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#### 

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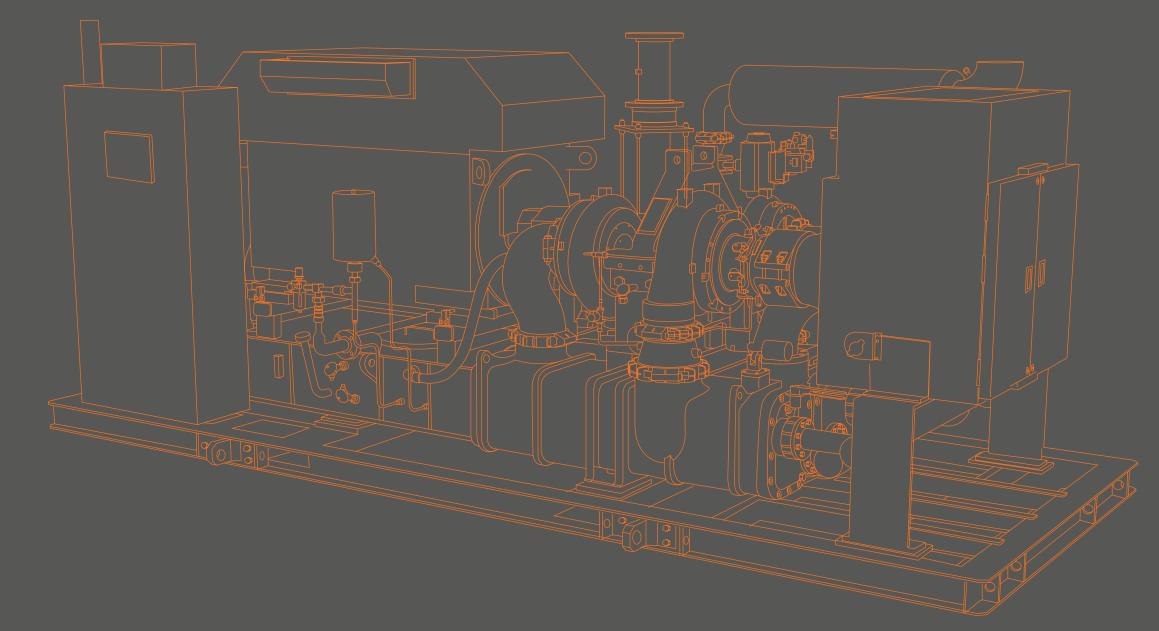
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# **OIL-FREE CENTRIFUGAL AIR COMPRESSOR SM/SM100 SERIES**





🚫 Hanwha Power Systems

## Introduction to Hanwha Power Systems

02

## **Dependable SM/SM100 Series**

### 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 1,000 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"
- 2018 Launched Turbo Expander Generator (TEG), an Environment-friendly Energy Solution Hydrogen Compressor Packager Agreement with PDC

### **Industries & Applications**

#### Upstream & Offshore



• Flash Gas, LP, MP Vapor Recovery / Instrument Air

#### Refinery

Make-up, Recycle, Booster (H<sub>2</sub>, 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 / N<sub>2</sub> booster (IGCC) • Syngas / Instrument Air

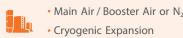
Hanwha Power Systems

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 5,500 units of turbo compressors worldwide.



Turbo Compressor Delivered

#### **Air Separation**



Cryogenic Expansion

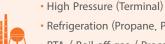
#### Fertilizer / Gas Processing

Process Air / Process Gas (NG, NH<sub>3</sub>, CO<sub>2</sub>)



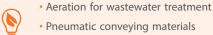
N<sub>2</sub> Booster / Instrument Air / NGL

#### Petro-chemical



- Refrigeration (Propane, Propylene)
- PTA / Boil off gas / Process Air / Instrument Air

#### Environment & Energy Saving



Mechanical vapor recompression

#### Way to ease your mind

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



#### **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 ZERO 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.

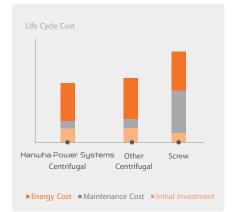
#### **Budget Savings**

- 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**

- once any problem happens





• 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

• RUSH112 service and wide range of service network minimizes downtime when emergency situation occurs

## **Key Technical Feature**

### 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



• 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 **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

