

# **Highly**

## **Rollkolbenverdichter**

## **Rotary Compressors**

## **Spezifikation**

## **Installation Manual**

# **WHP13300PSDPC8FQ**

**R 290**

**54,8 cm<sup>3</sup>/rev**

**Doppel Zyinder**

**900 - 6600 min<sup>-1</sup>**

**DC / BLDC**

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# CONTENTS

	—————	<b>1~4</b>
<b>WHP13300PSDPC8FQ SPECIFICATION</b>		
1.SCOPE		
2.SPECIFICATION OF THE MODEL		
3.THE PARAMETER OF MOTOR		
4.CHARACTERISTICS		
5.PARTS AND DRAWING LIST		
<b>HEAT PUMP Compressor CRITERIA</b>	<b>—————</b>	<b>5~15</b>
<b>CHECK UPON DELIVERY</b>	<b>—————</b>	<b>16</b>
1.BASIS FOR CHECKING UPON DELIVERY		
2.RULE FOR CHECKING UPON DELIVERY		
<b>DRAWINGS</b>	<b>—————</b>	<b>17~26</b>
<b>ATTACHED PAGE</b>	<b>0 —————</b>	<b>27~30</b>
<b>SPECIFICATION REVISION RECORD</b>	<b>———</b>	<b>31</b>

	<div>SUBJECT</div> <div>Model WHP13300PSDPC8FQ SPECIFICATION</div>	<div>PAGE: 1/31</div>
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1. SCOPE

This specification is applied to SHANGHAI HIGHLY Heat pump water heater compressor.

2. SPECIFICATION OF THE MODEL

Item	Spec
2.1 Model Type	WHP13300PSDPC8FQ
2.2 Power source input to inverter	Rated voltage / Rated frequency/Phase 380V/50Hz/3Φ OR 220V/50HZ/1Φ
2.3 Output	2630W (@3600 min <sup>-1</sup> )
2.4 Application	Heat pump water heater

2.5 Performance

Item	Rated Condition
Rotational speed	3600 min <sup>-1</sup>
Nominal Heating Capacity	13300W±5%
Motor input	2860W±5%
Current	11.5A±5%
COP(see*)	4.65±5%
Test Conditions	
Evaporating temp.	7.2℃
Condensing temp.	54.4℃
Liquid temp. entering expansion valve.	46.1℃
Return gas temp.	35℃
Ambient temp.	35℃

	SUBJECT Model WHP13300PSDPC8FQ SPECIFICATION		PAGE: 2/31
<p>*.COP= <u>Heating capacity (W)</u> Motor input (W)</p> <p>*.Rated Capacity and input are measured with HITACHI inverter circuit by secondary Refrigerant calorimeter Methods of JIS B8606 by SHANGHAI HIGHLY Electrical Appliances Co., Ltd.</p>			
2.6	Refrigerant	R290	
2.7	Displacement	54.8ml /rev (Double-cylinder	
2.8	Allowable frequency range	900～6600 min <sup>-1</sup>	
2.9	Oil	HAF68 1150±20ml	
2.10	Allowable amount of refrigerant charge	Below 1500g	
2.11	Hermetic Terminal	Conventinal Type	
2.12	Space volume of inner case	1500cm <sup>3</sup>	
2.13	Compressor weight	18.9kg incl. Oil	
2.14	Motor Type Insulation class	Direct current brushless motor E class	
2.15	Compressor natural frequencies	19.9Hz/21.7Hz/24.5Hz±3Hz (should be avoided or pass within ten seconds are compressor natural frequencies, and they can be changed when connecting with pipe lines. So, it is necessary to take the piping stress of the system into account. The recommended piping stress value can be seen as follow, When the system Start/stop: below 34.3N/mm <sup>2</sup> When the system operating: below 17.7N/mm <sup>2</sup>	

