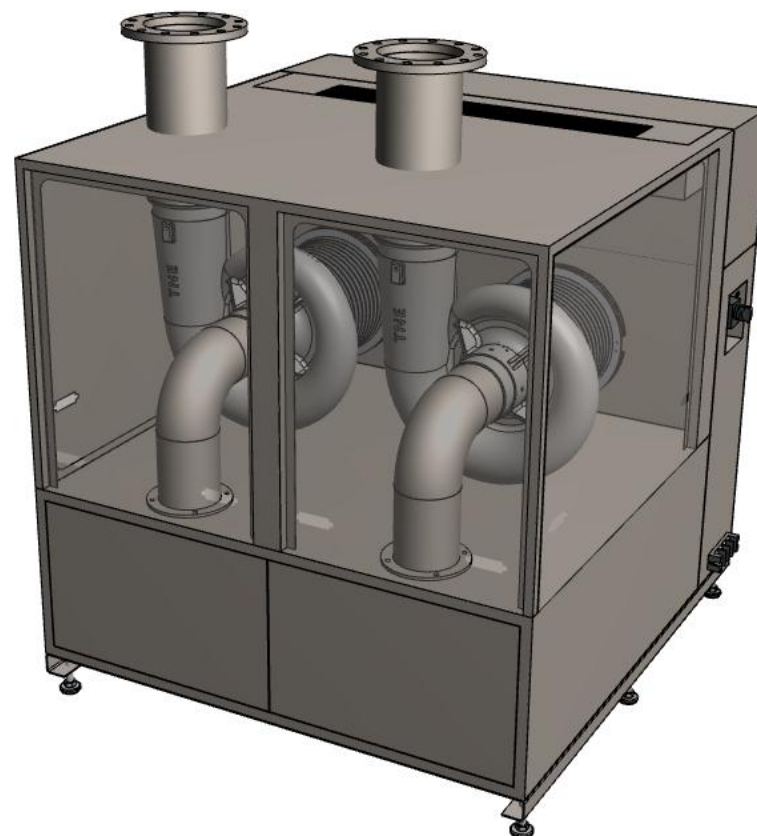
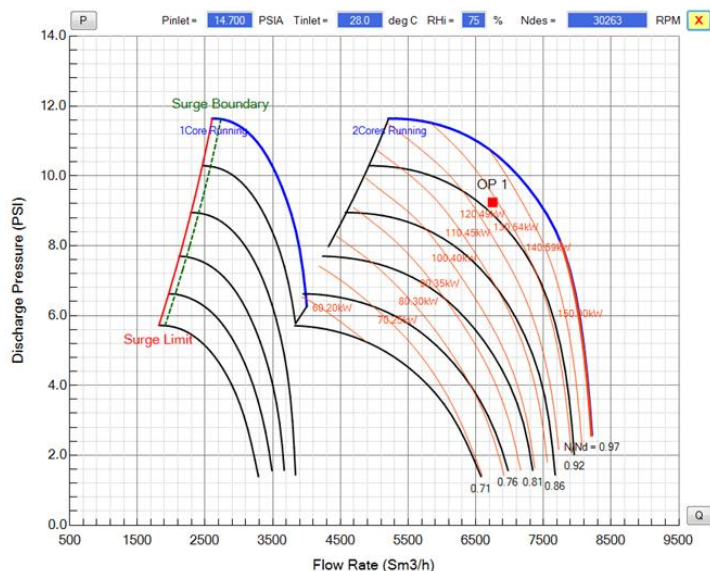
- External shelter for outdoor installation
- IP54/IP53 or equivalent protect for water and dust
- All stainless steel for rust proof application



