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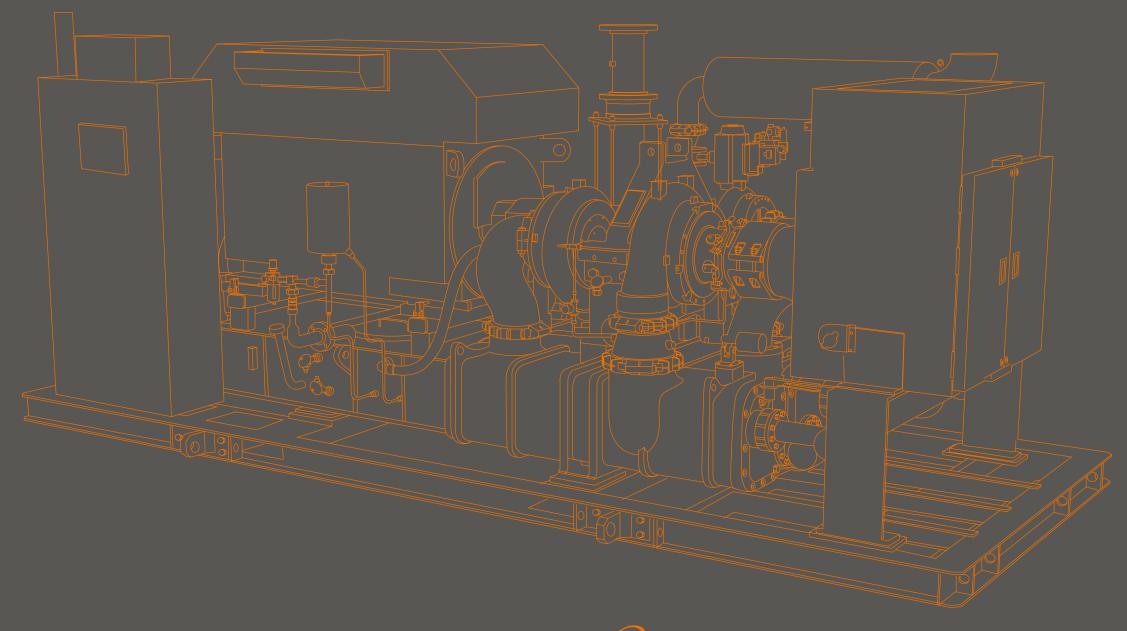
Present State of Hanwha Power Systems Turbo Compressor Authentication

- ISO14001 Authentication
- Korea New Technology Authentication
- IR52 Jang Young Sil Award
- ISO9001 Authentication
- CE Authentication
- ASME—complian
- ISO 8573-1 Class zero Authentication

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

OIL-FREE CENTRIFUGAL AIR COMPRESSOR

SM/SM100 SERIES





🚫 Hanwha Power Systems

History

Based on over 35 years of accumulated experience in precision machine industry from Gas Turbine to Compressor Business, Hanwha Power Systems has been chosen by more than w1,000 customers worldwide.

- 1977 Company Established (Samsung Techwin) in Samsung Group
- 1979 Overhaul and Repair of Aircraft Gas Turbine Engines
- 1996 Industrial Gas Turbine Developed
- 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 New Beginning in Hanwha group as "Hanwha Techwin"

Penetrated into the Offshore Market with Turbo Air & Gas Compressors

Launched Long-term Aftermarket Service Program
Expanding Portfolio by Cooperation with

Screw Compressor Manufacturers

2016 Saudi Aramco Approved Vendor registered
 (API617 Process Compressor & Blower)

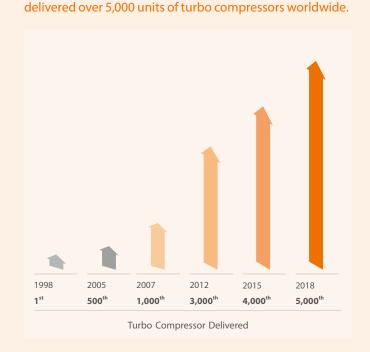
Parime action approximately approxim

Reciprocating compressor packager agreement with GE Oil&Gas

2017 MOU signed with KEPCO to jointly develop
 Oxy-Fuel Gas Turbine technology

Oxy-Fuel Gas Turbine technology New beginning as "Hanwha Power Systems" Hanwha Power Systems is one of the fastest growing solution providers in its industry since 1997.