3. THE PARAMETER OF MOTOR

3.1 Rotor Pole（Pole）	4	——
3.2 Rated Frequency Range（Hz）	30-220	Electrical Frequency, Relating to VDCmax of Inverter
3.3 Demagnetizing Current（A）	54.01A	Peak Current, at 120℃, -5% Demagnetizing Rate
3.4 Inductance Ld（mH）	Sheet 2	——
3.5 Inductance Lq（mH）	Sheet 2	——
3.6 Stator coil resistance（20℃）（Ω）	0.502（20℃）	line-to-line
3.7 Voltage Constant（Vrms/krpm）	43.10V/krpm	line-to-line
3.8 Torque Constant（N・m/Ams）	0.69	Torque/Current 力矩/电流
3.9 Inertia（Kg・m2）	0.000666	_____
3.10 Flux Φa（Wb））	0.1702	$\phi \text{ (Per Phase, Peak)} = \frac{\sqrt{2} \times E0}{2\pi f \sqrt{3}}$ $\phi \text{ (一相 peak 值)} = \frac{\sqrt{2} \times E0}{2\pi f \sqrt{3}}$
3.11 Magnet Material	NdFeB	

Sheet 2

Current	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
q	5.44	5.39	5.34	5.29	5.24	5.18	5.12	5.06	5.00	4.95	4.89	4.83	4.78	4.72	4.66
d	3.71	3.65	3.65	3.64	3.63	3.61	3.59	3.56	3.54	3.51	3.48	3.45	3.42	3.39	3.36

Sheet 3

Running effectiv current (A)	3	4	5	6	7	8	9	10
Running torque (N.m)	2.1	2.8	3.4	4.1	4.8	5.5	6.2	6.9

4. CHARACTERISTICS

4.1 Appearance

The surface of the compressor is painted to black, without obvious flaw ,impact scar, paint peel off, rust and so on.



## COMPRESSOR CRITERIA

## 1 Strictly observe the specification

The compressor should be used in specifications written in this “compressor specification” and not be used in specifications outside it.. The main circuit must link up with fuse or breaker.

## 2 Source voltage

Specified inverter is linked up with compressor terminals . Applied voltage of this inverter should be voltage specified in this “compressor specification”. Alternating voltage should never be applied on terminals (for example: commercial alternating voltage of 1 $\phi$ 100V, 200V, 3 $\phi$ 200V). This is because that if applied alternating current the direct current motor will demagnetize.

## 3 Operating voltage range

The compressor should be operated in the range of rated voltage  $\pm 10\%$  , under standard condition and overload condition of rated frequency (applied voltage to inverter). It must be satisfied with item 5 ,6,7.

## 4 Operating temperatures and pressures

The operating temperatures and pressures of a compressor should be within the range shown in the table 2 and graph 1.

## 5 Oil Back and height of the oil level

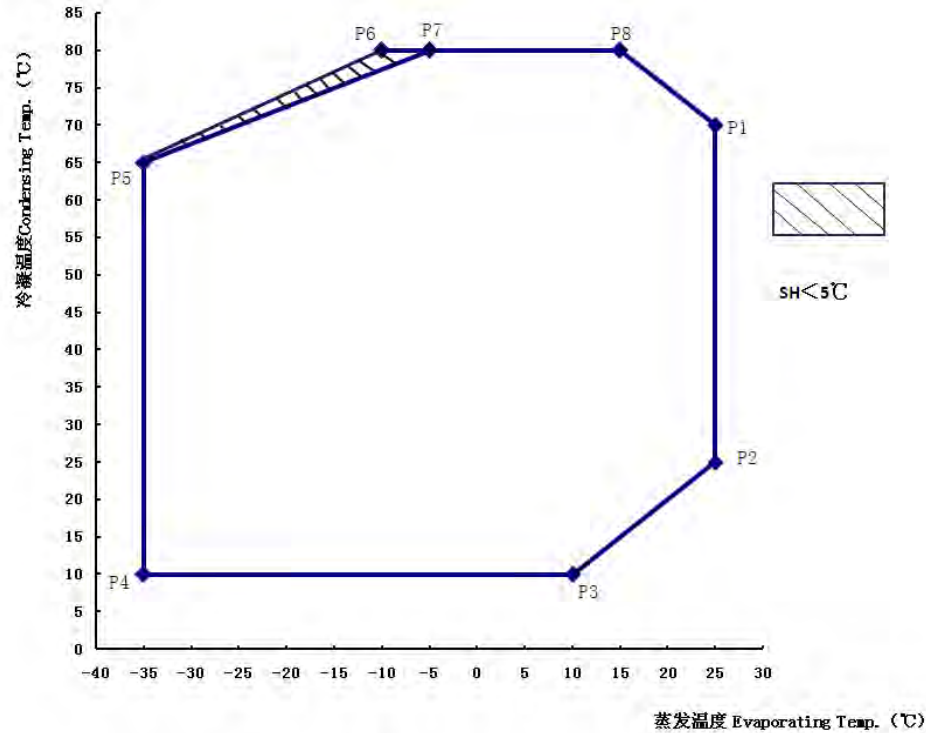
The oil should be returned continuously to the compressor and the structure of the refrigerating system should not make oil stay in the system. The oil level in compressor should be satisfied with chart 2. If not keep the oil level, the shortage will occur, and influence the reliability of the compressor. (please check the oil level in the compressor with the sight glass which supplied from SHEC.

