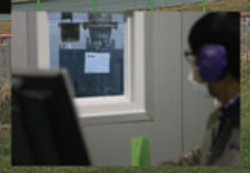

World Best Efficiency
Permanent Magnet Motor
Airfoil Bearing
No Gear
100% Oilless System
No Vibration
Low Noise
Compactness
Advanced Design
TC /TCL Series
The Highest Efficiency Turbo Compressor

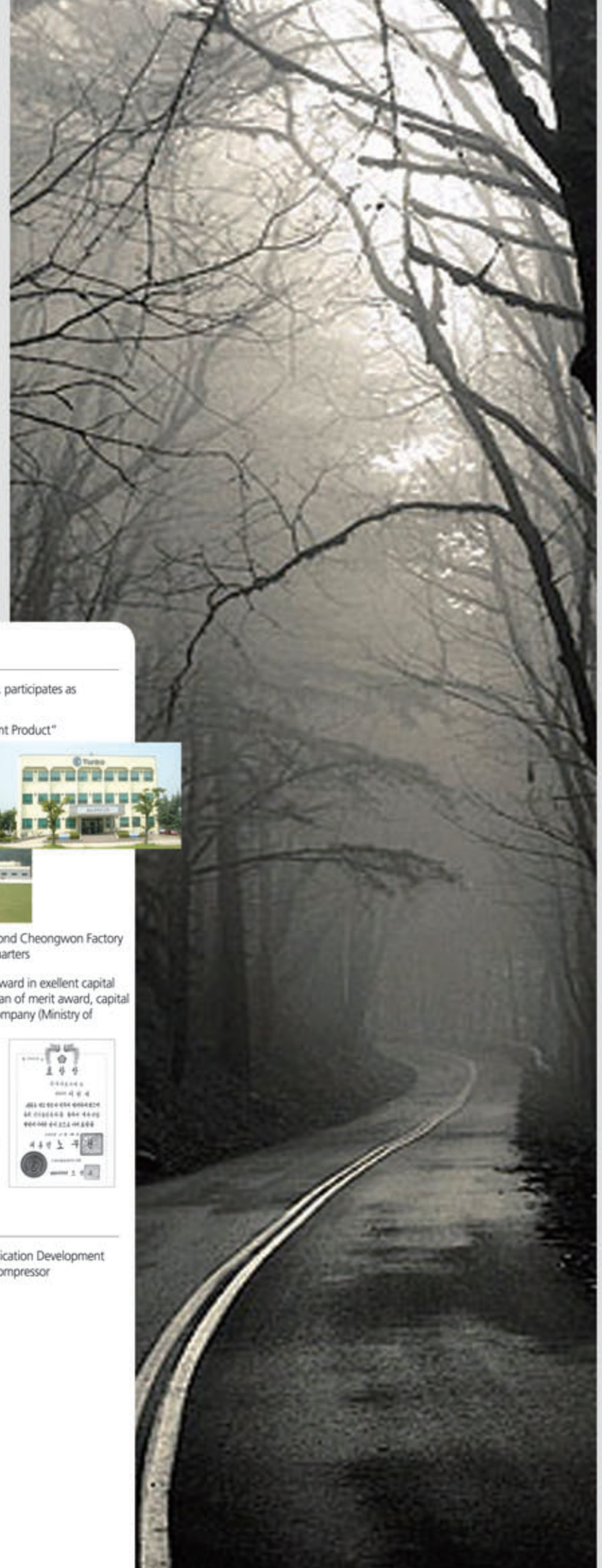
K Turbo

Technology that nurture mankind and
nature is what K Turbo aiming.

K Turbo is looking beyond techonlogy
that will last centuries.



Company History



1997 - 2004

1997 12 Powertech founded

1999 12 Becomes a corporation
(Kturbo INC. 500million won as paid in capital)

2000 10 Development of Precision Impeller casting technology

2001 01 Development of Bump Type Air Bearing (20HP, 30HP, 50HP)

02 Development of 20HP Turbo Blower

07 Awarded the Presidential Award in the "New Tech Korea 2001"

08 Completion of Cheongwon Factory

2002 07 Authorized as an INNO-BIZ company

2003 01 Commercialization of Turbo Blowers Series

2004 03 ISO 9001 : 2000 certified

11 "Excellent Machinery" Certification (Ministry of Commerce, Industry & Energy)

Engineer of the Month (Minister of Science and Technology award)

2005 - 2010

2005 01 SungShin Cement INC. participates as a stakeholder

04 EP selected as "Excellent Product" (from Public Procurement Service)

05 Completion of the second Cheongwon Factory and transfer of headquarters

11 2005 Prime Minister Award in exellent capital goods development man of merit award, capital goods development company (Ministry of Commerce, Industry and Energy)

12 New Technology Commercialization Award and the President Award (Ministry of Commerce, Industry and Energy)

2006 10 ISO 14001:2004 Certification Development of Proto Type Turbo Compressor

2007 08 Turbo Blower certified as an high-efficient material (Korea Energy Management Corporation)

10 CE certification (Turbo Blower)

12 CE certification (Turbo Compressor)

2008 06 NRTL Certification (Turbo Blower)
Korea Environmental Management Award in small business sector from the Prime Minister (Minister of knowledge and Economy, Minister of Environment)

2009 12 Kturbo USA Inc. founded

2010 12 "Tower of 5 million USD Exports" awarded on the 47th Trade Day
Major shareholder changed

(SungShin Cement ⇒ Heon Seok Lee)

2011 ~

2011 01 Sale of Blower franchise (Aerzen GmbH), production of Aerzen OEM in Korea, Japan and other regions

02 Retirement of paid in capital
(3.6 billion won⇒2.3 billion won)
Construction of a new factory approved and started
(Choungbuk Cheong-gun, GaDeok-myeon)

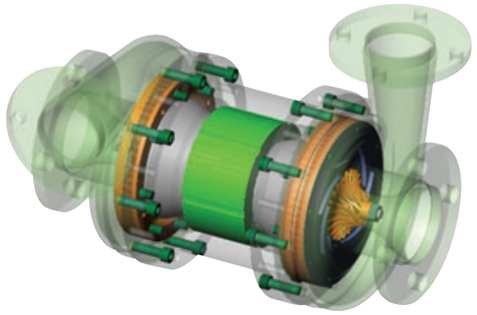
05 License acquired for manufacturing chiller compressor

12 Headqurters moved to the new factory
(64-2, HaengJeong-ri, GaDeok-myeon, Cheongwon-gun, Chungbok)

"Tower of 10 million USD Exports" awarded on the 48th Trade Day
Exellent Small Business Award from Chungcheongbuk-do

2012 04 Building completion ceremony of the new factory

Features



World Best Efficiency

KTurbo TC & TCL series are world's only and most advanced turbo compressor based on high speed focused specialized technology. Concurrently designed impeller, motor, bearing and VFD are the key of our high efficiency. Due to it's high rotational speed requirements, all components should have been redesigned considering high speed surge protection; all those were new challenges in order to overcome high speed difficulties. Now KTurbo TC & TCL series are the world's only blower which satisfies all technical requirements and efficiency.

