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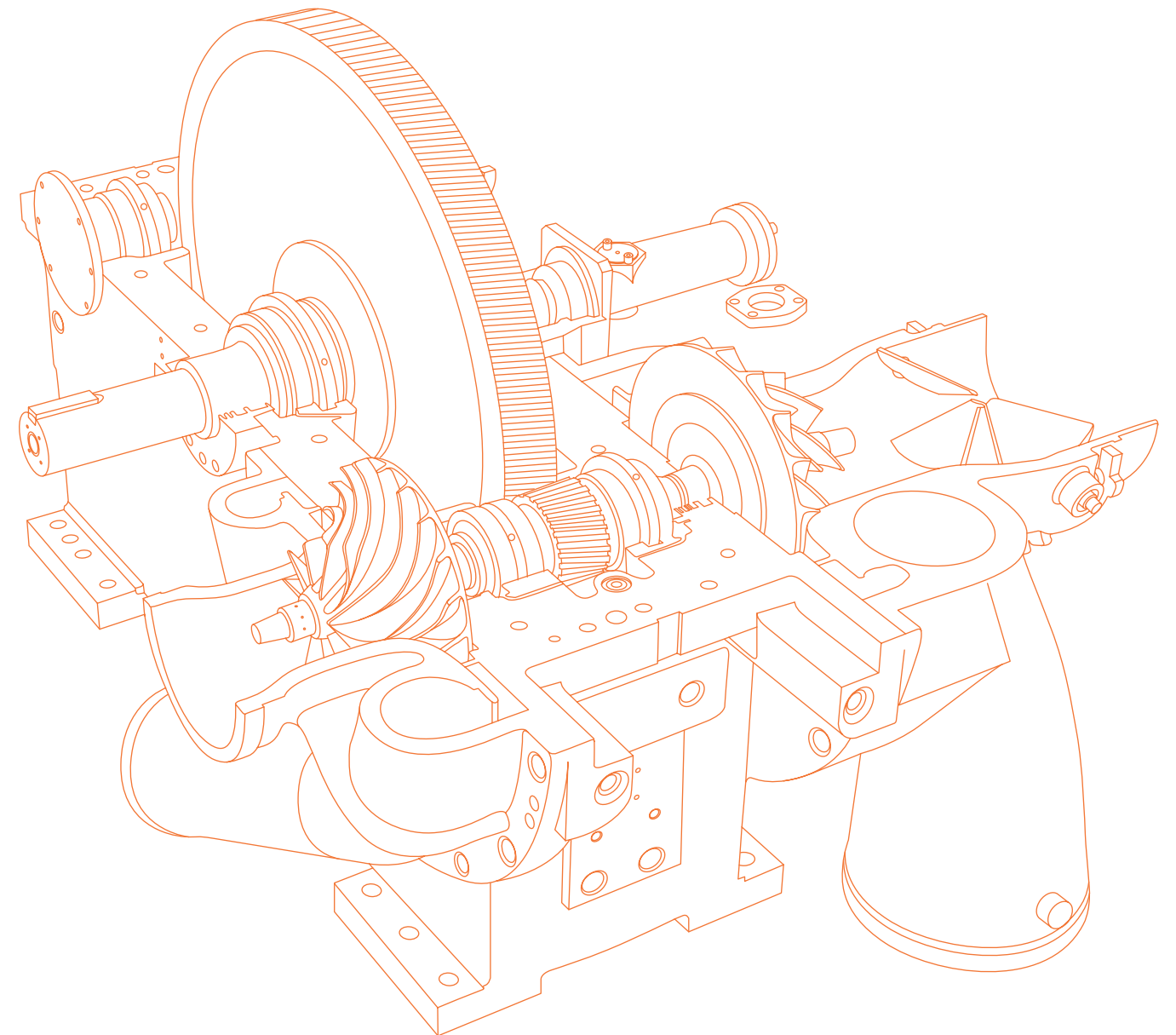
Present State of Hanwha Power Systems
Turbo Compressor Authentication

- ISO9001
- ISO14001
- ISO8573-1 Class0
- OHSAS18001
- CE
- ASME
- A Member of CAGI

The information in this publication is
subject to change without a notice.