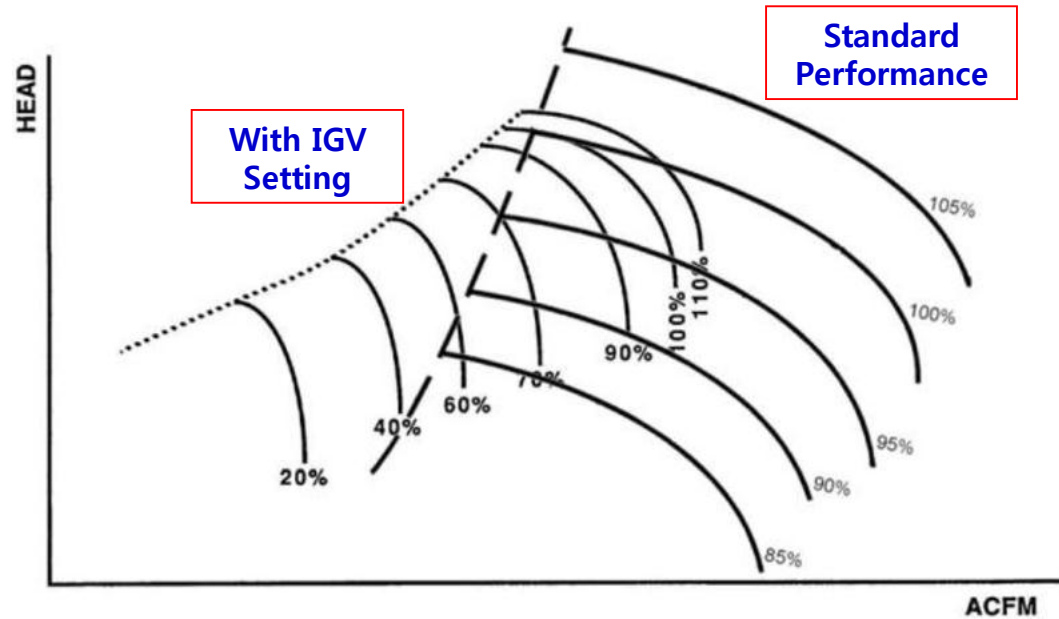
ENGINEERING MULTI-CORE PACKAGE



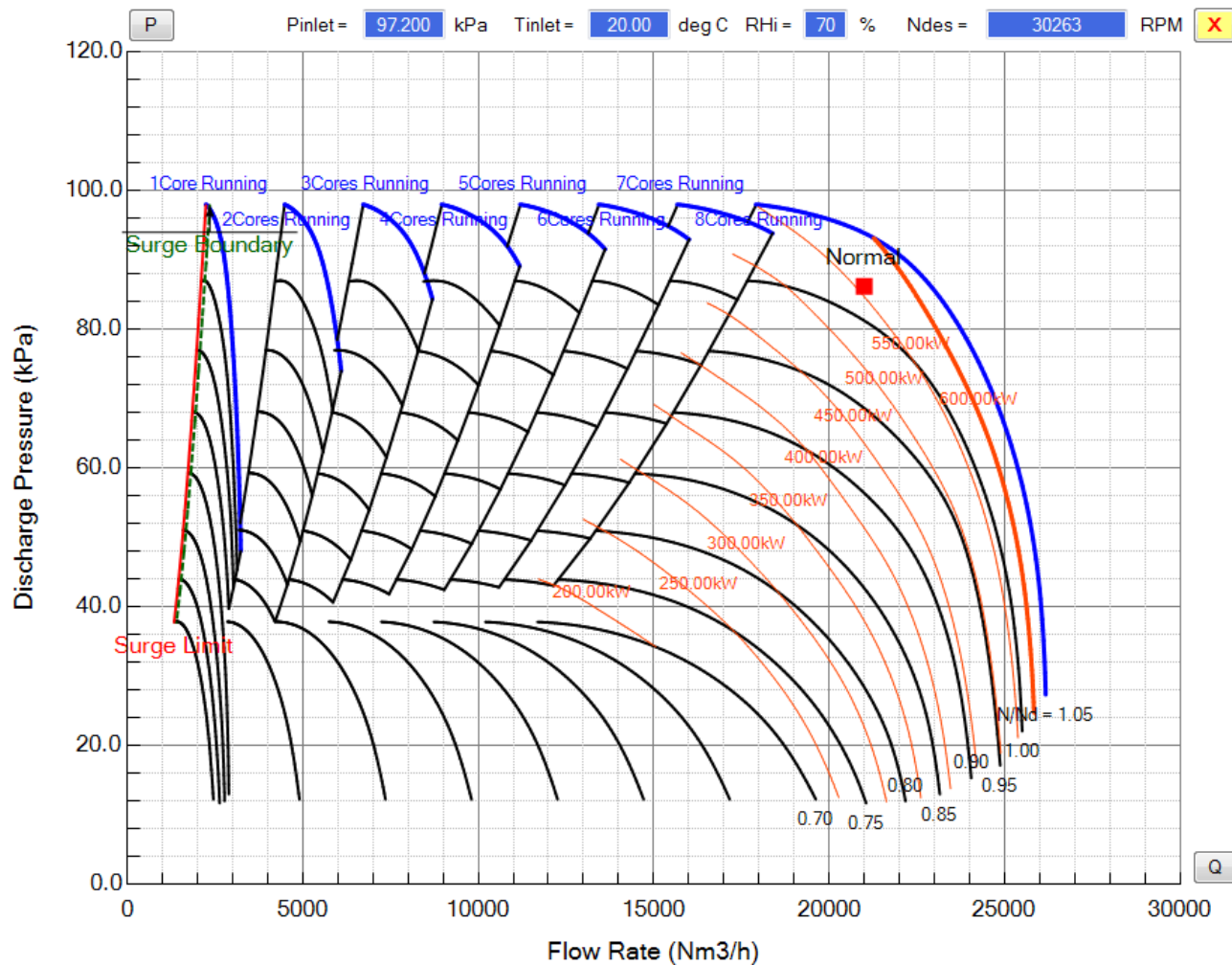
- Improvement on Turn-Down Ratio
- Operation at BEP (Best Efficiency Point)
- Better availability and Build-in Backup
- No dead zone at core transition period
- Ease of standardization
- Dual/Quad/Octa Core Packages



