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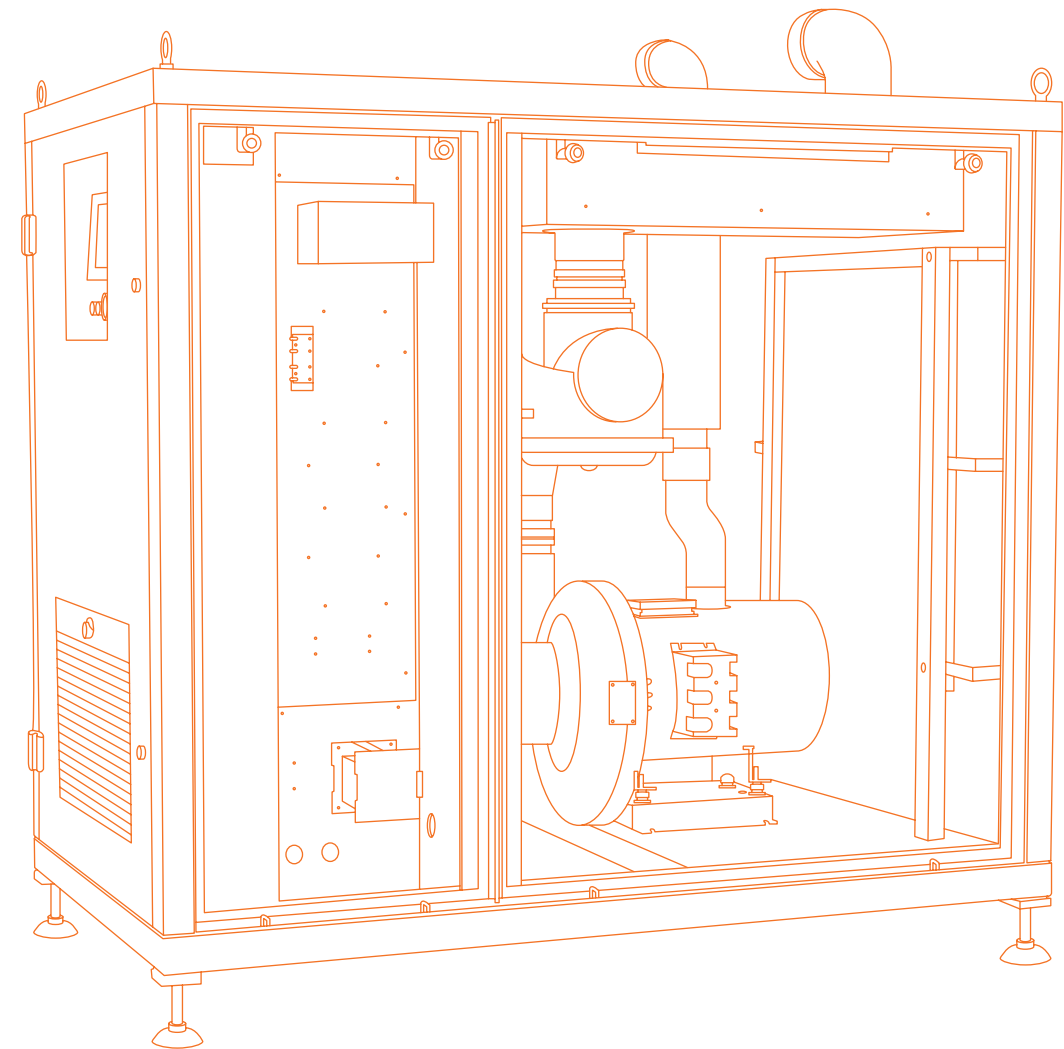
Present State of Hanwha Power Systems
Turbo Compressor Authentication