Hanwha Power Systems AFTER MARKET SERVICES

Be Comfortable with SMART CARE

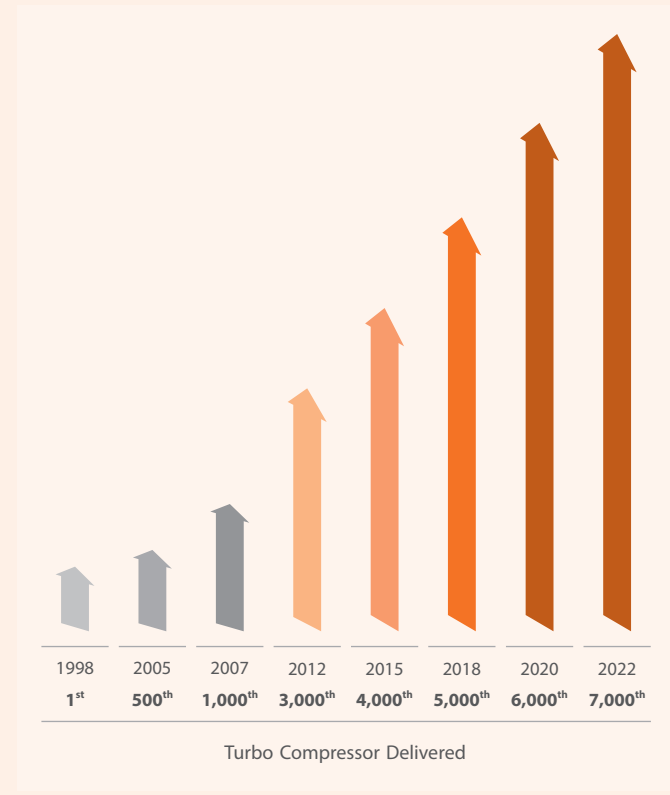


History

Based on over 40 years of accumulated experience in precision machine industry from Gas Turbine to Compressor Business, Hanwha Power Systems has been chosen by more than 1,500 customers worldwide.

Hanwha Power Systems is one of the fastest growing solution providers in its industry since 1997. During the last two decades Hanwha Power Systems delivered over 7,000 units of turbo compressors worldwide.

- 1977 · Company Established (Samsung Techwin) in Samsung Group
- 1979 · Overhaul and Repair of Aircraft Gas Turbine Engines
- 1992 · Started Developing Industrial Gas Turbine
- 1997 · First model of Turbo Compressor Introduced
- 2011 · Penetrated into Gas Compressor Market
- 2013 · SA3100, the World's Largest Capacity of Air Cooled Compressor, Introduced
· ISO8573-1 (Class 0) Certified
- 2014 · Contract to Supply the World 1st Integrally Geared Centrifugal Compressor for Offshore VRU Application 2015
- 2015 · New Beginning in Hanwha group as "Hanwha Techwin"
· Penetrated into the Offshore Market with Turbo Air & Gas Compressors
· Launched Long-term Aftermarket Service Program
- 2016 · Saudi Aramco Approved Vendor registered (AP1617 Process Compressor & Blower)
- 2017 · MOU Signed with KEPCO to Jointly Develop Oxy-Fuel Gas Turbine Technology
· New Beginning as "Hanwha Power Systems"
- 2018 · Launched Turbo Expander Generator (TEG), an Environment friendly Energy Solution
· Hydrogen Compressor Packager Agreement with PDC
- 2019 · Authorized Service Center Agreement (for Korean market) with Baker Hughes
· ADNOC (Abu Dhabi National Oil Company) Approved Service Vendor Registered
- 2020 · Contract to supply a hydrogen refueling system for a Korea Gas Corporation (KOGAS) energy complex
- 2021 · Achieved sCO₂ engine US DOE national project goal
- 2022 · Changed the holding company to 'Hanwha Power Systems Holdings Corp.', a subsidiary of Hanwha Impact
· Awarded Global R&D 100 for sCO₂ Engine Development for the first time
· Entering the Ethylene Compressor and CO₂ Compressor Market



Industries & Applications

- Upstream & Offshore**
 - Flash Gas, LP, MP
 - Vapor Recovery / Instrument Air
- Refinery**
 - Make-up, Recycle, Booster (H₂, Wet)
 - Sulfur Recovery / Process Air / Instrument Air
- LNG**
 - Boil off gas (Terminal, LNG Plant)
 - High Pressure (Terminal)
 - Low / High duty (LNGC, LNG FPSO)
- Power Generation**
 - Fuel Gas Booster / N₂ booster (IGCC)
 - Syngas / Instrument Air