INLET GUIDE VANE



ENGINEERING MULTI-CORE PACKAGE

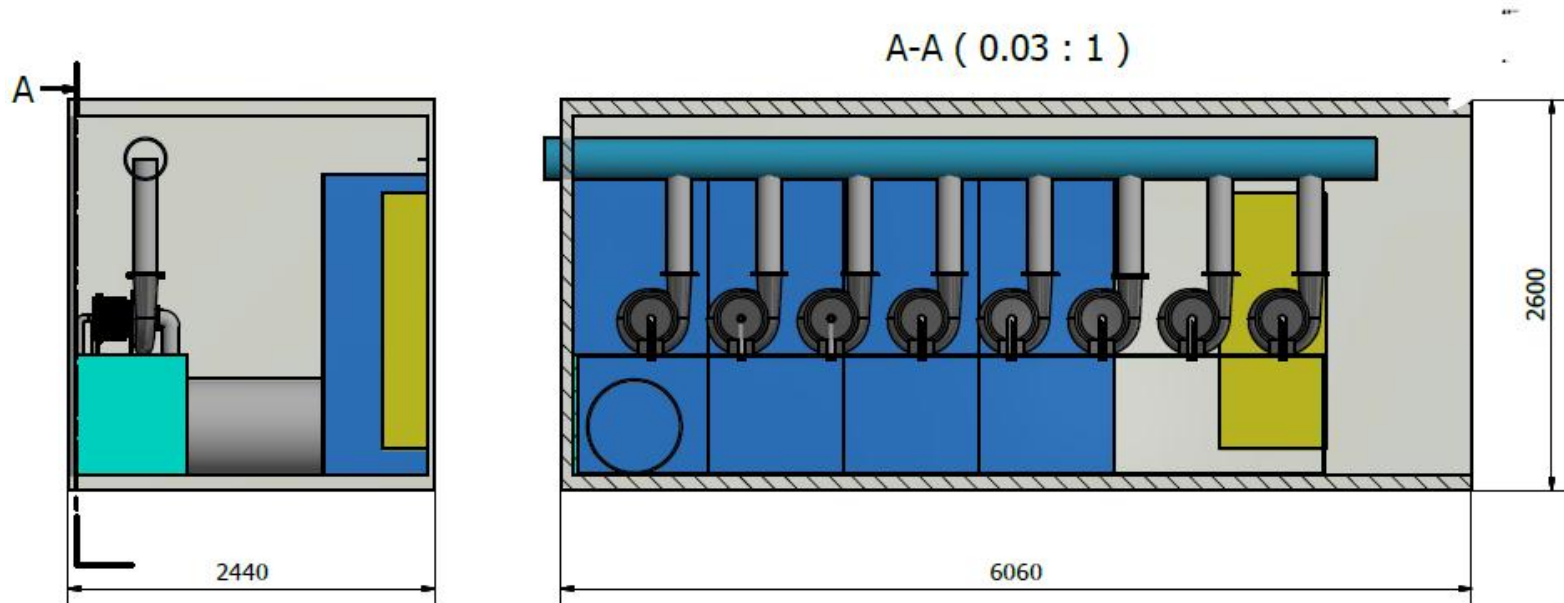


ENGINEERING MULTI-CORE PACKAGE

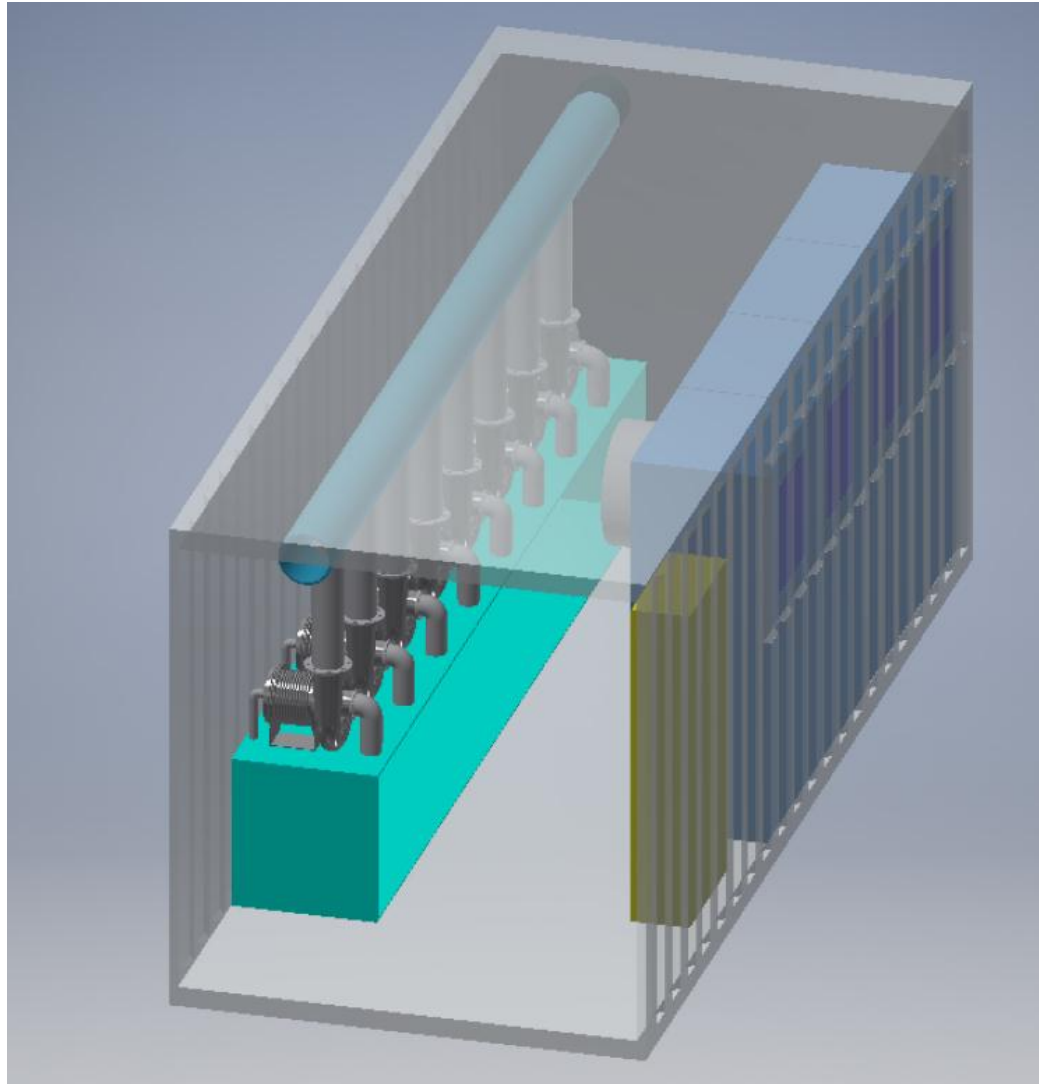


<u>PERFORMANCE DATA (1)</u>		NORMAL			
Gas to be compressed		amb. air			
Blower Load	%	100	80	60	40
Number of Core		8	7	5	3
Volumetric Flow for Single Core		21000	19200	20160	22400
Volumetric Flow	Nm ³ /h (wet)	21000	16800	12600	8400
	Nm ³ /h (dry)	-			
Volumetric Flow at blower suction	m ³ /h	-			
Variable flow	yes/no	YES			
Blower Inlet Pressure	kPa abs	97.2			
Blower inlet Temperature	°C	20			
Inlet Relative Humidity	%	70			
Minimum Discharge Pressure	kPa(g)	86.15			
Temperature at blower discharge	°C	89.32	89.37	89.17	90.36
Shaft power efficiency (2) (**)	%	83.93	83.87	84.11	82.69
Shaft power (2) (**)	kW	529.2	423.6	316.8	214.8
Impeller speed	RPM	30,889	30,375	30,617	31,513