Oilless Operation

Thanks to air foil bearings, ISO 8573-1 class 0 is over satisfied.

Flow Meter Installed

Bell mouth flow meter is installed and shows instantaneous flow rate with ±0.5% tolerance

Real High Rise-to-Surge

The most advanced current based control method enables an active high rise-to-surge advantage. This is a critical feature required by pneumatic conveying and MBR applications.

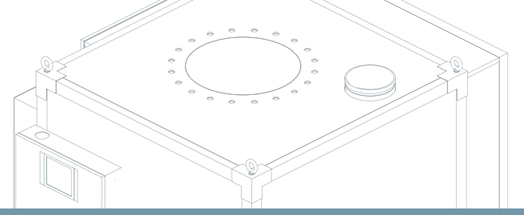
Compactness

TC & TCL series are world's most compact compressors reducing construction costs and space requirements.

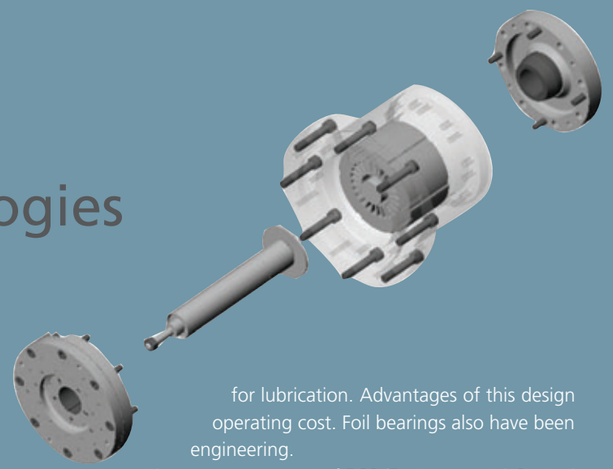
Semi-Permanent Life

TC & TCL series can be used ermanently with proper maintenance without performance degradation. Stainless steel impellers and packaging insure durability and allow for permanent life.

- Aeration System
- Pneumatic Conveying
  - Fermentation
  - Drying & Silo Fluidization
- Process Air
- Flue Gas Desulphurization

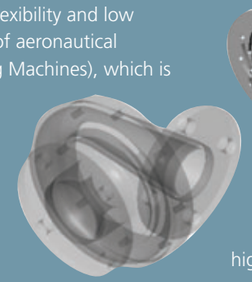


Core Technologies



The Most Advanced Hydrodynamic Air Bearing

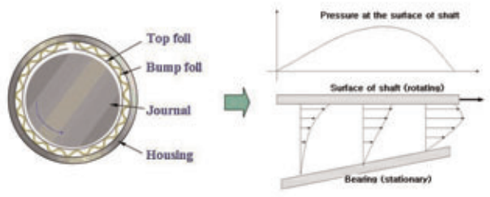
The foil bearing uses air rather than oil for lubrication. Advantages of this design includes that of flexibility and low operating cost. Foil bearings also have been used in the field of aeronautical engineering.
ACM (Air Cooling Machines), which is the core component of ECS (Environmental Control System) for air craft, have utilized air foil bearings since 1960's. The foil bearings allow a stable operation without the use of oil, eliminates contamination inside of the cabin and provide long term operation without maintenance.

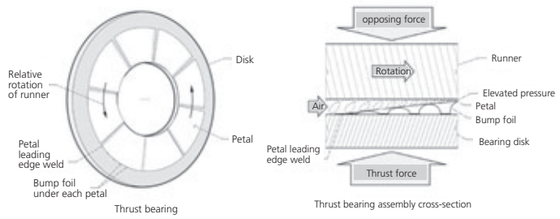


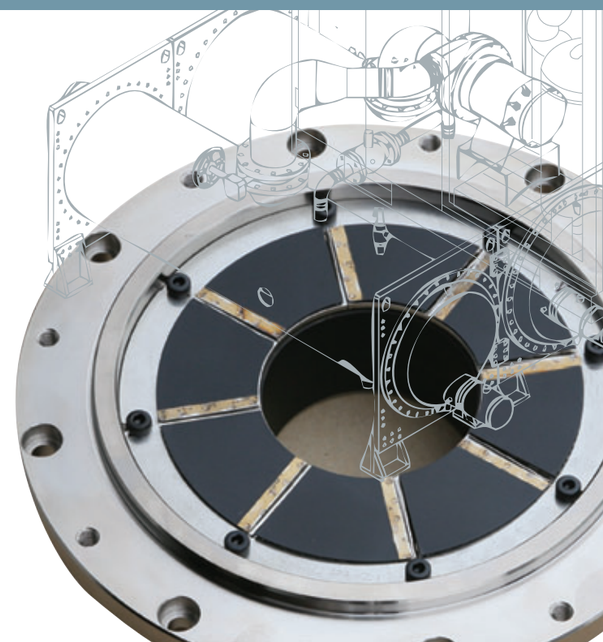
Air foil bearing can operate under much higher temperature than oil bearing. As a result, air foil bearing is the best solution for high speed motor which require operation in extreme environment of high speed and high temperature.

The working principle of foil bearings is similar to hydrodynamic tilting pad oil bearings which are used for classical gear increasing high speed machines. Because foil bearings are using surrounding air instead of oil to support the shafts., they need larger diameters and lengths and special damping mechanism. During start / stop direct contact between the shaft and bearing surface occurs. To protect bearing surfaces during start / stop dry lubricant coating is applied due to its vibration characteristics.