There should be superheated gas returned to the compressor under all normal operating conditions.

Table 2

Item	Operating Envelope	
Discharge pressure MPa	3.13 {30.91}MAX  (condensing temperature 80° C )	(see graph 1)
Suction Pressure MPa	0.139~0.95 {0.40~8.67} (Evaporation Temperature : -35℃~25℃). Compressor suction side can handle the same maximum pressure as discharge side without damage when compressor is not running.	
Compressor case bottom temp	99℃or below and 6 °C higher than condensing temperature, (the time compressor case bottom temp 6 °Cbelow the condensing temperature should be less than 5 minutes each time) ,  Requirement for high pressure ratio condition can be seen on page 28.	
Motor winding temp	R. Voltage±10%: 120℃ MAX	
Accumulator temp	Higher than outlet pipe of evaporator	
Ambient temp	Meet for the condition of above mentioned motor winding temp.	





Graph 1 图 1

	P1	P2	P3	P4	P5	P6	P7	P8
Condensing temperature	70°C	25°C	10°C	10°C	65°C	80°C	80°C	80°C
Evaporation Temperature	25°C	25°C	10°C	-35°C	-35°C	-10°C	-5°C	15°C

\*Requirement for high pressure ratio condition can be seen on page 28.

## 6 Current limitation

Current peak among motor terminals (include instantaneous current peak) should be below demagnetizing current in order to prevent magnet in motor from demagnetization.

## 7 Pressure difference between suction and discharge 吸气、排气压力差

In all allowable rotational speed range, the difference of pressure should be more than 0.39MPa{4kgf/cm<sup>2</sup>}. But if there is no problem of noise when assembled in air conditioner, it can also below this value(the requirement can be seen on page 28).

## 8 Discharge pipe temperature

Discharge pipe temperature is measured at a distance 300mm from the surface of compressor and should be less than 110°C. The tip of the thermocouple is fixed by soldering when measuring discharge pipe temperature .Furthermore, soldering point is covered with urethane foam to prevent the effect of wind.