During the last two decades Hanwha Power Systems



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

Way to ease your mind

Excellent solution and thorough service will guarantee customer's peace of mind

Dependable SM/SM100 Series





Stable Operation

- · Complying with global industry standards as ISO9001, API672 and customer specific requirements
- 100% Oil—Free compressed air without any contamination: ISO 8573-1 Class 0 certification

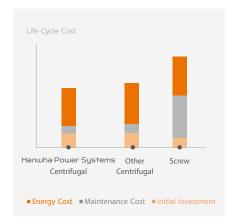


- * ISO 8573-1 specifies purity classes of compressed air with respect to particles, water and oil independent of the location in the compressed air system at which the air is specified or measured
- Using three–dimensional design system to eliminate potential design flaws in the design phase
- Thorough quality control system to reduce any risk exposure
- The fastest growing in the industry since 1997
- · Certified by major players in various industries in the Middle East, Europe, Americas, etc.



Budget Savings

- High efficiency oriented components and low maintenance design will provide customers with lower life—cycle cost
- Flexible IGV adjusting the flow rate in accordance with the fluctuation of air consumption to reduce energy consumption up to 7%
- Wear resistance materials as stainless steel for minimizing abrasion and corrosion
- Precise 5—Axis machined impeller and long life guaranteed oil and gas seals
- Simple and no wearing structure leads minimized maintenance effort and cost
- Energy saving analysis to diagnose current status and find the root cause of energy waste can minimize the unnecessary cost and keep customers' profit high





Risk Minimization

- Preventive maintenance program provides a guideline or an actual check service for keeping customer's equipment healthy
- Remote Monitoring System does daily check of customer's equipment, and provides prompt alarm / notification service once any problem happens
- RUSH112 service and wide range of service network minimizes downtime when emergency situation occurs

Key Technical Feature

O4

SM/SM100 Series • 05

Optimized design to maximize customer benefit

Low maintenance and highly efficient design play a key role to maximize customer profit



Energy Saving Inlet Guide Vane

- Precise control of air flow by efficient inlet air control
- Reduction of power consumption through partial load control
- Low pressure loss with airfoil profiled vanes



Durable Coolers

- Water-in-tube inter & aftercooler bundles allow simple maintenance and easy cleaning
- Corrosion / erosion resistant material applied for protecting damage of other components
- · Minimizing pressure drop by optimized airflow



Simple & Neat Package

- Complete full package for plug & run provides easy and low-cost installation
- Full enclosure is applicable for clean appearance and quiet operation which creates a comfortable work environment (Low noise with sound enclosure)
- Minimizing maintenance cost by simple structure



Leak-Free Lubrication System

- Minimum air leakage reduces losses and increases overall efficiency
- Leakproof gearbox prevents impurities from entering the process
- Complete lubrication system package (Including Oil reservoir, Auxiliary oil pump, Oil heater, Oil demister)



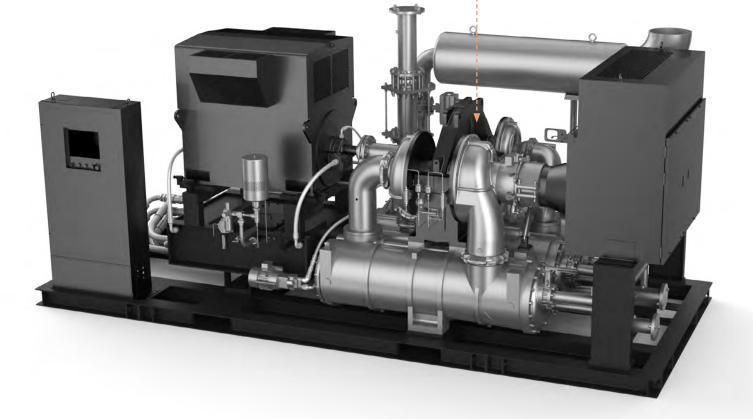
Maintenance Friendly Gearbox

- Easy maintenance by horizontally split structure
- Minimum cost for inspection and maintenance



Highly Efficient Main Drive Motor

- Highly efficient package saves energy
- Custom motors are available reflecting client requirements (option)