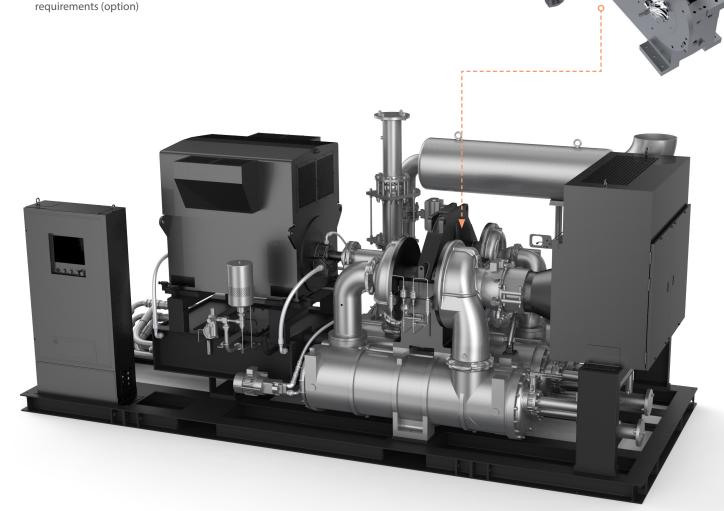


- Water-in-tube inter & aftercooler bundles allow simple maintenance and easy cleaning
- Corrosion / erosion resistant material applied for protecting damage of other components
- Minimizing pressure drop by optimized airflow

### 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)



Hanwha Power Systems



#### 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



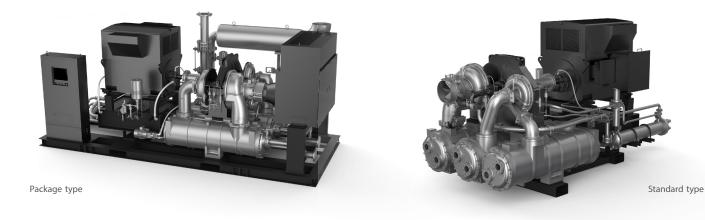
#### Leak-Free Oil & Gas Seals

- 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

## **Specifications SM Series**

| Model   |       | SM3000 | SM4000                | SM5000                | SM6000                |                       |  |
|---|-------|--------|-----------------------|-----------------------|-----------------------|-----------------------|--|
| Flow Rate                                       | 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        |  |
| Power   | 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         |  |
| Discharge Pressure                              | bar A |        | 3.5 - 18              |                       |                       |                       |  |
| Discharge Pressure                              | Psi A |        | 50 - 265              |                       |                       |                       |  |
|   | inch  | 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)                               |       | 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<br>to change. |       | 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**

P S

|                                 | P S |                        |
|---------------------------------|-----|------------------------|
| Air intake filter               |     | Main motor             |
| Inlet guide vanes               |     | PLC control system     |
| Blow off valve                  |     | Base frame             |
| Silencer                        |     | Cooling water manifold |
| Check valve and expansion joint |     | Sound enclosure        |
| Complete lubrication system     |     | Dual oil filter        |
| Aftercooler                     |     | Block valve            |
| Drain traps on all coolers      |     | Companion flange       |

| Ρ | S     |           |            |                  |
|---|-------|-----------|------------|------------------|
|   |       | Hot air p | iping      |                  |
|   |       | Auto trap | )          |                  |
|   |       | MODBUS    | / PROFIBL  | JS Interface     |
|   |       | Motor wi  | nding / be | earing protectio |
|   |       |           |            |                  |
|   | D     |           | C (1)      | La cal da cara   |
|   | Pac   | kage type | S Stand    | lard type        |
|   | 🖊 Sta | ndard (   | Options    | × Not applica    |

## **Monitoring System**

### **Customer Oriented Monitoring System**

Provides convenient operation and accurate control



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

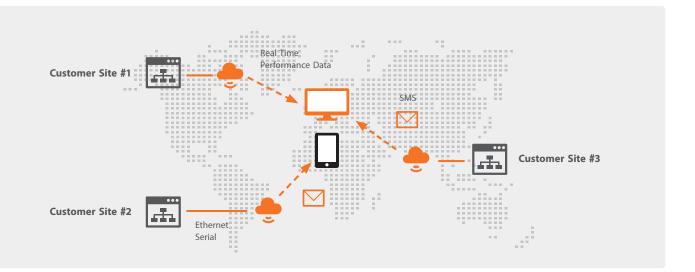
## **User Friendly Interface with Improved**

#### **Operability and Legibility**

 Conversion to ICON / animation of main information as operation / stop, valve status etc.