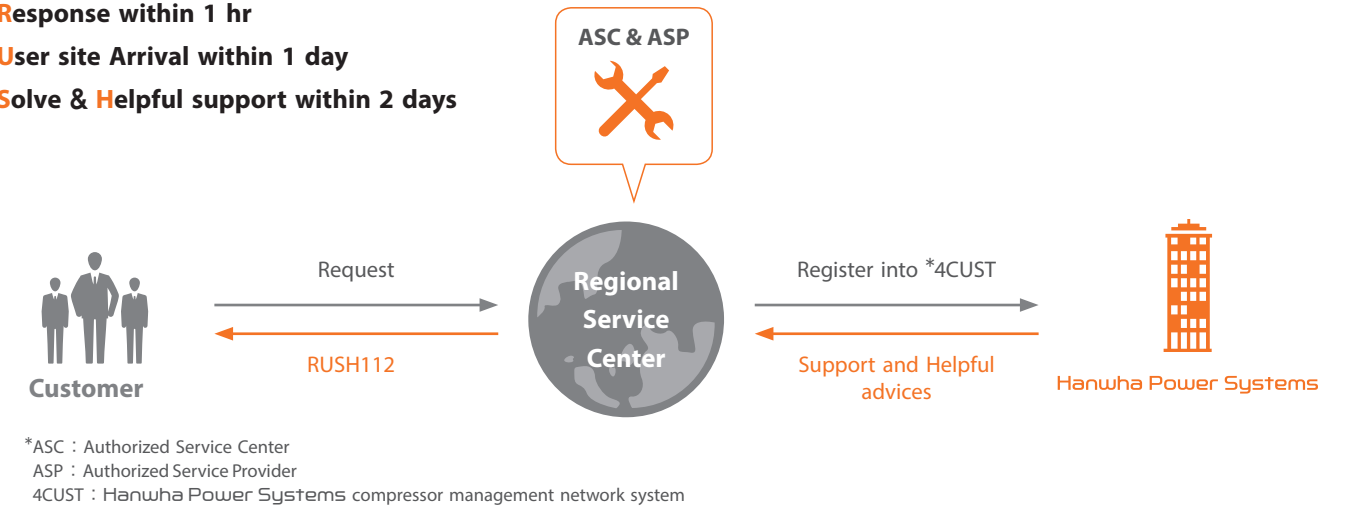
- Air Separation**
 - Main Air / Booster Air or N₂
 - Cryogenic Expansion
- Fertilizer / Gas Processing**
 - Process Air / Process Gas (NG, NH₃, CO₂)
 - N₂ Booster / Instrument Air / NGL
- Petro-chemical**
 - High Pressure (Terminal)
 - Refrigeration (Propane, Propylene)
 - PTA / Boil off gas / Process Air / Instrument Air
- Environment & Energy Saving**
 - Aeration for wastewater treatment
 - Pneumatic conveying materials
 - Mechanical vapor recompression

Maximize Operating-time & Minimize Down-time banner below, operate the Regional Service Center (RSC) and the local branch to respond to global customer requests quickly, headquarters are subsequent support local service center through the service history management, materials management and technical support.

Service Policy

RUSH 112

- Response within 1 hr
- User site Arrival within 1 day
- Solve & Helpful support within 2 days






Maintenance & Operation Training

Hanwha Power Systems is training with the knowledge and skills necessary to operate the compressor operating to the customer, and offers a "Operator training program" that allows customers to efficiently operate the compressor through education for compressor maintenance / repair.



Hanwha Power Systems Aftermarket Services Total Solution Program

Hanwha Power Systems is providing the various services for stable and efficient operation of the compressors which makes possible to extend the life of compressors, to increase the operation time by Preventive Maintenance Service, like Long Term Service Program, to minimize energy loss and ultimately to give customer's benefits.

Maintenance/Parts	Performance Upgrade	Control & Energy Saving
 <ul style="list-style-type: none"> • Periodic Maintenance • Genuine Parts • Long Term Service 	 <ul style="list-style-type: none"> • Modification & Retrofit • Performance Optimization 	 <ul style="list-style-type: none"> • SCADA System • LSC • PLC Modification • Monitoring System

CUSTOMER BENEFIT



Cost Saving Maintenance & Predicting Budget

Hanwha Power Systems is providing customized & specific service to keep the compressors manage minimum cost for maintenance and also proposing periodic maintenance for long term managing customer's maintenance budget and shut down schedule.