Impeller tip speed	m/s	321	316	318	328
Motor speed	RPM	30,889	30,375	30,617	31,513

ENGINEERING MULTI-CORE PACKAGE



ENGINEERING MULTI-CORE PACKAGE



INSTALLATION MORE THAN 100 UNITS SINCE 2014



INSTALLATION WWTP APPLICATIONS



Coca Cola FEMSA, Aeration, Colombia




Chevron Petroleum, Aeration, Colombia

COMPETITIVE ADVANTAGES



(Based on 0.6 barG, 50 HP)

MANUFACTURER	TNE TURBO	PD Lobo 1	PD Lobo 2	PD Lobo 3	Screw 1
					
Blower Type (Model)	Air Bearing Turbo (R31M)	PD Lobe	PD Lobe	PD Hybrid	PD Screw
Flow Rate (m3/min)	35.6	28.1	27.4	27.2	30.9
Disch. Prs. (barG)	0.6	0.6	0.6	0.6	0.6
BSHP (HP)	47.1	47.1	47.1	47.1	47.1
Aero Efficiency (%)	85.0	67.3	65.6	65.1	74.0
Motor Power (kW)	37	39	39	39	37
Rel. Aero Eff.	1.00	0.75	0.73	0.72	0.87
Size (WxDxH, mm)	650x1130x1130	1530x1956x1681	1935x1600x1700	1500x1800x1900	1905x1245x1562