Our improved technology of life time extension ensures 10 years continuous operation.

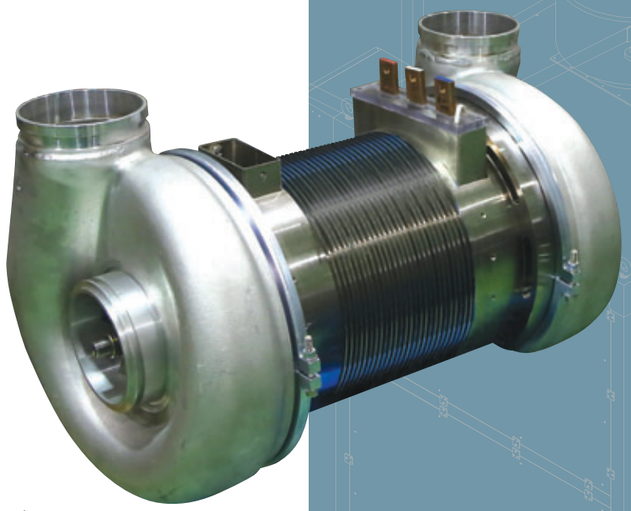






Features

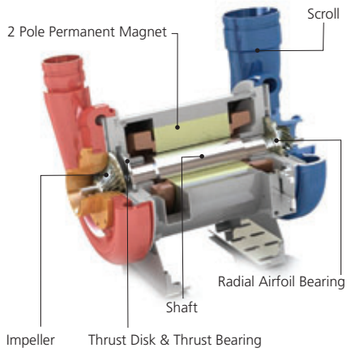
High Efficiency PM (Permanent Magnet) Motor



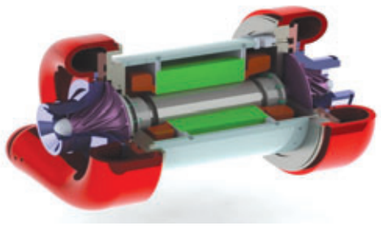
The permanent magnet makes it possible to have even higher efficiency (>95%) over an entire operating range.
Due to KTurbo's high efficiency design and manufacturing, heat generation from the motor is much smaller compared to other regular PM motors. Hence, air cooling was made possible and is the standard for all the models up to 600hp. Main benefits of an air cooling system include higher safety and less maintenance.

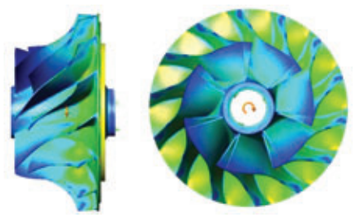
Optimized Sensorless VFD

Our high speed focused, optimized VFD needs very small starting current (< 5% Full load current) and provides very High Efficiency (>96%), which helps to reduce electric facility costs.
Because our most advanced high efficiency motor design requires minimum cooling efforts, the motor cooling air has a surplus capability allowing for cooling of the VFD before the air is used for motor cooling. We do not have VFD cooling fans which allows to minimize maintenance cost and increase total efficiency



Scroll Casing	AC4CH Aluminum Alloy
Impeller	17-4 PH Stainless Steel
Shaft & Balanced	Titanium Alloy
Airfoil Bearings	Stainless Steel with Plasma Coat
Base plate	Structural Steel
Casing	Min. ratings of 20 PSIG
Compressor Discharge Spool and Elbow	Steel, ASTM A 36





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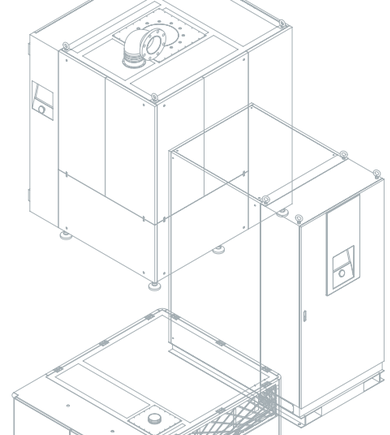
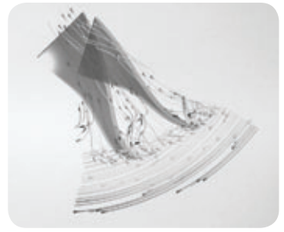


Casted Stainless Impeller (17-4PH)

We are using aerospace class high tensile strength (980 Mpa) stainless steel for impellers. Because the impeller material strength is critically important design factor for high efficiency, we have developed new technology of stainless steel impeller casting for Mass-Customization. Thanks to its very high strength margin as a blower, we could design with very thin blade and highly curved design for maximum efficiency. One example of 17-4PH is that all standard industrial turbo air compressors are using 17-4PH cast impellers and its speed and pressure is much higher than blowers.

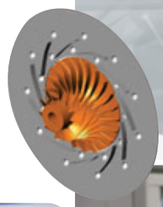


Permanent Magnet

SmCo is used in the rotor, which has very good high temperature characteristics. Even under very high temperature and high loading condition, SmCo magnet is not demagnetized and very stable. But, because it is very brittle, very high precision manufacturing process is required.

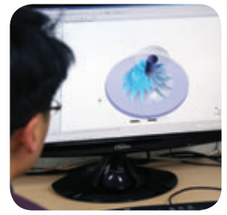
Bearing

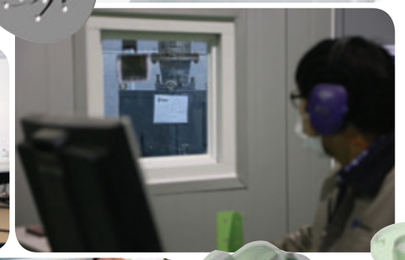
Regular TB series are using stainless steel for bearing parts. However, high pressure models are using high temperature material like incornel.

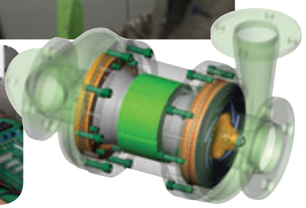


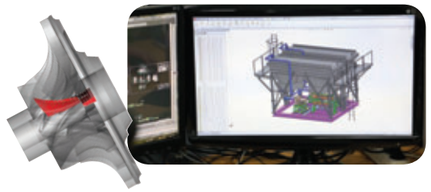
Bearing coating

Teflon-S has been successfully adopted for radial and thrust bearing for 8 years.
The bearing surface shows different level of performance according to actual coating process.
We have developed stable standardized manufacturing process which are optimized for foil bearing application.