High Quality Service

Hanwha Power Systems is providing the best total solution service for compressor maintenance & repair based on the world leading technology and various experience & reference.



Energy Saving Program

Hanwha Power Systems is providing Energy Saving program to control and produce optimized quantity of compressed air to prevent specific compressors on site from over operating and consuming.



Risk Reduced & Management

Hanwha Power Systems is providing SMART CARE PROGRAM, which to minimize the risk for operation management in using compressors, and consider the site operation condition & convenience.

MAINTENANCE

Hanwha Power Systems shall propose maintenance & service program to operate, securely, customized compressors without stopping and suggest the periodic maintenance to decrease service time & minimum duration. Smart Care Program is background on Hanwha Power Systems's design policy, manufacturing, test & evaluation and various service code to provide customer reliability, continuous operation and predicting maintenance with Long Term Service Agreement.

Periodic Maintenance

We shall provide system maintenance and high quality service code(below), which makes compressor keep optimized condition and continuous operation like a new machine.

COD	YEAR	MAJOR ACTIVITIES
S1	0,5 Year (4,000 OH)	<ul style="list-style-type: none"> • To detect the abnormal condition of parameters and make a corrective action. • To prevent the fault and malfunction due to parts, cables, piping, etc. on the appearances.
S2	1 Year (8,000 OH)	<ul style="list-style-type: none"> • To prevent a cause of rotor or bearing damage through the check of oil cooling system. • To prevent a damage of motor or main coupling through the check of driving parts.
S3	3 Year (24,000 OH)	<ul style="list-style-type: none"> • To prevent a cause of air-end parts to be damaged due to an operating condition.
S4	5 Year (40,000 OH)	<ul style="list-style-type: none"> • To prevent a core accident thru the check of high speed rotating parts condition and replacement. • To extend life expectancy of machine through the comprehensive check & corrective action.

• OH : Operation Hour
 • The above code differs from site and operation condition

Long Term Service Agreement

We shall provide the 1:1 customer service to manage optimized operation condition, maintenance budget & saving cost through S1, S2, S3 and S4.

Activities	<ul style="list-style-type: none"> • Providing customized periodic maintenance & service • Supporting technical training, technology, service on site • Supporting various customer requirements and design
Contract term	<ul style="list-style-type: none"> • Providing service from S1 to S4 depending on customer maintenance budget & site condition

Hanwha Power Systems shall provide optimal performance throughout wide range of operation conditions and their performance is guaranteed by high quality genuine parts. Thus to use the genuine parts means to maintain compressor's designed optimal performance and to guarantee its designed life time and is the only way to save compressor's operating cost. Genuine parts are made not only by using the same design features as applied to your compressor's parts, but also manufactured by advanced design, quality and manufacturing conditions so that it makes possible to secure customized performance and obtain the same effect as with the newly purchased compressor. Hanwha Power Systems always has a lot of inventory items to meet customer requirements to minimize the downtime of your compressor.

Core Parts



Bearing

Tilting pad journal bearing assembled at pinion gear prevents oil whip at high speed rotation, and thrust bearing mounted bull gear effectively supporting on axle and then minimizes friction loss.



Seal

Seal is composed of air and oil seal is to keep extreme hot & cold process gas away from bearing oil and to prevent bearing oil from moving into the process gas and contaminated from leaking to outside.



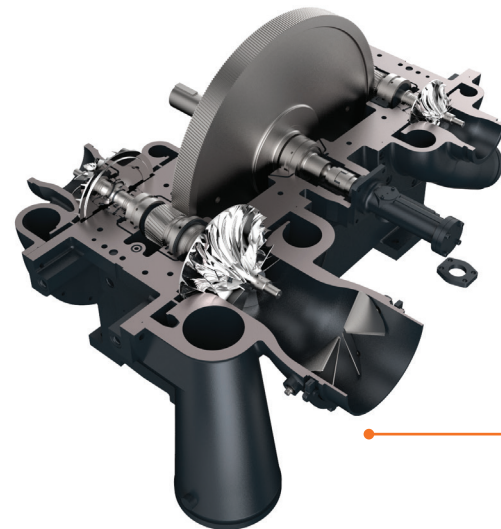
Impeller

Backward lean type impeller with optimal blade angle provides high efficiency in the whole operation range and has anti-rust and abrasion resistance characteristics, and offers high credibility through the special speed(115% Over Speed) spin test.