Weight (kg)	220	2,087	1,313* (Excl. Control Center)	1,020** (Excl. Motor&Belt Drive)	-
Repair & TS	On-site/Shop	On-site/Shop	On-site/Shop	On-site/Shop	On-site/Shop
Relative Price (Bare Unit)	1.0	0.7	0.7	0.7	-

COMPETITIVE ADVANTAGES (0.6 barG, 50 HP)



MANUFACTURER	TNE TURBO	Turbo 1	Turbo 2	Turbo 3	Turbo 4
					
Blower Type (Model)	Air Bearing Turbo (R31M)	Air Bearing Turbo	Air Bearing Turbo	Air Bearing Turbo	Air Bearing Turbo
Flow Rate (m3/min)	35.9	33	29.4	33	31.9
Disch. Prs.(kgf/cm2)	0.6	0.6	0.6	0.6	0.6
BSHP (HP)	47.1	47.1	47.1	47.1	47.1
Aero Efficiency (%)	84.5	77.7	69.2	77.7	75.0
Motor Power (kW)	37	37	37	37	37
Rel. Overall Eff.	1.00	0.92	0.90	0.92	0.89
Size (WxDxH, mm)	650x1130x1130	770x1550x1500	750x1600x1150	700x1050x1000	815x834x1350
Weight (kg)	270	540	-	250	540
Repair & TS	On-site/Shop	Shop	Shop	Shop	Shop
Relative Price	1.0	1.5	1.0	1.2	1.5