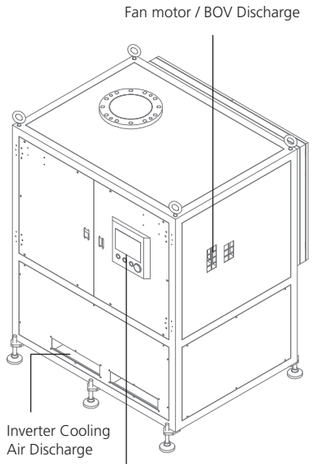




Machine Components

Machine Components

Front View



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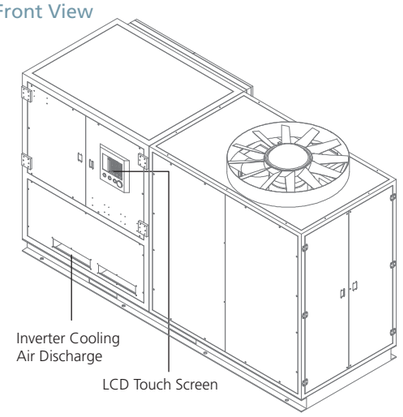

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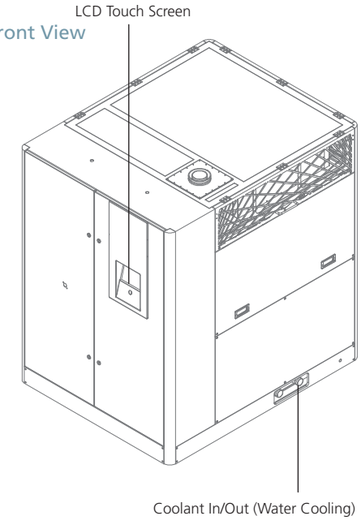
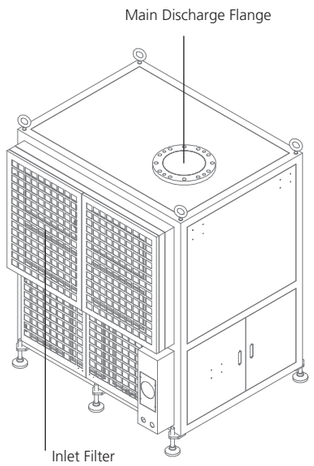


Rear View



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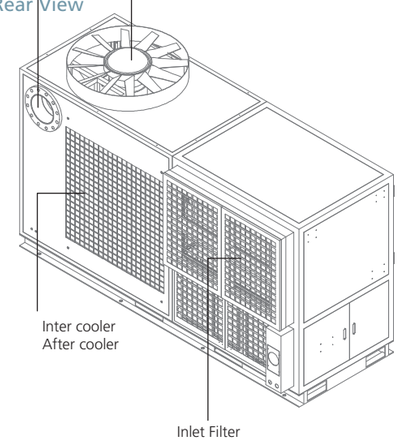
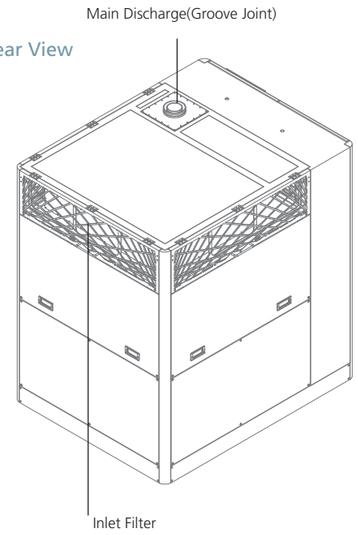
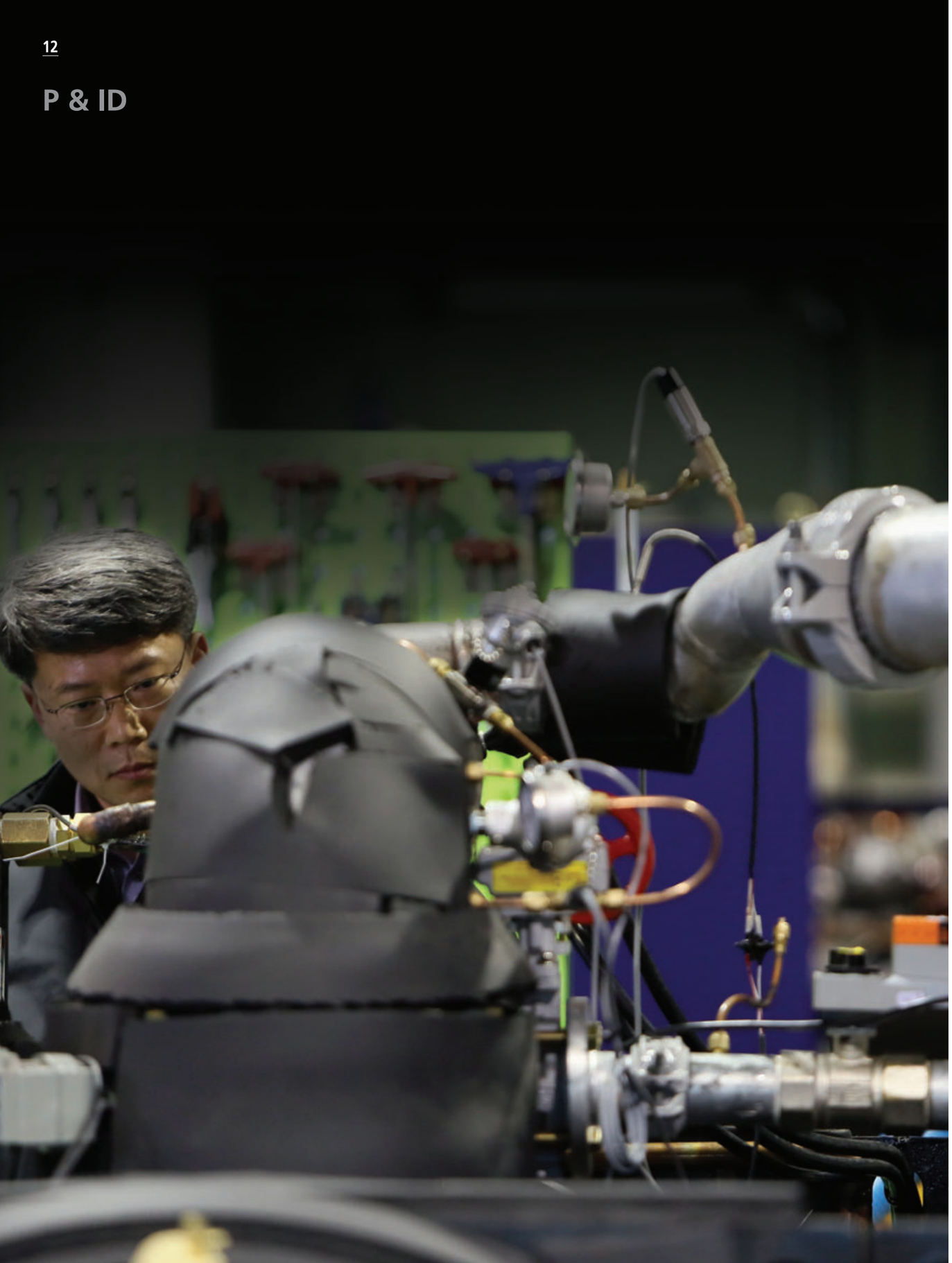