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

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

TURBO BLOWER HB SERIES

30HP - 400HP / 0.4 - 1.5bar



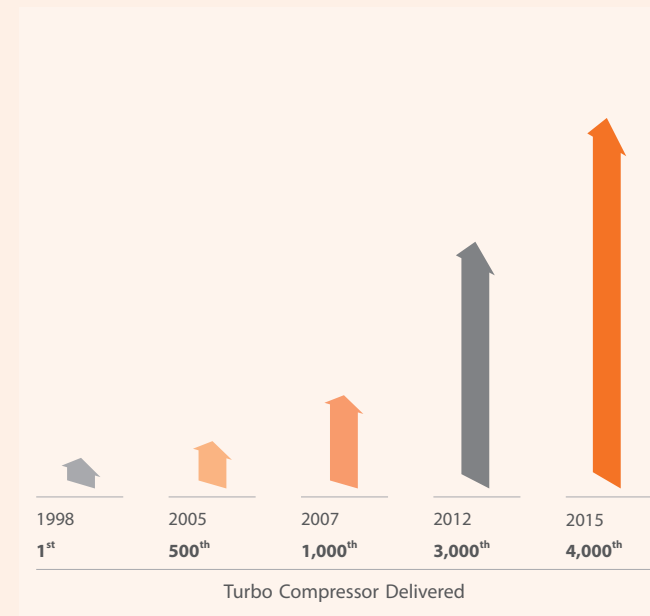
History

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 1,000 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)
Reciprocating compressor packager agreement with GE Oil&Gas
- **2017** MOU signed with KEPCO to jointly develop 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 delivered over 4,000 units of turbo machinery worldwide.



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

HB Series

HB Series is the single stage centrifugal turbo blower directly coupled with a permanent magnetic motor. Customers can economically and environmentally get benefit from HB Series which is suitable for the customers' applications.

Applications

- Water Treatment : Aerobic microorganism digests waste by providing air into the waste water
- Conveying powder such as chemical materials, cement, and flour to storage
- Provision of air for oxidation reaction in an absorber
- Air supply for stirring work of raw materials in the repository
- Fabrics of films for washing
- Air knife for manufacturing semiconductor, LCD/LED and continuous galvanizing line
- Braiding in Textile Mill

Benefits

Low Total Cost of Ownership

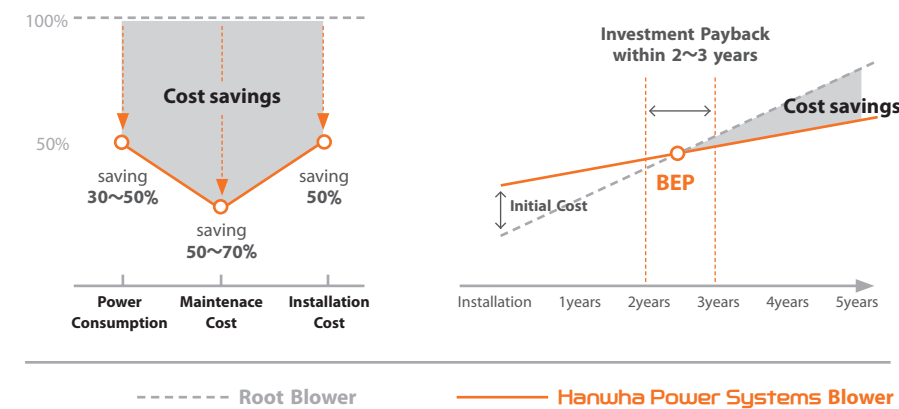
- High performance applying proven technologies : Optimized impeller, permanent magnetic motor, and Inverter
- Wide operational flexibility : Turndown ratio between 45~100%
- Minimizing operating and maintenance costs through semi-permanent components
- Low installation costs by plug & play design

High Reliability & Easy Maintenance

- Stringent quality-control system by Hanwha Power Systems to reduce risks
- Simple structure and easy access to key components

100% Oil-less Eco Blower

- Environmental performance through applying oil less air foil bearing technology
- No need extra oil treatment system
- Low Noise (75~85dB), Low vibration