• Quickly and easily switchable screen by navigation bar

**Complete Control Package** 



#### • Real-time monitoring by PC and smartphone

- Warning and trouble shooting message transferred once alarm or shutdown occurs





#### 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



Compressor remote management and energy saving solution

## **Driving Performance SM100 Series**

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

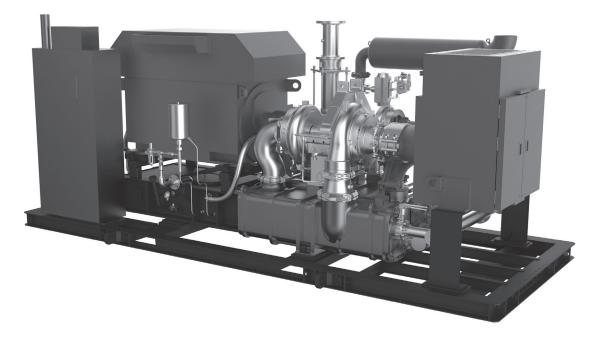
| Model  |       |   | SM3100                | SM4100                | SM5100                | SM6100                | SM7100                |
|--|-------|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Flow Rate  | m³/hr |   | 3,300 - 5,500         | 5,500 - 9,000         | 9,000 - 15,000        | 15,000 - 24,500       | 24,500 - 32,000       |
| Flow Rate  | CF    | M | 1,950 - 3,250         | 3,250 - 5,300         | 5,300 - 8,850         | 8,850 - 14,400        | 14,400 - 18,800       |
| D  | kW    |   | 200 - 580             | 300 - 930             | 500 - 1,500           | 800 - 2,500           | 1,000 - 3,100         |
| Power  | HP    |   | 270 - 780             | 400 - 1,200           | 670 - 2,010           | 1,070 - 3,350         | 1,340 - 4,155         |
| Discharge Duscours   | Bar A |   | 3.5 - 13              |                       |                       | 3.5 - 11.4            |                       |
| Discharge Pressure   | Psi A |   | 50 - 188              |                       |                       | 50 - 165              |                       |
| Dimension (L×W×H)<br>*Dimension and weight are<br>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 |
|  |       | Р | 207 x 89 x 98         | 217 x 89 x 98         | 246 x 89 x 100        | 244 x 89 x 100        | -                     |
|  | inch  | 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   | K.    | Р | 8,600                 | 9,500                 | 13,150                | 17,900                | -                     |
|  | Kg    | S | 6,900                 | 7,500                 | 10,300                | 14,450                | 20,500                |

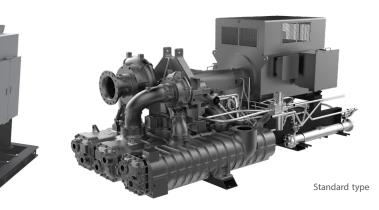
P Package type S Standard type



#### **Scope of Supply**

| S            |                                 | Р  |   |
|--------------|---------------------------------|--|---|
|              | Air intake filter               | $\checkmark$   |   |
| $\checkmark$ | Inlet guide vanes               | $\checkmark$   |   |
| $\checkmark$ | Blow off Valve                  | $\checkmark$   | Č   |
|              | Silencer                        | $\checkmark$   |   |
| $\checkmark$ | Check valve and expansion joint |  |   |
| $\checkmark$ | Complete lubrication system     |  |   |
| $\checkmark$ | Aftercooler                     |  |   |
| $\checkmark$ | Drain traps on all coolers      |  |   |
|              |                                 | <ul> <li>s</li> <li>Air intake filter</li> <li>Inlet guide vanes</li> <li>Blow off Valve</li> <li>Silencer</li> <li>Check valve and expansion joint</li> <li>Complete lubrication system</li> <li>Aftercooler</li> <li>Drain traps on all coolers</li> </ul> | ✓       Inlet guide vanes       ✓         ✓       Blow off Valve       ✓         ●       Silencer       ✓         ✓       Check valve and expansion joint       ●         ✓       Complete lubrication system       ●         ✓       Aftercooler       ● |





Main motor
 PLC control system
 Base Frame
 Cooling water manifold
 Sound Enclosure
 Dual oil filter
 Block Valve
 Companion Flange



## **Driving Performance & Low Flow SM2100**

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.