	HEAT PUMP WATER HEATER COMPRESSOR CRITERIA 热泵热水器专用压缩机使用基准	PAGE: 8/31
<p>9 Dust of compressor hermetic terminals</p> <p>Compressor hermetic terminals should be mounted with specified cover in right way to prevent dust entering, and should be used in direction which dust is hard to enter in.</p> <p>10 Lead wire of compressor hermetic terminals</p> <p>Measuring the temperature of hermetic terminals , lead wire should be resist to the temperature and be clamped so as not in touch with the surface of compressor and pipe.</p> <p>11 Start-stop frequency</p> <p>The frequency should be less than 6 times per hour. Operating time from start to stop should be more than 3 minutes to make sure the oil is above the minimum level. Stopping time should be more than 3 minutes to make sure the suction pressure and discharge pressure is balance.</p> <p>12 Rate of rotational speed change</p> <p>The rate of compressor rotational speed (acceleration) should be less than 133min<sup>-1</sup>/s as the compressor speed is below 5400rpm while less than 60min<sup>-1</sup>/s as the compressor speed is higher than 5400rpm. However, when rotational speed is reduced to avoid temporary over-current, the rate can also be less than 600min<sup>-1</sup>/s when the compressor speed is below 5400rpm and should be less than 300min<sup>-1</sup>/s when the speed of compressor reach above 5400rpm, only if the variable range is below 120min<sup>-1</sup>.</p> <p>13 Air and moisture in refrigerating system</p> <p>The degree of vacuum in refrigerating system should be less than 20Pa (150×10<sup>-3</sup>mmHg) at room temperature just before charging refrigerant. The quantity of water should be less than 0.15ml.</p>		

## 14 Impurities in refrigerating system

- (1) The weight of residue on the inside surface of the heat exchanger and tube should be less than  $0.01\text{g/m}^2$ . But metallic dust should not be permitted in the system. This value means the weight of foreign residue collected by filter paper after washing inside surface of the heat exchanger tubes with R-11.
- (2) Prevent the impurities from entering into the enclosed unit system used R290. When the impurities entered into the enclosed system, it will damage the moving mechanism parts and result in the capillary depositing.
- (3) Eliminate all system contaminants such as trichlorethylene, alkalies, soaps, oil, acids & washing fluid used at machining heat exchanger and tubes.

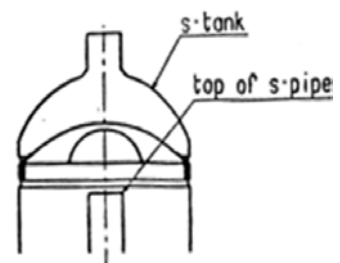
## 15 Compressor vacuum operation

Compressor should never be operated while under vacuum. Otherwise, internal arcing can cause damaging parts.

- 16 The compressor should be operated for more than 20 seconds within 15 minutes after charging refrigerant into the system so proper lubrication results.

## 17 Liquid refrigerant return limitations 有关液体制冷剂回流的限制项目

- (1) Liquid refrigerant level in s-tank should be lower than the top of s-pipe in s-tank. (see chart at right)



- (2) There should not exist noise of the liquid refrigerant compression, current and vibrancy increase. System can append the assistant tank or reduce the amount of refrigerant to prevent from liquid refrigerant compression. Refrigerant system forbid liquid refrigerant from flowing back compressor in any case. In normal condition the overheat gas refrigerant should flow back compressor.

18 Purge parts with dry nitrogen or dry air to remove remains in parts (dust, detergent, etc.)

before assembly of system. Time for purging: over one second for pipe; over three seconds for heat exchanger. Purging pressure:  $0.9 \pm 0.1 \text{ MPaG}$ . Dew point of dry air: Below  $-20^{\circ}\text{C}$ .

The motor winding temperature should be less than  $149^{\circ}\text{C}$  and hermetic terminal body temperature should be less than  $177^{\circ}\text{C}$  in process of manufacturing.

19 Apply for vehicle

The compressor should not be used on moving equipment such as automobiles, trains, ships, etc.

20 Installation

The rotational axis of compressor should be kept vertical during operation. But in actual application the axis incline must be within  $5^{\circ}$  at all directions during operation.

21 Pipe vibration

The displacement of the pipes, which connect from the compressor to other parts of the refrigerate-or systems, should be less than  $0.8 \text{ mm}$  ( $1/32''$ ) when the compressor is operating at allowable rotational speed range and voltage range of rated  $\pm 10\%$ .

Displacement in excess of  $0.8 \text{ mm}$  ( $1/32''$ ) will require changing tube length and/or routing.

22 Connecting tube design

In designing and routing tubing that connect from the compressor to the other parts of the air conditioner, following should be considered.