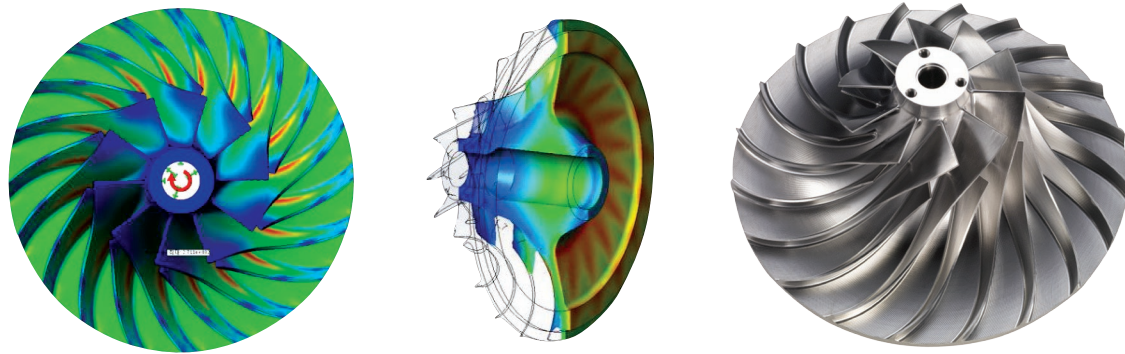
- Energy Saving up to 70% (Maintenance Cost) compared with conventional blower type
- HB Series users can recover the initial investment within 2-3 years and continue to reduce the operating cost

Do you know?
Hanwha Power Systems is the 1st company which introduced airfoil bearing technology in the industry!

Key Technical Features

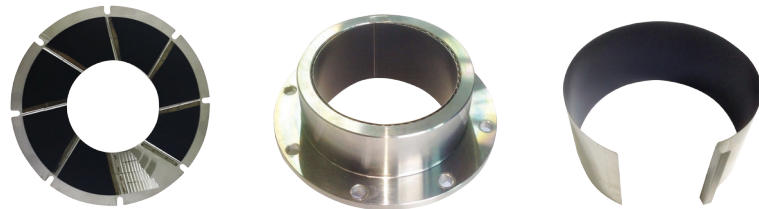
State-of-the-art 5-axis machined impeller

- Consistently high quality & efficiency through precision machining (0.001 mm) and optimized aerodynamic (Impeller-Diffuser-Scroll) design
- Strong resistance to corrosion in humid and harsh environment by excellent surface treatment and hard anodizing coatings
- Accumulated technology by more than 4,000 compressors delivered for the last 20 years
- Titanium or SUS (Steel Use Stainless) impeller (optional)



Durable air foil bearing

- Eco-friendly without lubricant oil injection
- Low energy consumption and vibration thanks to non-mechanical contact during operation
- Long life span due to non-contact operation and heat-resisting alloy materials applied
- Enhanced reliability and load capacity by applying third generation bump foil air bearings