Concentrating on efficiency with reliability

Core Unit is the heart of SM Series to achieve high efficiency and reliability by strictly selected optimized components and simple design





State-of-the-art 5-Axis Machined Impeller

- Precisely balanced and designed for stability and high efficiency
- Wide operational flexibility with turndown ratio of 30-40%
- 115% over-speed spin test to guarantee reliability
- SUS impellers for extended life cycle with low vibration and low noise



Long Life Thrust Bearing

- Tilting pad journal bearings applied on pinion gears offer reliable operation and almost permanent life without replacement
- Low friction loss sleeve journal and taper landed thrust bearings are applied on bull gear



Precise Bull Gear and Pinions

- High precision gear system provides long-life time, low vibration and low noise
- Taper land bearings effectively support axial loads delivered from pinion gears that improve stability of rotation and efficiency
- Easy inspection of gear system without stage disassembly



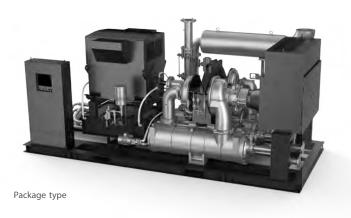
Leak-Free Oil & Gas Seals

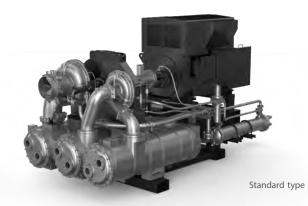
- Supplies 100% oil-free air in accordance with ISO8573-1 class zero for minimizing loss from downtime
- 4 stages of sealing which satisfies API specification
- Split structure for easy check and maintenance

Hanwha Power Systems

Model			SM3000	SM4000	SM5000	SM6000		
El P	m³/hr		3,300 - 5,300	5,300 - 8,400	8,400 - 15,000	15,000 - 21,000		
Flow Rate	CFM		1,950 - 3,100	3,100 - 4,950	4,950 - 8,850	8,850 - 12,400		
Davis	kW		210 - 680	310 - 1,010	490 - 1,540	780 - 2,350		
Power	HP		282 - 913	410 - 1,350	660 - 1,800	1,050 - 3,150		
Disabawa Duanawa	bar A		3,5 - 18					
Discharge Pressure	Psi A		50 - 265					
		Р	4,750 x 2,100 x 2,500	5,100 x 2,250 x 2,500	5,450 x 2,250 x 2,500	6,200 x 2,300 x 2,550		
Dimension (L×W×H)	mm	S	3,150 x 1,980 x 2,100	3,780 x 2,080 x 2,130	3,960 x 2,100 x 2,350	4,480 x 2,220 x 2,520		
*Dimension and weight are subject to change.	inch	Р	187 x 83 x 98	201 x 89 x 98	215 x 89 x 98	244 x 91 x 100		
		S	124 x 78 x 83	149 x 82 x 84	156 x 83 x 93	176 x 87 x 99		
Weight	kg	Р	8,700	10,250	12,950	17,550		
		S	7,050	8,400	10,900	15,250		

P Package type S Standard type





Scope of Supply

Air intake filter ✓ ✓ Inlet guide vanes

Check valve and expansion joint

Complete lubrication system Aftercooler

✓ ✓ Drain traps on all coolers

✓ ✓ Main motor ✓ ✓ PLC control system **✓ ✓** Base frame

Cooling water manifold Sound enclosure

Dual oil filter Block valve

Companion flange

Hot air piping

MODBUS / PROFIBUS Interface Motor winding / bearing protection

✓ Standard

 Options

X Not applicable

Customer Oriented Monitoring System

Provides convenient operation and accurate control

Monitoring System



High-resolution Color LCD Touch Screen Panel

• Touch screen size: 7.0 Wide or 10.2 Wide

• Resolution / Color : WVGA 800 x 480 / 65k Color



Reliable and Stable Control System

• Conforms to EMC international standard during in operation: CE, RE, CS, RS, ESD, Surge, Burst (CISPR 11 Class A, IEC 61000-4)



User Friendly Interface with Improved Operability and Legibility

- Conversion to ICON / animation of main information as operation / stop, valve status etc.
- Quickly and easily switchable screen by navigation bar