Moving tubes to the moving parts; minimum clearance 12.7mm(1/2") Moving  
tubes to non-moving parts; minimum clearance 9.5mm((3/8")  
Moving tubes never touch to lead wire.

### 23 Avoid refrigerant migration

The refrigerant migration to compressor shell should be avoided during the heat pump water heater system shut down periods, It's suggested that the electric heating belt should be used around the shell bottom when necessary.

### 24 Miscellany

(1) The compressor should be carried carefully to avoid drop, drag , impact and should not apply partial force on projection parts such as pipe, hermetic terminals, foot during carrying and processing.

(2) The compressor should not be operated to form a vacuum and to absorb air. The compressor only can run in one direction which according to lead routing wiring diagram. Never reversion otherwise the compressor will be in trouble.

(3) The compressor should not be left opened in the atmosphere for more than 5 minutes.

When the air entered into the unit system with refrigerant R290, it will expedite the deterioration of the oil and result in the capillary depositing and the reducing of insulation resistance.

(4) Electric pulse should not be applied to compressor when it is in vacuum.

(5) The compressor should be kept in the place with low-dust, low-moisture.

- (6) The compressor can't be used in the place with corrosive atmosphere such as hot spring and chemical warehouse. It should not be the structure often splash water on the surface of the compressor forcibly.
- (7) The trouble of cross valve, electromagnetic valve, defroster, refrigerant controller, fan motor used in refrigerating system may cause compressor accident. So their reliability should be ensured completely. Moreover, the way of design, manufacture, application of refrigeration cycle with less-leak should be adopted.
- (8) The main electric circuit should be equipped with fuse or breaker.
- (9) Refrigerant should be charged from the end of condenser of refrigerating systems.
- Never Charge refrigerant to the compressor directly.
- The refrigerant should always be charged in liquid state. When the refrigerant is charged in gas state. The percent component will possibly be changed.
- (10) Temperatures within systems during stable compressor operation should not be less than  $-35^{\circ}\text{C}$  to prevent wax precipitation from the oil.
- (11) The units of refrigerating system should be connected to earth.
- (12) Compressor mounting
- Rubber grommets are designed soft to provide the noise isolation and to lessen vibration Energy transmission. Stud bolt should be designed to provide sufficient clearance for noise and vibration isolation and to prevent compressor from coming off its mount.
- 橡胶避振脚是采用防止由于噪音引起的振动及振动能量吸收原理设计的。所设计的固定杆应提供足够的间隙用于噪音及振动隔离，并且防止压缩机从避振脚上滑落。
- (13) There should be adequate clearance between the under—surface of Push-Nut and the upper surface of rubber grommets.

- (14) SHEC will not take any responsibility against accident that is caused by the accessories equipped by yourselves.
- (15) The hermetic terminals of compressor should not be inserted slantingly and not be applied twisting force after inserting so as to avoid reducing of terminal fixed force.
- (16) The pipe and hermetic pens attached to the compressor should not be bent.
- (17) The dropped compressor can't be used anymore.
- (18) Compressor can be used when ambient temperature is higher than  $-10^{\circ}\text{C}$ . Confirm the start-up of compressor if the temperature of compressor surface is below  $-10^{\circ}\text{C}$ . Heat up compressor to reach the temperature higher than  $-10^{\circ}\text{C}$  with heater if the ambient temperature is below  $-10^{\circ}\text{C}$ .
- (19) Set a thermistor on the case cover of compressor to prevent from accident of leakage of refrigerant.
- The thermistor can stop the operation of compressor when compressor in abnormal temperature.
- The lead wires of thermostat is enveloped with tube, as same as that of the terminals, to avoid directcontact with the compressor and pipe.
- (20) The compressor should not be splashed with water intentionally. Prevent moisture from entering into the enclosed unit system. When the moisture entered into the unit of the refrigerant R290, the refrigerant oil and the organic compound material presented in the hermetic motor will possibly decompose on the affecting of water. It will result in the capillary depositing and the reducing of insulation resistance.

It is necessary to install a dryer to dehumidify the residual moisture mixed in the refrigerant in the cycling system. The specially defined molecular-sieve dryer is advised.