Inlet Guide Vane (IGV)

Highly efficient variable IGV controls the inlet air quantity and air rotating angle optimally, resulting in stable operation, performance improvement and electric power saving.



Others



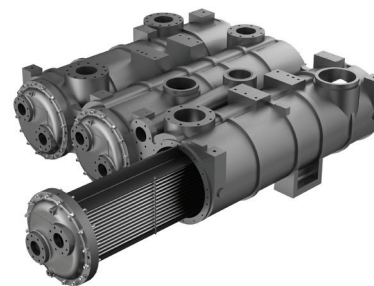
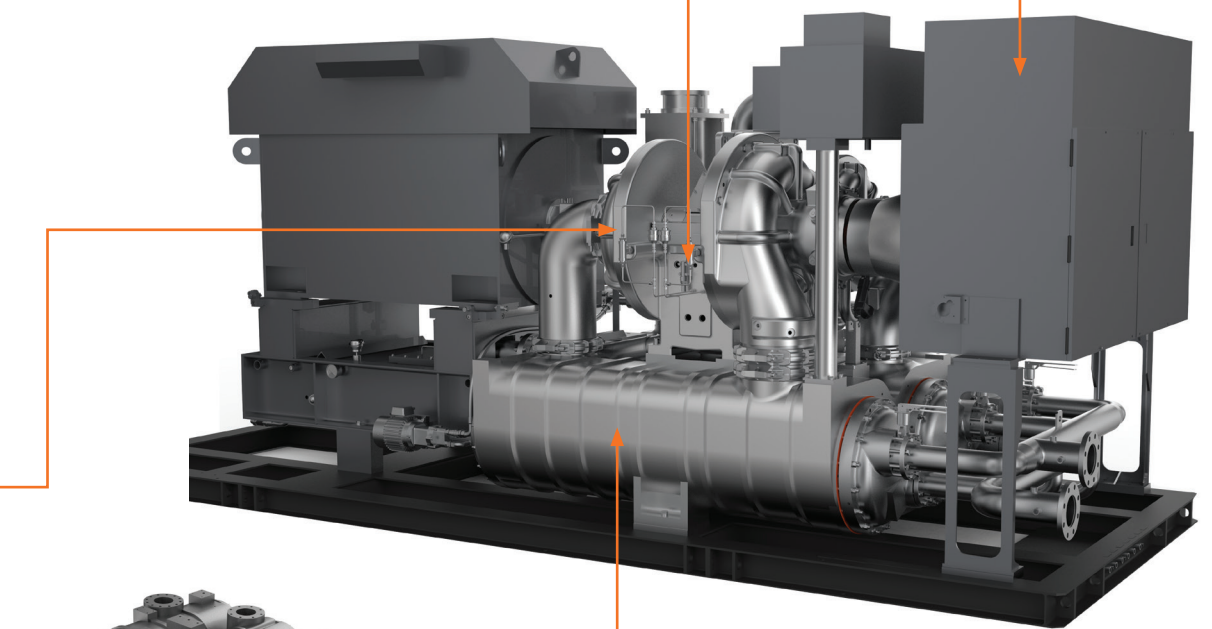
Sensors

To keep long term using compressors securely by checking and monitoring for pressure, temperature and vibration through various sensors during compressor operation



Filters


Intake filters are the first line of defense in filtering. These filters can remove contaminates and also remove chemical contaminants & foreign objects through 1st and 2nd filter elements.



Coolers

Straight type water-in-tube design makes cleaning and maintenance of the intercooler more convenient and specially surface treated intercooler is so scale-proof that enhances the cooling efficiency The excellent cooling efficiency of the intercooler minimizes pressure loss.