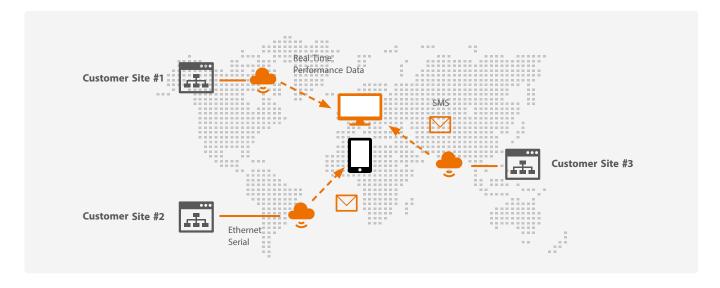


Automatic Control

- Optimization of surge control margin : High turndown ratio through minimizing surge margin
- Precise pressure control in overall operation range
- Local / Remote control function
- Self check and automatic resolution logic against errors







- Real-time monitoring by PC and smartphone
- Warning and trouble shooting message transferred once alarm or shutdown occurs
- Compressor remote management and energy saving solution

SM100 series focuses on accomplishing enhanced performance and efficiency to satisfy customers particularly seek performancecentered products.

Flexible packages according to your needs

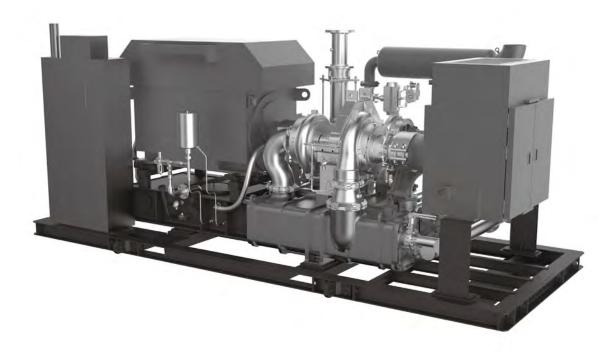
- Packaged plug & play type for easy installation
- Standard type without base frame, silencer, cooling water manifold and enclosure
- Silencer and cooling water manifold can be added as anoption



Advanced efficiency and performance

through design modification

- Thrust collar applied to enhance operation reliability and mechanical efficiency by reducing mechanical loss and oil consumption
- · Labyrinth seal of non-contacting type minimizes mechanical loss and needs of replacement
- Reduced distance between shafts to minimize oil mist friction and mechanical loss for improved performance and isothermal efficiency

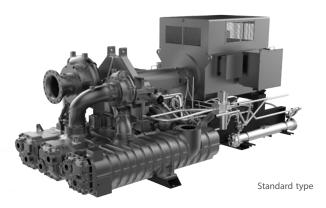


Specification

Model			SM3100	SM4100	SM5100	SM6100	SM7100
=1 = .	m³	/hr	3,300 - 5,500	5,500 - 9,000	9,000 - 15,000	15,000 - 24,500	24,500 - 32,000
Flow Rate	CF	М	1,950 - 3,250	3,250 - 5,300	5,300 - 8,850	8,850 - 14,400	14,400 - 18,800
Power	k'	W	200 - 580	300 - 930	500 - 1,500	800 - 2,500	1,000 - 3,100
	Н	IP	270 - 780	400 - 1,200	670 - 2,010	1,070 - 3,350	1,340 - 4,155
Discharge Pressure	Bar A			3.5 - 11.4			
	Psi A			50 - 165			
Dimension (LxWxH) *Dimension and weight are subject to change.	mm	Р	5,250 x 2,250 x 2,500	5,500 x 2,250 x 2,500	6,250 x 2,250 x 2,550	7,100 x 2,250 x 2,550	-
		S	3,210 x 2,150 x 1,920	3,800 x 2,300 x 2,050	4,750 x 2,490 x 2,130	5,290 x 2,400 x 2,420	5,700 x 2,800 x 2,950
	inch	Р	207 x 89 x 98	217 x 89 x 98	246 x 89 x 100	244 x 89 x 100	-
		S	126 x 85 x 76	150 x 91 x 81	187 x 98 x 84	208 x 95 x 95	224 x 110 x 106
Weight		Р	8,600	9,500	13,150	17,900	-
	Kg	S	6,900	7,500	10,300	14,450	20,500

P Package type S Standard type





Scope of Supply

✓ ● Air intake filter ✓ Inlet guide vanes

☑ Blow off Valve Silencer

Check valve and expansion joint ✓ ✓ Complete lubrication system

✓ ✓ Aftercooler

✓ ✓ Drain traps on all coolers

✓ PLC control system

✓ X Base Frame ✓ ● Cooling water manifold Sound Enclosure

Dual oil filter Block Valve Companion Flange

MODBUS / PROFIBUS Interface Motor winding / bearing protection

P Package type S Standard type

✓ Standard • Options

X Not applicable

10

SM2100 applied by new technology of Hanwha Power Systems, is a best—fit product for customers who need low flow compressors with high efficiency.