(21) Use the refrigerant of specified brand. When the refrigerant not specified used, it will possibly cause trouble of the performance and reliability of the compressor by the impurities in the refrigerant.

(22) The lead wires should be connected to hermetic terminals without being touched on the surface of the compressor.

(23) Be careful of avoiding oxide scale while soldering during assembly of refrigerating system.

(for example: flow or fulfill dry nitrogen)

(24) The quantity and kind of contamination (the process materials) in the cycle should be grasped and managed. Carry on reliability test that input contamination a lot than anticipated contamination quantity.

(25) To avoid water and impurity into the refrigeration system and make sure no leakage of refrigerant during the operating course. It's required to direct the erector and maintenance man of air-conditioner.

(26) The start-up current and torsion of compressor

Adjust the start-up current of the compressor to get enough torsion by inverter. Confirm and measure the start-up current if change the parts and design.



(27) The fuse or/and breaker should be equipped in the main circuit.

(28) The thickness of the refrigerating system using tube  
the tube thickness as followed

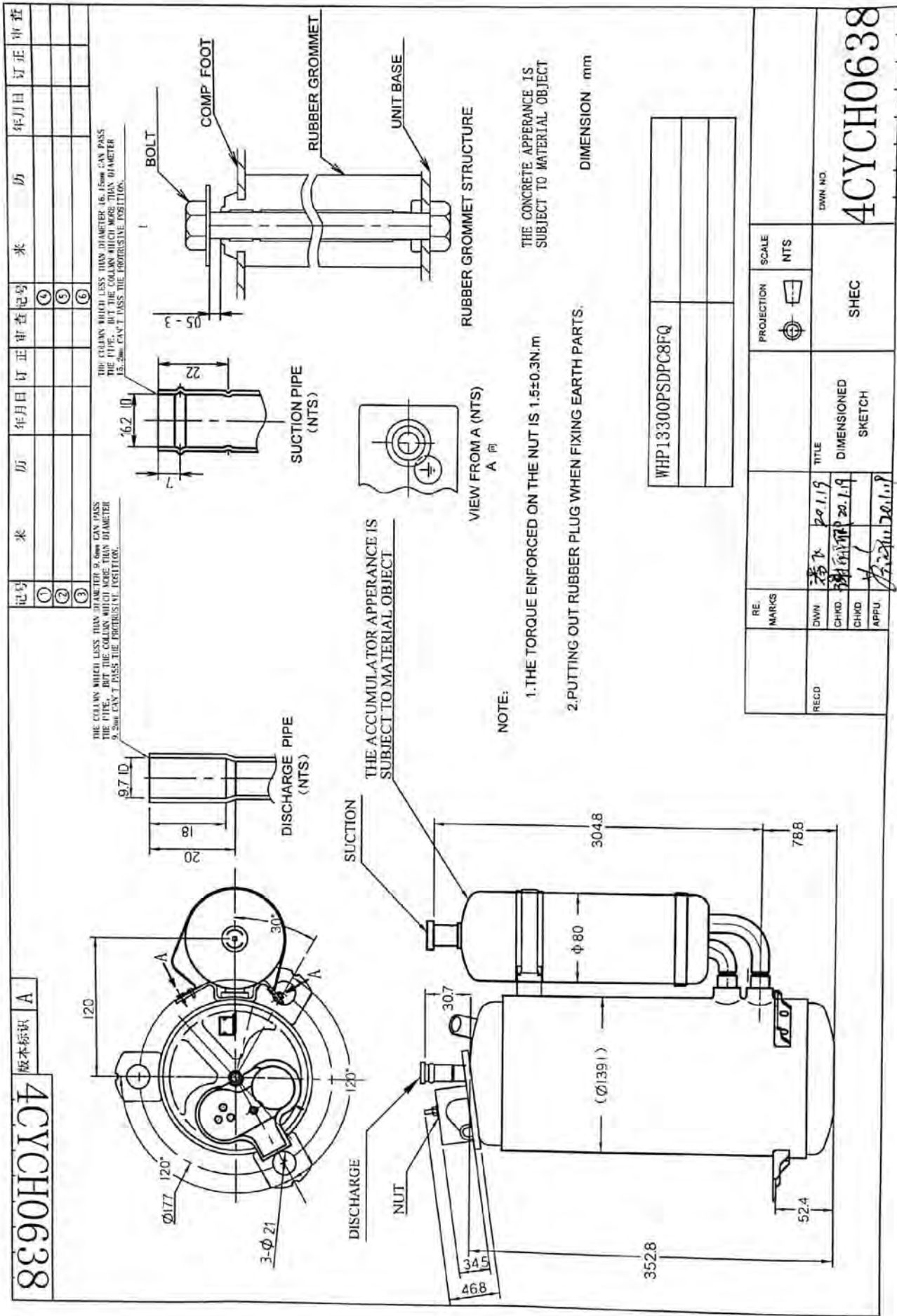
External diameter(mm)	6.35	6.35~11.0	11.0~13.0	13.0~15.0	15.0~19.0
Thickness	$\geq 0.5$	$\geq 0.5$	$\geq 0.6$	$\geq 0.6$	$\geq 0.8$