Rear View



P & ID



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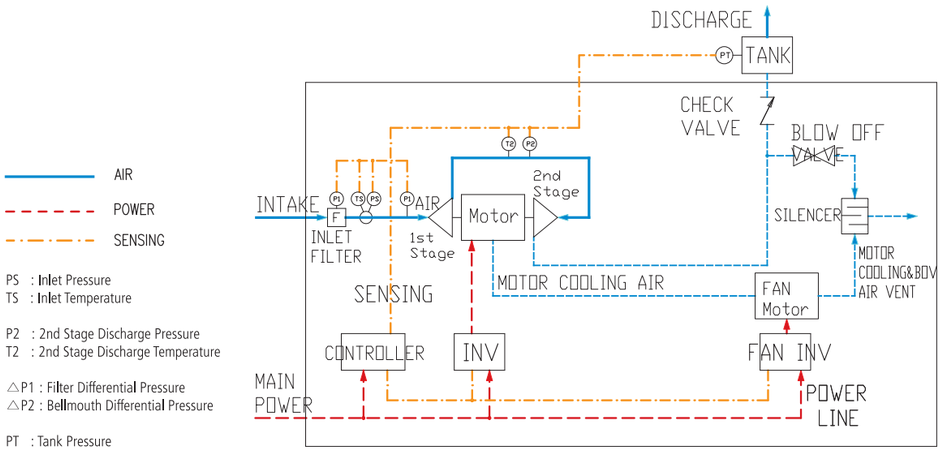
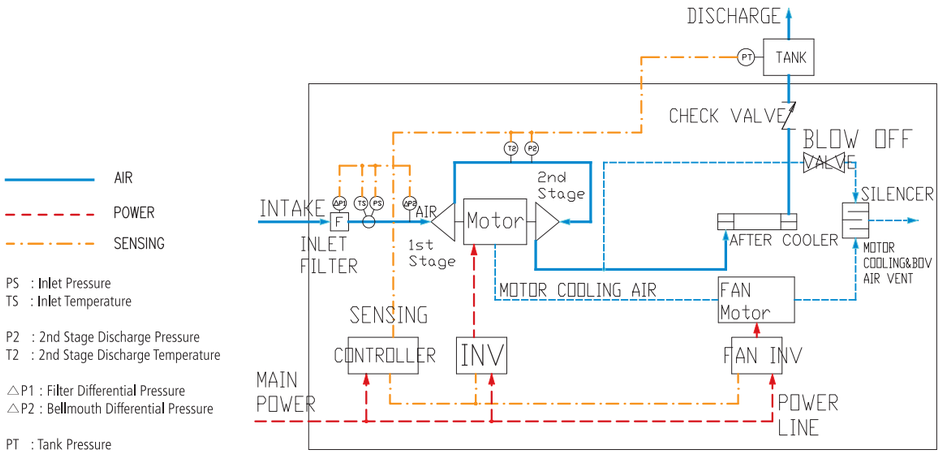