Customized options based on your needs

- Available to provide customized solutions from standard type for extendability to packaged plug & play type for easy installation according to your selection of options
- Base frame, cooling water manifold and enclosure can be added as an option.



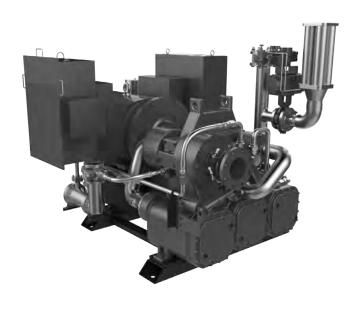
Easy maintenance and superior standard features

- Tilting pad journal bearings applied on pinion gears offer reliable operation and long life cycle.
 (Depending on the conditions of usage, the only bearings may need to be replaced.)
- Compact design for minimal foot print
- Standard features include three stage vibration probes, an oil heater, and a vacuum gauge in an oil tank,



Advanced efficiency and performance for low flow compressor

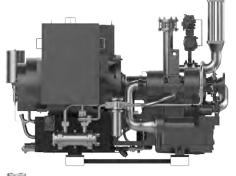
- Sealing system with 4 stages which satisfies API specification to minimize gas leaks
- Highly efficient inlet guide vanes to improve the performance of compressor at part load and to reduce power consumption
- State-of-the-art 5-axis machined impeller for stability and high efficiency

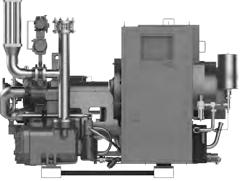




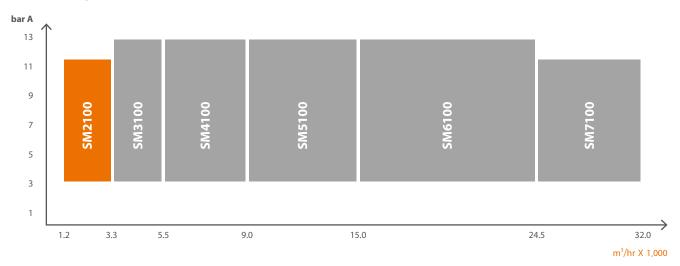
Specification

Model	SM2100		
Flow Rate	m³/hr	1,200 - 3,300	
Flow Rate	CFM	700 - 1,950	
Power	kW	150 - 335	
Power	HP	200 - 450	
Disabanna Duassana	bar A	3.5 - 11.4	
Discharge Pressure	psi A	50 - 165	
Dimension (LaMed)	mm	2,360 x 1,660 x 1,770	
Dimension (L×W×H)	inch	93 x 65.4 x 70	
Moight	kg	3,700	
Weight	lb	8,160	





Product Range



Scope of Supply

- ✓ Inlet guide vanes
- ✓ Blow off valve and silencer
- ✓ Discharge check valve
- ✓ Complete lubrication system
- Aftercooler
- ✓ Drain ports with ball valves on all coolers
- Main motor
- ✓ Motor winding / bearing protection
- ✓ PLC control system
- Air intake filter
- Base frame
- Cooling water manifold
- Sound enclosure (available with base frame)Dual oil filterBlock valve
- Companion flange