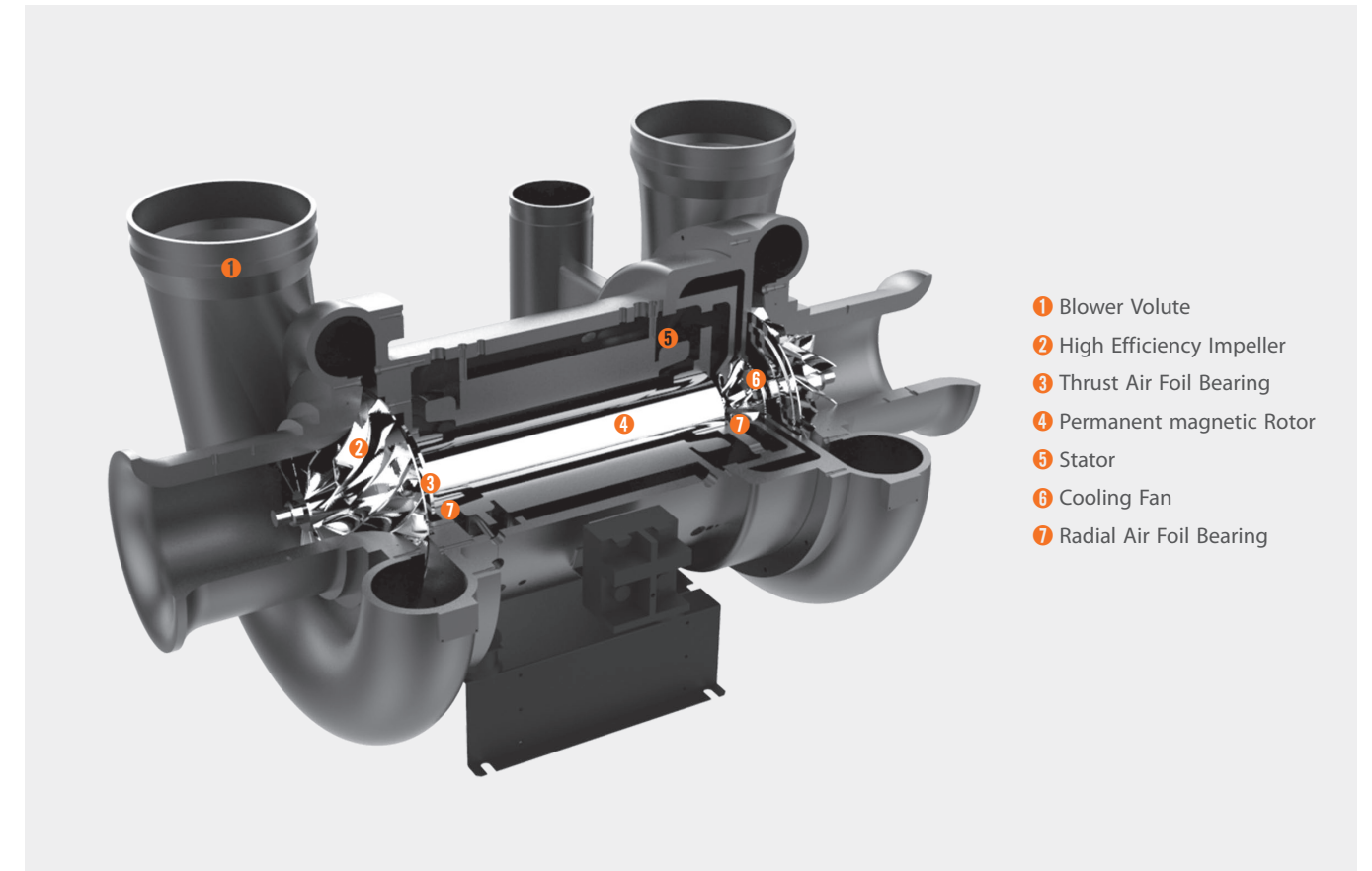


Customer oriented control system

- PLC or MICOM (optional)
- User friendly interface and state-of-the-art touch screen
- Easy control and real-time operation monitoring
- Various operation modes (Auto Flow / Auto Pressure / Auto power / DO link)
- Various communication protocols for remote operation (MODBUS, TCP/IP, PROFIBUS-DP, ETHERNET)

Most efficient permanent magnetic synchronous motor

- **Improved operating efficiency and durability by applying direct-drive permanent magnetic motor**
 - ▶ Less power losses/slips and higher efficiency compared with conventional induction motors
 - ▶ No need for power transmission and V-belt maintenance thanks to direct drive technology



Proven inverter technology

- Stable and safe operation by using proven high-frequency inverter
- Minimizing energy loss by accurate motor speed control in accordance with customer's operation condition
- Wide range of operational flexibility : 45% - 100% of turndown ratio
- Optimized algorithm for high-speed rotation