Dryer



*** Parts List**

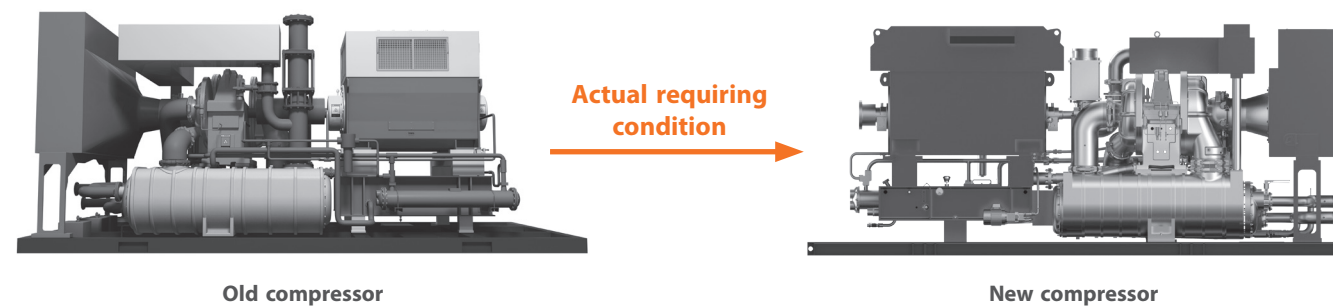
- Dryer Filter Element
- Desiccant
- Drain Trap
- Valve & Gauge

We provide modification program for the old compressor into up-to-date compressor at low cost, in order to provide this benefits with our customer who are operating the old Hanwha compressor. In addition, we believe that Modification program combined with up-to date technology gives the effect of purchasing new compressor, and also makes it possible to dramatically reduce maintenance costs and to greatly improve the reliability of the compressor by in advance preventing potential defects caused by old and unreplaced parts.

Compressor Modification & Retrofit

Modification old compressor into updated new Hanwha compressor

- Suitable for compressor using at improper condition
- Depends on actual requiring condition replace



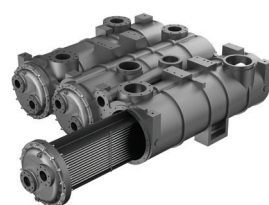
Performance Optimization

Old and performance-deteriorated compressors can be reborn into new and updated Hanwha compressor through our latest technology. This upgrade program guarantees the performance improvement, the recovery of operation credibility, the reduction in operating cost and operator's convenience.



Inlet Guide Vane(IGV)

Highly efficient variable IGV controls the inlet air quantity and air rotating angle optimally, resulting in stable operation, performance improvement and electric power saving.