- Auto trap
- MODBUS / PROFIBUS Interface

✓ Standard

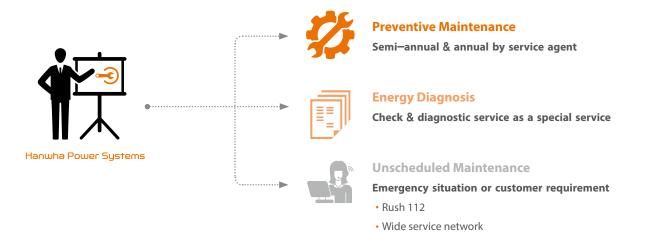
Options

Hallwild Powel Systems

Smart Care

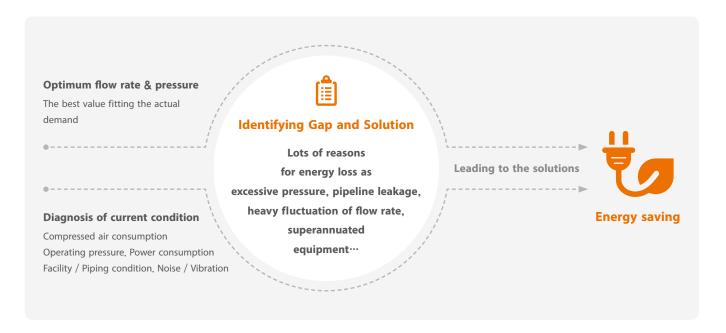
SM/SM100 Series • 13

Hanwha Power Systems provides total care service, called Smart Care, ranging from current equipment diagnosis to urgent repair service to get rid of customer risks. This prevents unnecessary energy loss and minimizes downtime that may occur.



Energy Diagnosis

Operators expect equipment to run in an optimized mode. In many cases, however, it is hard to notice small changes leading to inefficiencies in it's operation. Hanwha Power Systems provides diagnosis service inspecting if current equipment is being operated properly and efficiently. Through this Service, customers can learn which part causes energy loss and how to improve the efficiency. Ultimately customers minimize waste and maximize profitability.



Preventive Maintenance program

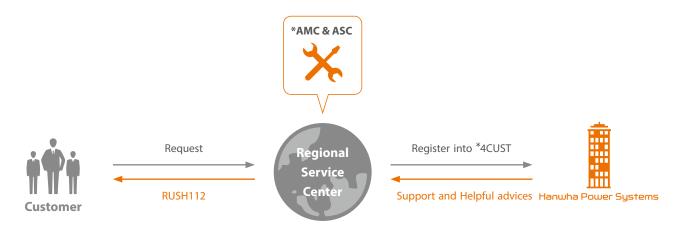
To prevent malfunction during operation, Hanwha Power Systems provides 4 programs by operating time and specific programs are customized per each customer's requirements. This program will enable customer equipment running stably without any problem so that customers can minimize downtime, low life cycle cost through saving additional trouble shooting cost,



Rush 112 Worldwide

Hanwha Power Systems is willing to provide immediate service to customers worldwide based on RUSH 112 philosophy.





- * 4CUST: Customer-centric 4C oriented system (4C: Consumer, Cost, Convenience, Communication)
- * AMC: Authorized Maintenance Center

lanwha Power Systems
Hanwha Power

^{*} ASC: Authorized Service Center

Introduction to Hanwha Group

Hanwha Businesses

a FORTUNE Global 500 Company

66 years of business experience with 325 global networks

2017 total assets of \$166 billion and total sales of \$55 billion



Manufacturing & Construction

Hanwha Corporation ()

Hanwha Techwin 🕕

Hanwha Power Systems ()

Hanwha Land Systems 🕕

Hanwha Precision Machinery ()

Hanwha Thales ()

Hanwha Chemical 2

Hanwha General Chemical 🛭

Hanwha Total Petrochemical 2

Hanwha Fine Chemical 2

Hanwha Engineering & Construction ()

Hanwha Q CELLS 🚯 Hanwha Q CELLS Korea ()

Hanwha Advanced Materials

Hanwha Energy

YEOCHUN NCC

Hanwha City Development

Finance

Hanwha Life 🜖

Hanwha General Insurance 🖯

Hanwha Investment & Securities ()

Hanwha Asset Management ()

Hanwha Investment Hanwha Savings Bank

Services & Leisure

Hanwha Hotels & Resorts ()

Hanwha Galleria 9

Hanwha Galleria Tmeworld

Hanwha 63 City 🜖

Hanwha S&C

Hanwha Station Development

Global Network

325 Global Networks (December 2017)

Frýdek-Místek Istanbul London

70 Affiliates all over the world



Wide Service Network

Belarus

Brazil

China

Czech

Finland

India

Korea

Kazakhstan

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,



Malavsia

Poland

Russia

Thailand

Turkey Ukraine

USA

Vietnam