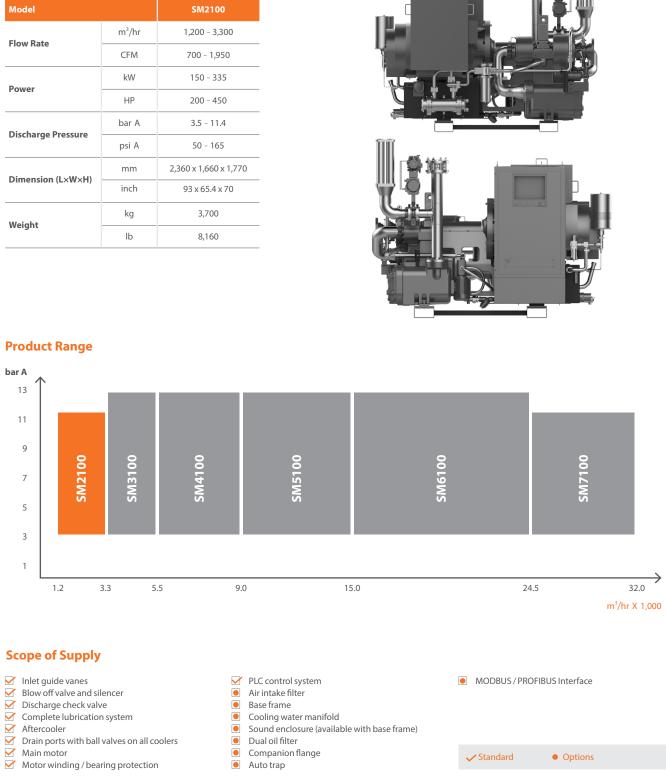
(Depending on the conditions of usage, the only bearings may need to be replaced.)

- 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

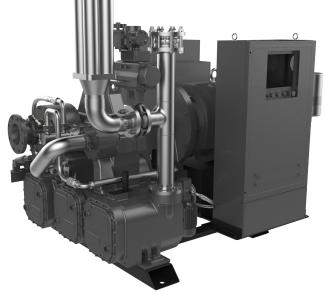
- Sealing system with 4 stages which satisfies API specification to minimize gas leaks
- Highly efficient inlet guide vanes to improve the performance of compressor at part load and to reduce power consumption
- State-of-the-art 5-axis machined impeller for stability and high efficiency

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



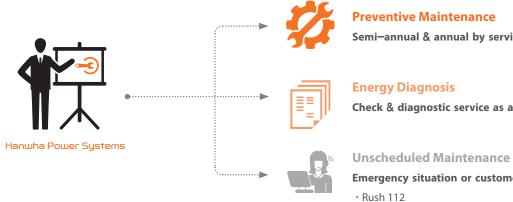
#### **Scope of Supply**

- ✓ Inlet guide vanes



## **Smart Care**

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.





**Emergency situation or customer requirement** 

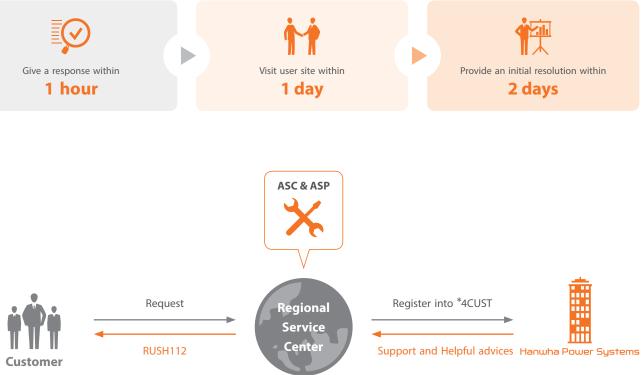
Wide service network

### **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**

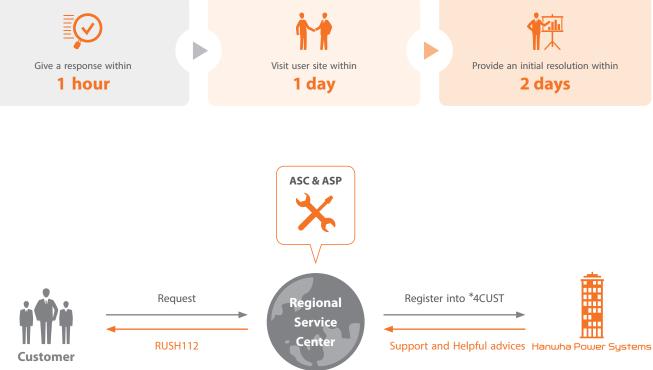
Hanwha Power Systems is willing to provide immediate service to customers worldwide based on RUSH 112 philosophy.