#### 1. Basis for Checking upon Delivery

The Performance test will be carried out in accordance with this “compressor Specification”.  
The Safety Performance in accordance with GB4706.1 Safety of household and similar electrical appliances General requirements and GB 4706.17 Safety of household and similar electrical appliances Particular requirements for motor-compressor.

#### 2. Rule for Checking upon Delivery

If come across any quality problem, please notify the company in written form within 30 days after the arrival of the cargo, the company shall exchange exactly the number of the products, otherwise they shall be regarded as being up to standard.

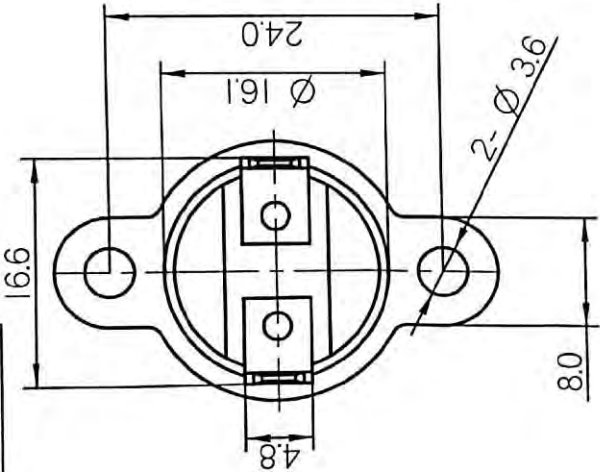


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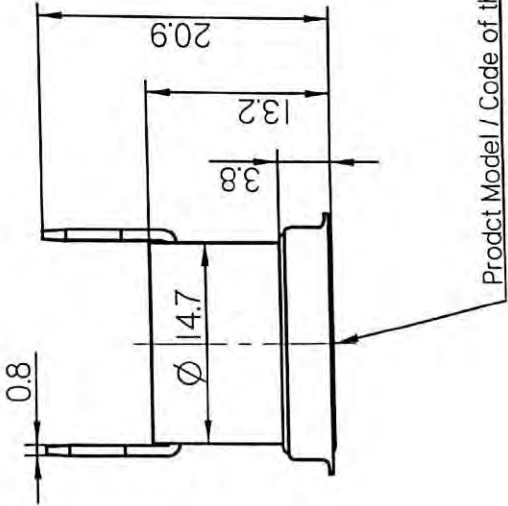


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SPECIFIED LIMITS

manufacturer	Product Model	(OFF) Operating Temp(OFF)	(ON) Operating Temp(ON)	Testing Voltage	Testing Current
Tongbao	KSD301-11.5/10BC22S20-S2	115±3℃	95±5℃	AC250V	10A