AIR
POWER
SENSING
PS : Inlet Pressure
TS : Inlet Temperature
P2 : 2nd Stage Discharge Pressure
T2 : 2nd Stage Discharge Temperature
△P1 : Filter Differential Pressure
△P2 : Bellmouth Differential Pressure
PT : Tank Pressure
DISCHARGE
TANK
CHECK VALVE
BLOW OFF VALVE
SILENCER
INTAKE
INLET FILTER
AIR
1st Stage
2nd Stage
Motor
MOTOR COOLING AIR
FAN Motor
MOTOR COOLING&BOV AIR VENT
SENSING
CONTROLLER
INV
FAN INV
MAIN POWER
POWER LINE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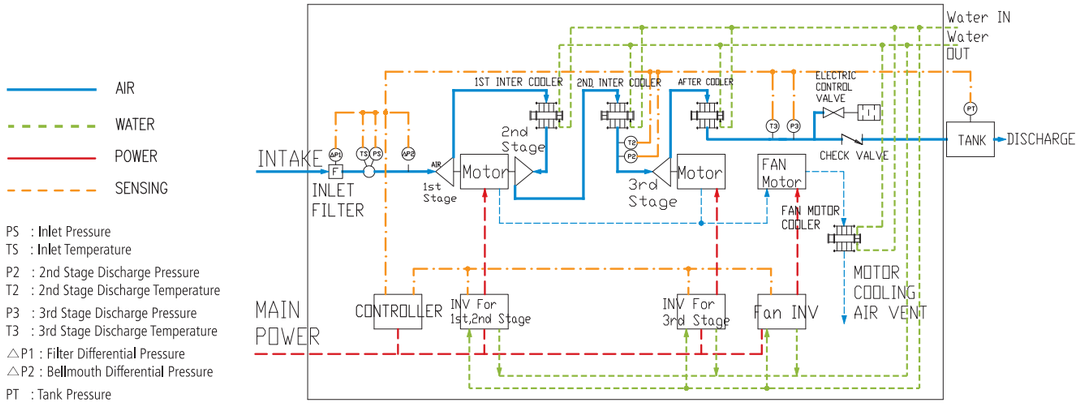
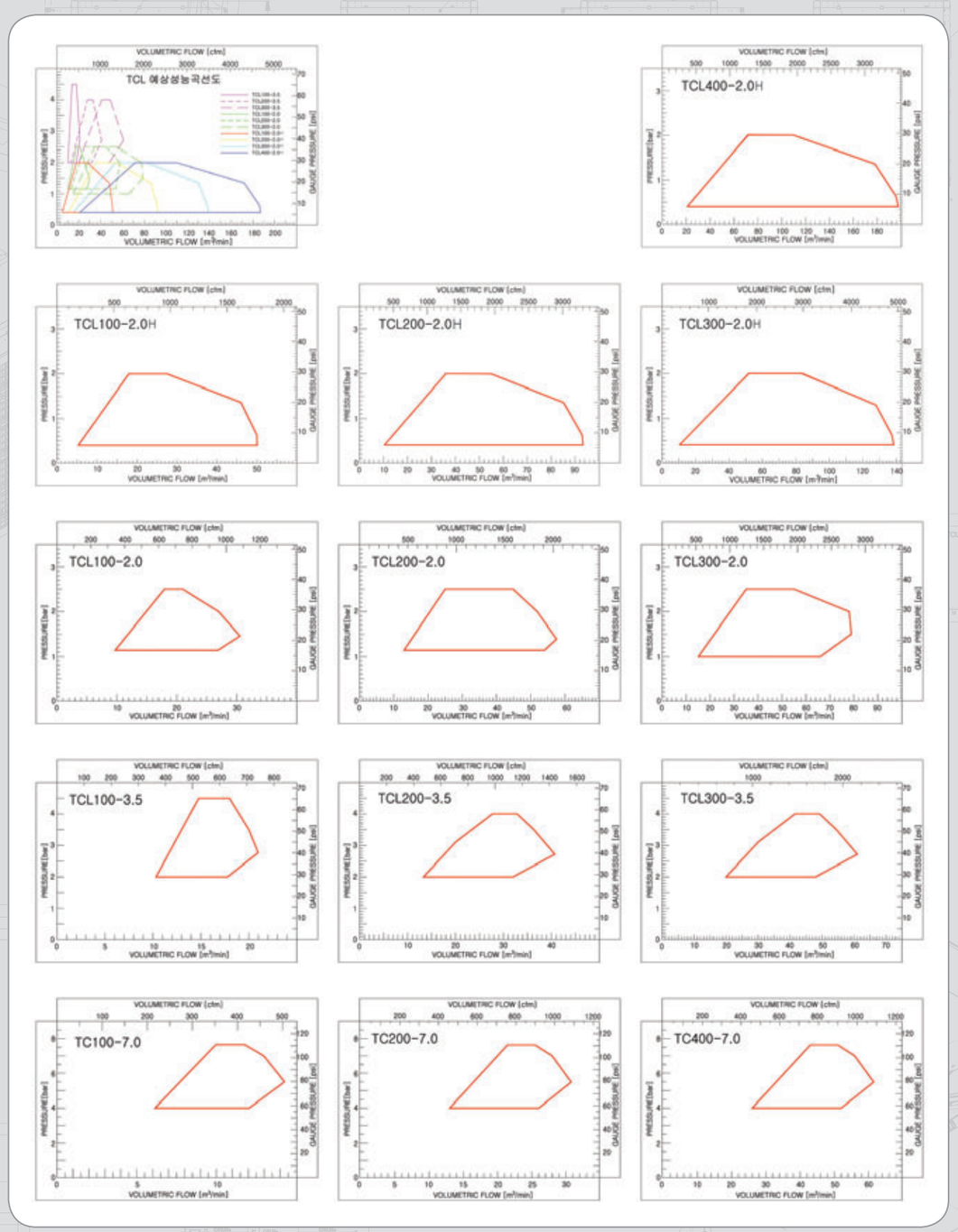
INV
FAN INV
MAIN POWER
POWER LINE


AIR
WATER
POWER
SENSING
PS : Inlet Pressure
TS : Inlet Temperature
P2 : 2nd Stage Discharge Pressure
T2 : 2nd Stage Discharge Temperature
P3 : 3rd Stage Discharge Pressure
T3 : 3rd Stage Discharge Temperature
△P1 : Filter Differential Pressure
△P2 : Bellmouth Differential Pressure
PT : Tank Pressure
Water IN
Water OUT
1ST INTER COOLER
2ND INTER COOLER
AFTER COOLER
ELECTRIC CONTROL VALVE
TANK
DISCHARGE
INTAKE
INLET FILTER
AIR
1st Stage
2nd Stage
3rd Stage
Motor
CHECK VALVE
FAN Motor
FAN MOTOR COOLER
MOTOR COOLING AIR VENT
MAIN POWER
CONTROLLER
INV For 1st,2nd Stage
INV For 3rd Stage
Fan INV

Performance

The research of K Turbo which presents the final standard of energy machine will be continued.

Performance



Performance

1. Test condition calculation

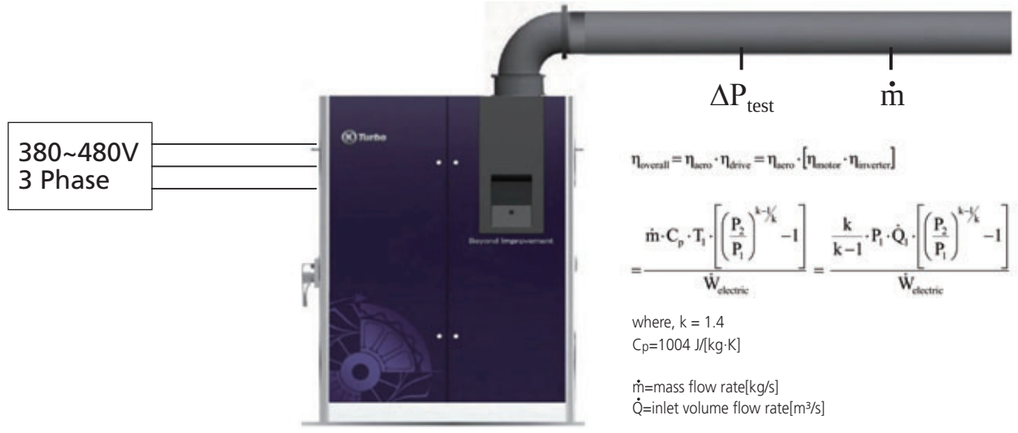
$$\dot{Q}_{test} = \dot{Q}_c \cdot \sqrt{\frac{T_{test}}{T_{std}}} \qquad \Delta P_{test} = \Delta P_c \cdot \frac{P_{test}}{P_{std}}$$

2. Running on the test condition (volume flow rate, discharge pressure)

- Flow rate is measured by intake bell mouth or other type of flow meter.
- Discharge static pressure is measured after diffusing cone.
- Total kW is measured at the package inlet electric input after the harmonic filter.
- Ambient temperature and pressure is measured by sensors specially tuned for ambient condition.