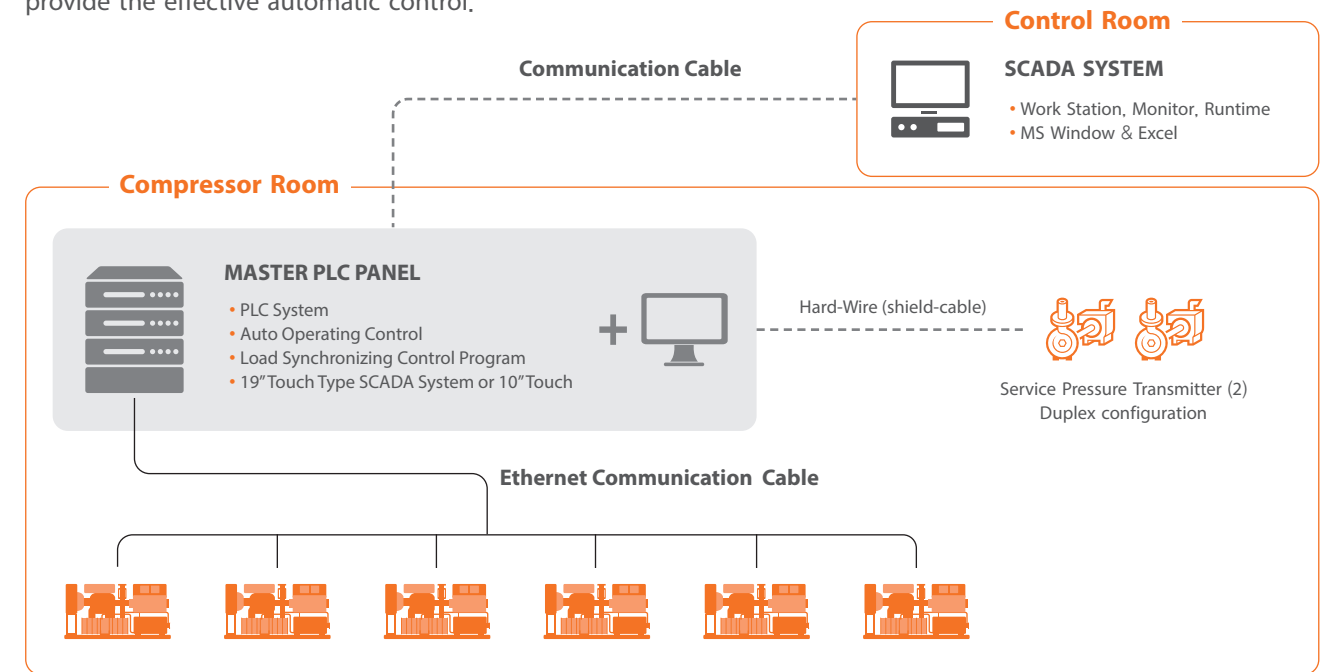


Intercooler

Straight type water-in-tube design makes cleaning and maintenance of the intercooler more convenient and specially surface treated intercooler is so scale-proof that enhances the cooling efficiency The excellent cooling efficiency of the intercooler minimizes pressure loss.

SCADA (Supervisory Control And Data Acquisition) System

SCADA System for Hanwha Power Systems's compressor enables the operators to have a convenient & useful remote control and operation. Along with collecting & storing & monitoring a real time data and displaying a trend after installing Master Control Panel at Central Control Room or the adjacent site, it enables the operators to provide the effective automatic control.



LSC (Load Synchronizing Control)

LSC of Hanwha Power Systems is the energy consumptions reduction system that enables compressor to quickly and actively correspond with the change of pressure and air quantity in the production line and to produce optimized quantity of compressed air at the sites with multiple compressors simultaneously. By enabling automatic start-up, load operation, stop, according to the load, it is possible to extend the compressor's maintenance period by maintaining the number of minimum operating compressor and controlling the running time almost uniform through regular operation.



Before LSC



After LSC

PLC Modification

The modification of the latest Hanwha Power Systems controller applied by touch screen consisted of customized PLC control & Operation manual warrants the stability of the compressor control system and provides the optimized service information for high reliability, operator's convenience by warning right time of quick operation status confirmation, data collection & control, maintenance & overhaul.