Optimized cooling system

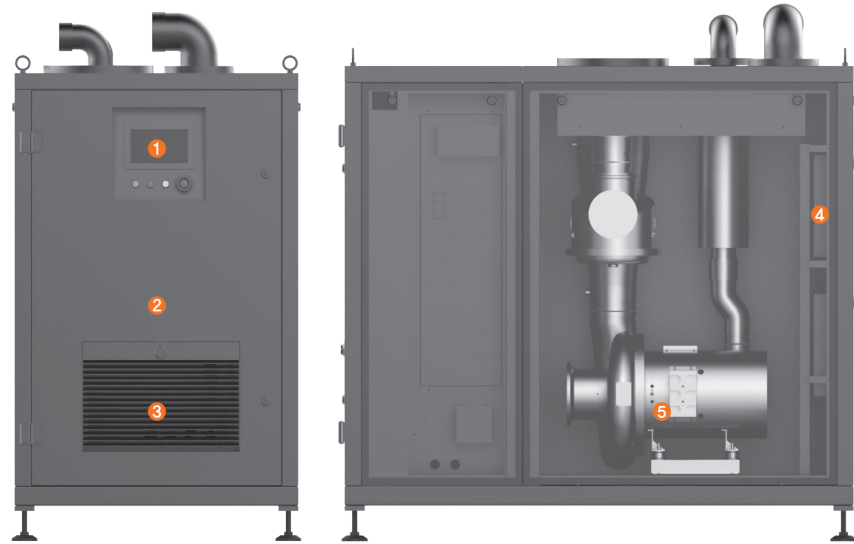
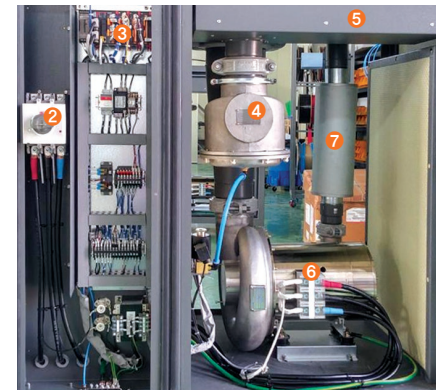
- **Patented cooling system through double cooling structure without extra cooling devices (external fans and sinefilters, etc.)**
 - ▶ 1st Cooling : Outside of motor Cooling → 2nd Cooling : Air bearing, Winding and Rotor Cooling

Standard structure

Simple and durable design for easy operation and less maintenance

- 1 Touch Screen
- 2 Panel
- 3 Inverter Filter
- 4 Inlet Filter
- 5 Single stage blower with PM motor

- 1 Inverter
- 2 No fuse circuit breaker
- 3 PLC
- 4 BOV V/V
- 5 BOV Silencer
- 6 PMSM motor
- 7 Cooling Air Silencer



Product range

Standard type: 30HP - 400HP / 0.4bar - 1.5bar (5.8 - 21.8psi)

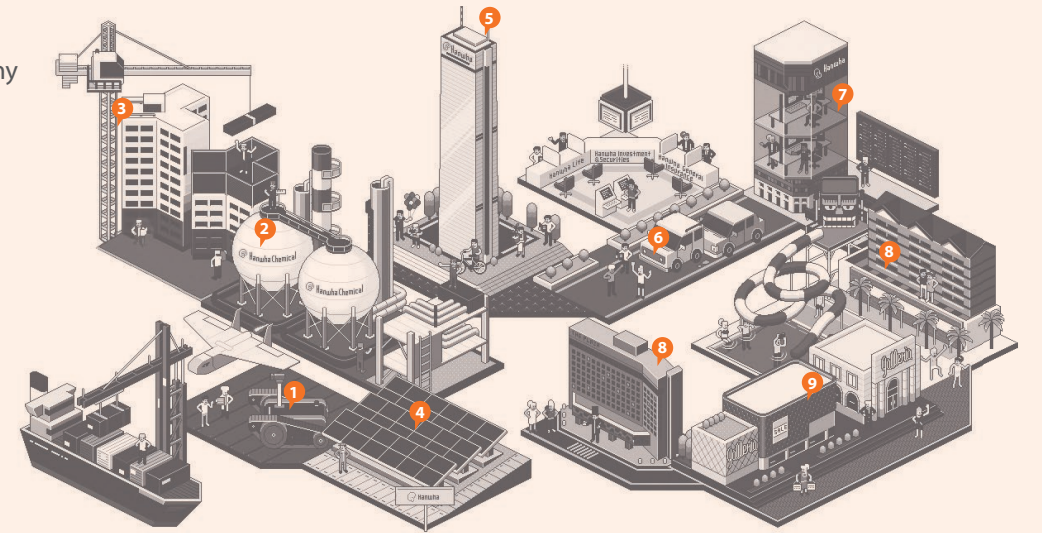
Model		HB 30	HB 50	HB 75	HB 100	HB 125	HB 150	HB 200	HB 250	HB 300	HB 400	
Type		Single Impeller										
Discharge Pressure		Flow rate (CMM/CFM) : 1 atm, 20°C(68°F), 65% / Tolerance= + - 5 %										
CMM @ 0.6 bar		20	34	51	69	85	105	140	164	210	280	
CFM @ 8.7 psi		700	1,200	1,800	2,450	3,000	3,700	4,950	5,800	7,400	9,900	
CMM @ 0.8bar		17	28	42	55	70	84	109	135	164	218	
CFM @ 11.6 psi		600	1,000	1,500	1,950	2,500	3,000	3,850	4,750	5,800	7,700	
CMM @ 1bar		-	-	34	45	-	67	87	104	133	174	
CFM @ 14.5 psi		-	-	1,200	1,600	-	2,400	3,100	3,650	4,700	6,150	
Shaft Power (HP)		30	50	75	100	125	150	200	250	300	400	
Exhaust Pipe		150A	150A	200A	200A	200A	300A	300A	300A	400A	500A	
Dimension	W	mm	700	700	850	850	850	900	900	1,200	1,500	
		Inch	30	30	33	33	33	35	35	35	48	60
	L	mm	1,300	1,300	1,500	1,500	1,500	1,800	1,800	1,800	2,200	2,300
		Inch	51	51	59	59	59	71	71	71	87	87
	H	mm	1,100	1,100	1,400	1,400	1,400	1,650	1,650	1,650	2,000	2,000
		Inch	43	43	55	55	55	65	65	65	79	79
Weight (kg)		500	500	700	700	700	900	900	900	1,200	1,400	