3. Calculate total efficiency.

- Humidity effect is included when mass flow rate is calculated.



$$\eta_{overall} = \eta_{aero} \cdot \eta_{drive} = \eta_{aero} \cdot [\eta_{motor} \cdot \eta_{inverter}]$$

$$= \frac{\dot{m} \cdot C_p \cdot T_1 \cdot \left[\left(\frac{P_2}{P_1} \right)^{k-1/k} - 1 \right]}{\dot{W}_{electric}} = \frac{\frac{k}{k-1} \cdot P_1 \cdot \dot{Q}_1 \cdot \left[\left(\frac{P_2}{P_1} \right)^{k-1/k} - 1 \right]}{\dot{W}_{electric}}$$

where, k = 1.4
C_P=1004 J/[kg·K]

$\dot{m}$=mass flow rate[kg/s]
$\dot{Q}$=inlet volume flow rate[m³/s]

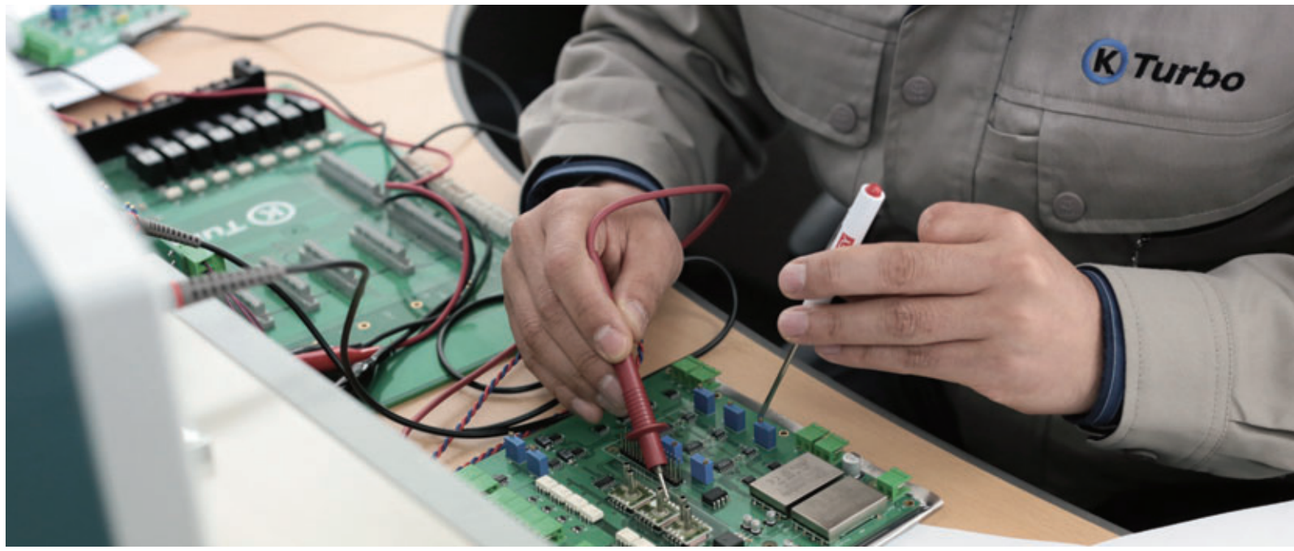
Measurement

Pressure	PTC 19.2	USA
Temperature	ASME PTC 19.5	USA
Flow Rate (Differential pressure type of flow meter and its calculation)	ASME MFC-3M	USA
	BS 1042	G.B
	DIN VDI / VDE 2040	GERMANY
	ISO 5167	International
	KS B ISO 5167	KOREA
	JIS Z 8762, 8763	JAPAN

Performance

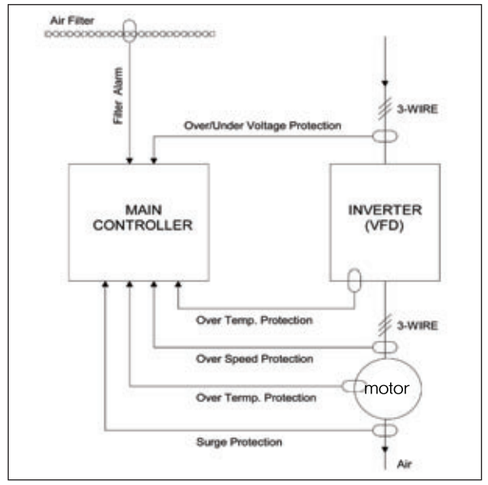
Test Calculation (Operating condition correction, Gas Conversion)	ASME PTC 10	USA
	ISO 5389	International
	KS B ISO 5389	KOREA
	DIN VDI 2045	GERMANY
Test Method (Flow Meter, Flow Calculation, Overall Efficiency)	JIS B 8340	JAPAN
	KS B 6350	JAPAN

Safeties & Maintenance



Air Filter Change Alarm
Surge Protection
- Surge line detection
- High speed differential pressure behavior detection