COMPETITIVE ADVANTAGES (0.6 barG, 30 HP)



MANUFACTURER	TNE TURBO	Turbo 1	Turbo 2	Turbo 3	Turbo 4
					
Blower Type (Model)	Air Bearing Turbo (R21L)	Air Bearing Turbo	Air Bearing Turbo	Air Bearing Turbo	Air Bearing Turbo
Flow Rate (m3/min)	20.6	19	17.5	18	N/A
Disch. Prs.(kgf/cm2)	0.6	0.6	0.6	0.6	
BSHP (HP)	28	28	28	28	
Aero Efficiency (%)	81.5	75.2	69.2	71.2	
Motor Power (kW)	22	22	22	22	
Rel. Overall Eff.	1.00	0.92	0.85	0.87	
Size (WxDxH, mm)	590x990x940	770x1070x1090	750x1530x1150	700x1050x1000	
Weight (kg)	220	280	-	250	
Repair & TS	On-site/Shop	Shop	Shop	Shop	
Relative Price	1.0	1.5	1.0	1.2	

CASE STUDY

- Replacement an existing PD blower with TNE Compact Turbo Blower
- Installed and tested at food processing company in South Korea
- Operation started on March 2015
- Water Treatment Capacity 20 ton/day



CASE STUDY



ITEMS	UNIT	BEFORE	AFTER
Number of Unit	EA	1	1
Flow Rate	m3/min	9	9
Discharge Pressure	kPa	60	60
Noise	dB(A)	105	80
Rated Motor Power	kW	15	11
Power Consumption ¹	kW	2,558.8	1,691.6
Savings of Electricity	%	-	33.9 %
Yearly Maintenance Cost	USD/Year	2,400	720

1. Based on the power measurement at the site over 18days on May 2014 (before) and 2015 (after)

AIR INLET FILTER SYSTEM

- Dual Filter System (Pre Filter + Main Filter)

- ❑ Air Inlet Pre Filter : Washable Fabric, 10 μ m

- ❑ Air Inlet Main Filter : HEPA Type, 3 μ m

- Non-corrosive material for air intake

- IP54 Class Package Sealing

- Easy Filter Condition Monitoring

- ❑ Filter Minder Indicator : 2.5kPa

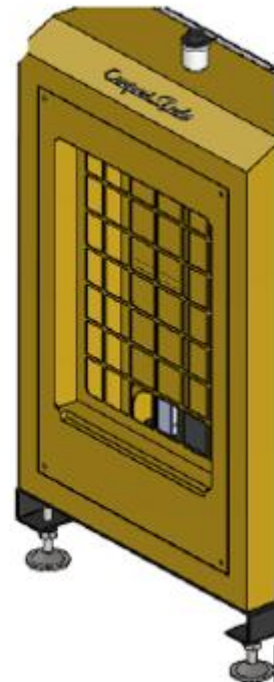
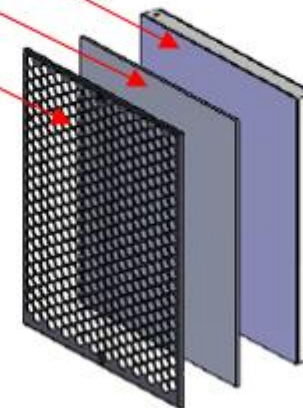


Pre Filter



Main Filter

Honey Form Panel
(Air Inlet Grill)



SUMMARY

- Changing Technology to Save Energy, Save World
- Reliable, Affordable Innovation
- Environment, Operator Friendly Product
- Thinking in long term



**Interdisciplinary
Product**



**Better and Consistent
Performance**



**Green Product
Standard**

PRODUCT FEATURES



Industry Friendliness

*A Wide Range of Discharge Pressure from 40kPa to 250kPa
High Efficiency and Energy Saving
Compact & Light Weight*



Environment Friendliness

Oil-Free, Low-Vibration, Low-Noise, Low Waste material



User Friendliness

Worry-Free protection, Simple UI, Local and Remote Operation



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THANK YOU

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