### **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.



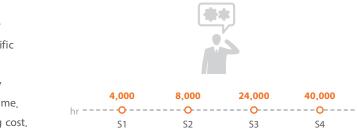


\* 4CUST: Customer-centric 4C oriented system (4C: Consumer, Cost, Convenience, Communication)

\* ASC: Authorized Service Center

\* ASP: Authorized Service Provider

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## Introduction to Hanwha Group

#### Hanwha Businesses

- a FORTUNE Global 500 Company
- 67 years of business experience with 351 global networks

2018 Total assets of \$179 billion and total sales of \$62billion



#### Manufacturing & Construction

| Hanwha Corporation         | Hanwha General Chemical           |
|----------------------------|-----------------------------------|
| Hanwha Aerospace           | Hanwha Total Petrochemical        |
| Hanwha Systems             | Hanwha Advanced Materials         |
| Hanwha Defense             | YEOCHUN NCC                       |
| Hanwha Techwin             | Hanwha Q CELLS                    |
| Hanwha Precision Machinery | Hanwha Energy                     |
| Hanwha Power Systems       | Hanwha Engineering & Construction |
| Hanwha Chemical            | Hanwha City Development           |

#### Finance

Hanwha Life Insurance Hanwha General Insurance Hanwha Investment & Securities Hanwha Asset Management Hanwha Savings Bank

**76** Affiliates all over the world

#### Services & Leisure

14

Hanwha Hotels & Resorts Hanwha Galleria Hanwha Galleria Timeworld Hanwha Estate Hanwha Station Development Hanwha Eagles

#### **Global Network**

#### 351 Global Networks (December 2018)

| Bakersfield   | Aix-en-Provence   | Johannesburg  |
|---|---|---|
| Bremen  | Athens  | Nairobi   |
| Cerritos  | Berlin  |   |
| Chicago   | Bitterfeld-Wolfen   | Cyberjaya   |
| Forest  | Bolzano   | Ho Chi Minh   |
| Franklin  | Budapest  | Jakarta   |
| Hawaii  | Chertsey  | Kuala Lumpur  |
| Irvine  | Dietfurt  | Manila  |
| Monroe  | Eschborn  | Muara Teweh   |
| New York  | Frýdek-Místek   | Mumbai  |
| Opelika   | Istanbul  | New Delhi   |
| Pontiac   | London  | Samut Prakan  |
| Saipan  |   | Singapore   |
| Shelby  | Moscow  | Taipei  |
| Teaneck   | Stuttgart   | Tehran  |
| London  | Warsaw  | Yangon  |
| Vancouver   |   | Bangkok   |
|   | Al Khobar   |   |
| Monterrey   | Almaty  |   |
| Santiago  | Baghdad   |   |
| São Paulo   | Bismayah City   |   |
|   | Doha  |   |
|   | Dubai   |   |
|   | Kuwait City   |   |
|   | Modi'in-  |   |
|   | Maccabim-Re'ut  |   |
| Hawaii<br>Irvine<br>Monroe<br>New York<br>Opelika<br>Pontiac<br>Saipan<br>Shelby<br>Teaneck<br>London<br>Vancouver<br>Monterrey<br>Santiago | Chertsey<br>Dietfurt<br>Eschborn<br>Frydek-Mistek<br>Istanbul<br>London<br>Moscow<br>Stuttgart<br>Warsaw<br>Al Khobar<br>Almaty<br>Baghdad<br>Bismayah City<br>Doha<br>Dubai<br>Kuwait City<br>Modi'in- | Kuala Lumpur<br>Manila<br>Muara Teweh<br>Mumbai<br>New Delhi<br>Samut Prakan<br>Singapore<br>Taipei<br>Tehran<br>Yangon |

Seoul Nagasał Tokyo Perth Sydney

Dongguan Guangzhou Hangzhou Hong Kong Lianyungang Ningbo Quidong Shanghai Shenzhen Tianjin Zhangjiagang



solutions in time.



Belaru Brazil China Czech Finland



### 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

#### Hanwha Power Systems

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

| 15 | India      | Malaysia   | Thailand |
|----|------------|------------|----------|
|    | Indonesia  | Mexico     | Turkey   |
|    | Italy      | Netherland | Ukraine  |
|    | Kazakhstan | Poland     | USA      |
| d  | Korea      | Russia     | Vietnam  |
|    |            |            |          |