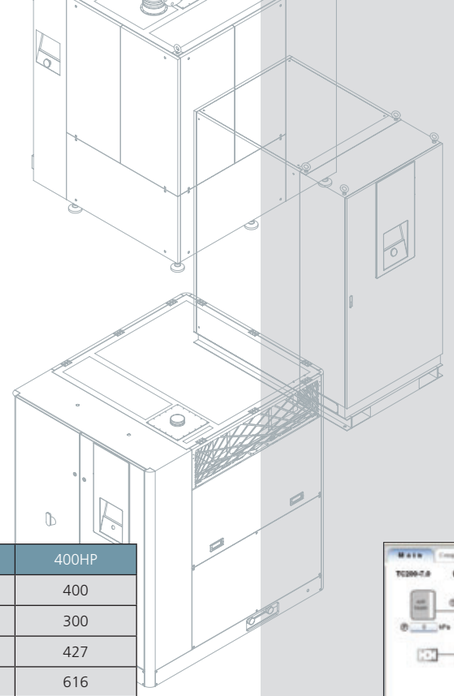
Over-Voltage / Under-Voltage Protection
Over Speed Protection
Motor Over Temperature Protection
Inverter Over Temperature Protection



Service	Period
Impeller Cleaning Bearing Inspection	2 Years
Bearing Overhaul	10 Years
Standard Filter	3~6 Months
Cooling Fan	2 Years
Electric Capacitor	5 Years (Full power continuous operation)

	TC / TCL
Standard	99% (10㎛ (68% @ 2㎛)
Configuration	Two Stage
Pressure Drop	44mm (1.73 inch) H2O
Maintenance	3~6 Months

Electric Data

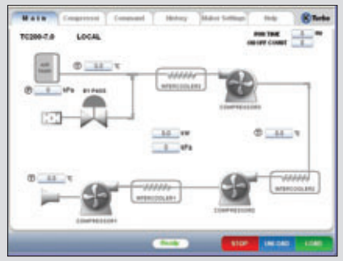


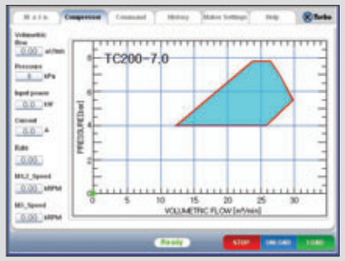
		100HP	200HP	300HP	400HP
Motor Rating	[HP]	100	200	300	400
	[KW]	75	150	224	300
Output Ratings	Capacity [KVA] (1)	107	213	320	427
	Current [A]	154	308	462	616
Input Ratings	Voltage	3Ø 380 ~ 480V (optional 600V)			
	Frequency	50/60 Hz (±5%)			
Cooling method		Forced air cooling			

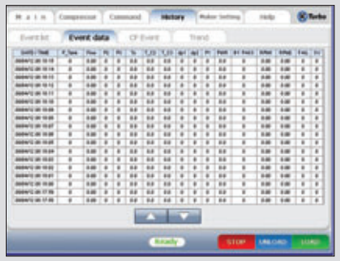
Environment	Ambient temperature	−10℃ ~ 40℃ (14℉ ~ 104℉)
	Storage temperature	−20℃ ~ 65℃ (−4℉ ~ 149℉)
	Ambient humidity	Less than 90% RH Max. (Non−Condensing)
	Altitude-Vibration	Below 1,000m (3,300ft), Below 5.9㎨ (0.6G)
	Application site	Pollution degree 2 / No corrosive gas, combustible gas, oil mist, or dust

Class	Total Harmonics	Power Factor	Configuration	Remarks
Level 1	I_THD < 35%	PF < 0.95	DC Choke	KTurbo Standard
Level 2	I_THD < 12%	PF < 0.98	Passive Harmonic Filter	Recommend ; full passive element with high efficiency
Level 3	I_THD < 5%	PF < 0.99	Active Harmonic Filter	Not Recommend •1.8% energy loss •When active filter is failed, bypass capability provide power to the compressor. So it is safer than PWM converter
Level 4	I_THD < 3%	PF < 0.99	PWM Converter	•1.8% energy loss •If the PWM converter has trouble, there is no way to supply power to the compressor

Controls / Specification







Model			TCL100-2.0H	TCL200-2.0H	TCL300-2.0H	TCL400-2.0H	TCL100-2.0	TCL200-2.0	TCL300-2.0	TCL100-3.5	TCL200-3.5	TCL300-3.5	TC150-7.0	TC200-7.0	TC400-7.0
Dimension	L	mm (inch)	910 (35.8)	1106 (43.5)	1270 (50.0)	2212 (87.0)	1260 (49.6)	1090 (42.9)	1110 (43.7)	1090 (42.9)	1260 (49.6)	1260 (49.6)	1987 (78.2)	1577(62.1)	2093 (82.4)
	W	mm (inch)	950 (37.4)	1090 (42.9)	1484 (58.4)	2180 (85.8)	2096 (82.5)	2408 (94.8)	3270 (128.7)	2096 (82.5)	2196 (86.5)	2787 (109.7)	1987 (78.2)	1577(62.1)	2093 (82.4)
	H	mm (inch)	1611 (63.4)	1683 (66.3)	1680 (66.1)	3366 (132.6)	1670 (65.7)	1895 (74.6)	1947 (76.6)	1770 (69.7)	1670 (65.77)	1805 (71.1)	1987 (78.2)	1577(62.1)	2093 (82.4)
Inlet Flow Rate	m³/min		29	58	87	116	29	58	87	20	40	60	21	29	58
	cfm		1024	2048	3072	4096	1024	2048	3072	706	1413	2119	742	1024	2048
Discharge Flow Rate	m³/min		9.25	19.50	29.26	39.00	12.58	25.16	37.74	4.49	8.98	13.47	2.66	3.67	7.33
	cfm		327	689	1033	1378	444	886	1333	159	317	476	94	130	259
Discharge Pressure	kPa		200	200	200	200	200	200	200	350	350	350	700	700	700
	psi		29.01	29.01	29.01	29.01	29.01	29.01	29.01	50.76	50.76	50.76	101.53	101.53	101.53
Discharge Pipe Size	SI (A)		150	200	250	300	200	150	300	100	125	150	80	100	150
	ANSI (inch)		6	8	10	12	8	10	12	4	5	6	3.2	4	6
Discharge Temperature	℃		27	27	27	27	114	114	27	27	27	27	27	27	27
	℉		81	81	81	81	237	237	81	81	81	81	81	81	81
Cooler Amount			-	-	-	-	1	1	1	2	2	2	Main : 3 Sub : 2	Main : 3 Sub : 2	Main : 4 Sub : 2
Cooling Type							Air	Air	Air	Air	Air	Air	Water	Water	Water

Client

K Turbo Ethics

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