Hanwha Businesses

a FORTUNE Global 500 Company

64 years of business experience with 190 global networks

2015 Total assets of \$146billion and total sales of \$53billion



Manufacturing & Construction

- Hanwha Corporation 1
- Hanwha Techwin 1
- Hanwha Power Systems 1
- Hanwha Land Systems 1
- Hanwha Precision Machinery 1
- Hanwha Thales 1
- Hanwha Chemical 2
- Hanwha General Chemical 2
- Hanwha Total Petrochemical 2

- Hanwha Fine Chemical 2
- Hanwha Engineering & Construction 3
- Hanwha Q CELLS 4
- Hanwha Q CELLS Korea 4
- Hanwha Advanced Materials
- Hanwha Energy
- YEOCHUN NCC
- Hanwha City Development

Finance

- Hanwha Life 5
- Hanwha General Insurance 6
- Hanwha Investment & Securities 7
- Hanwha Asset Management 8
- Hanwha Investment
- Hanwha Savings Bank

Services & Leisure

- Hanwha Hotels & Resorts 1
- Hanwha Galleria 3
- Hanwha Galleria Tmeworld
- Hanwha 63 City 6
- Hanwha S&C
- Hanwha Station Development

Global Network

190 Global Networks (As of June 2015)

58 Affiliates all over the world

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|-----------------|-------------------|--------------|--------------|
| Ponitiac | London | Bismayah | Seoul |
| Chicago | Weybridge | Kuwait city | Tokyo |
| Bremen | Aix-en-Provence | Tehran | Nagasaki |
| Franklin | Stuttgart | Dubai | Fukuoka |
| London(Ontario) | Warsaw | Baghdad | Shenzhen |
| Forest | Eschborn | Almaty | Chongqing |
| New York | Ismaning | Mumbai | Guangzhou |
| Cranbury | Bitterfeld-Wolfen | New Delhi | Beijing |
| Bakersfield | Berlin | Yangon | Linyungang |
| Irvine | Dietfurt | Bangkok | Hangzhou |
| Shelby | Diosd | Samut Prakan | Ningbo |
| Hawaii | Budapest | Ho Chi Minh | Zhangjiagang |
| Monterrey | Moscow | Phnom Penh | Shanghai |
| Hartford | Frydek-Mistek | Selangor | Qidong |
| Teaneck | Bolzano | Kuala Lumpur | Dongguan |
| Ridgefield park | Athens | Singapore | Suzhou |
| Opelika | Istanbul | Jakarta | Tianjin |
| Monte | | Manila | Hong kong |
| Sao Paulo | | Saipan | Taipei |
| Santiago | | | Sydney |
| | | | Johannesburg |