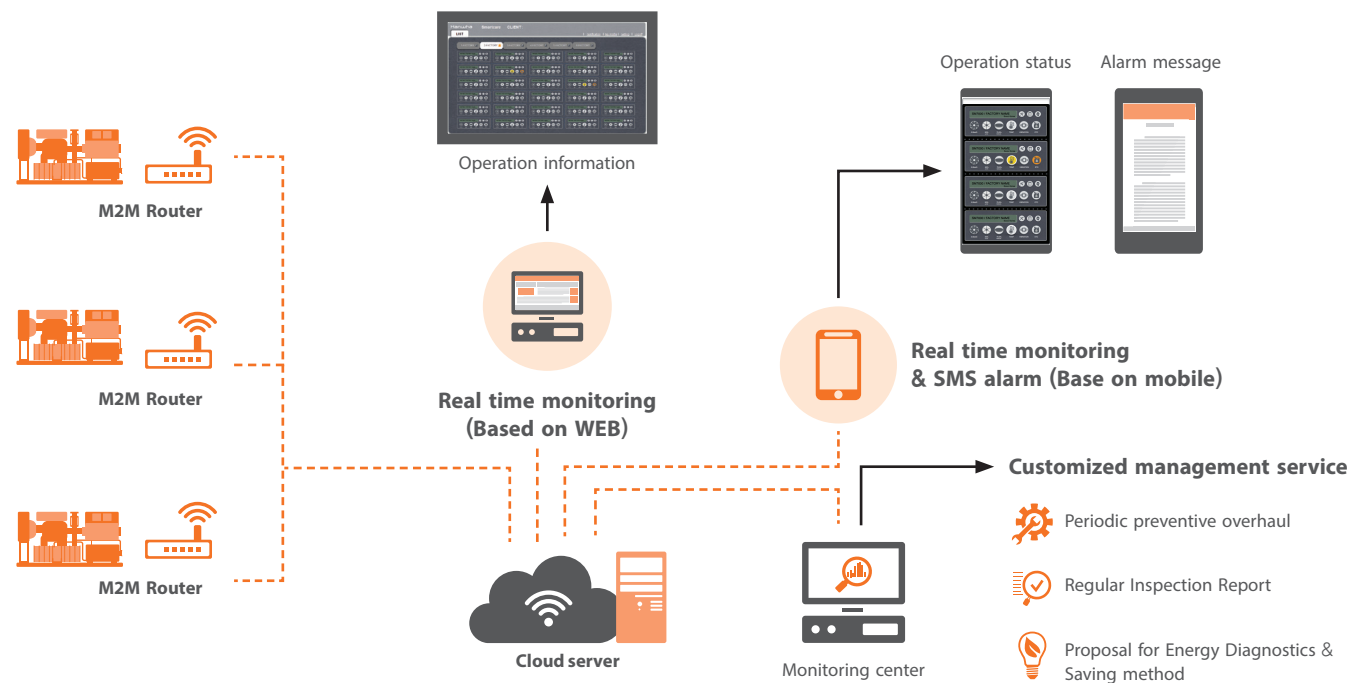


Panel modification for compressor

- Equipment difficult to operate and maintain the compressor due to aging of the Control Panel
- Equipment with limitation of compressor control & status confirmation by applying spherical controller of Relay type & Micom type
- Equipment difficult to real-time confirmation and collection of data necessary to operate the compressor(Flow rate, Pressure, Temperature, Vibration, etc.)

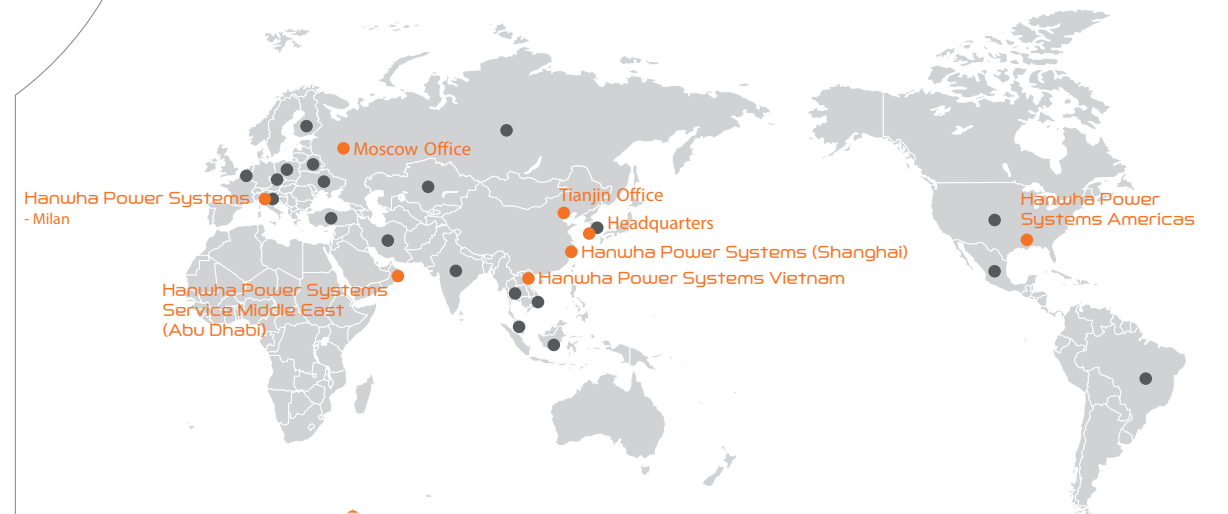
TIMS(Turbo Intergrated Monitoring System)

Hanwha Power Systems monitoring system is remote monitoring solutions applied IoT technology to compressor. Any time & anywhere, it enables to check the status of compressor in real time and to support to perform the timely decision making through it and to allow regular inspection & predictive failure prevention activities. Along with operating Hanwha Power Systems Monitoring Center, it provides operators with the optimized compressor operation method according to the driving environment characteristics of the customer's site.



Wide Service Network

Provides prompt service for customers around the world, Hanwha Power Systems has built a large number of centers globally. Customers can ask for service at anytime through those centers and get solutions in time.



Hanwha Power Systems

✕ ASC (Authorized Service Center) & ASP (Authorized Service Provider)

Belarus	India	Malaysia	Thailand
Brazil	Indonesia	Mexico	Turkey
China	Italy	Netherland	Ukraine
Czech	Kazakhstan	Poland	USA
Finland	Korea	Russia	Vietnam