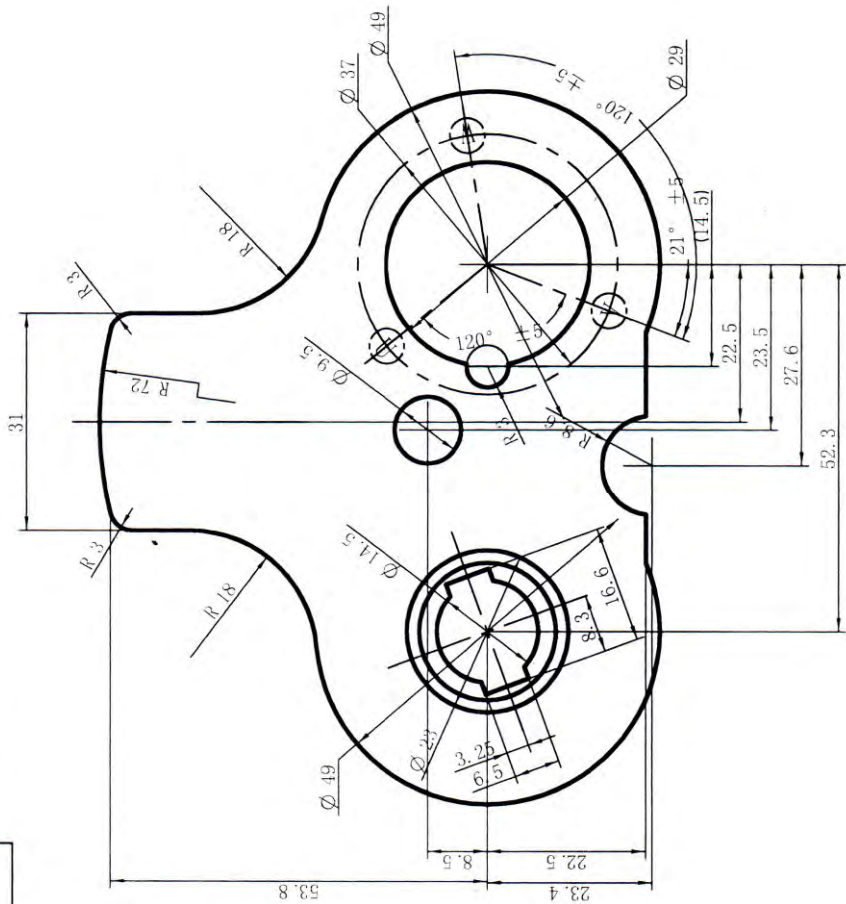
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MATERIAL: EPDMFOP-B

DIMENSION: mm

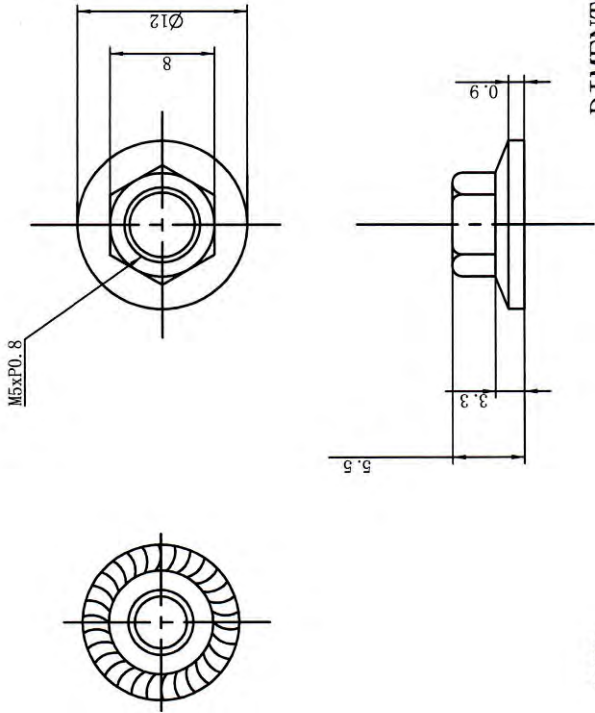
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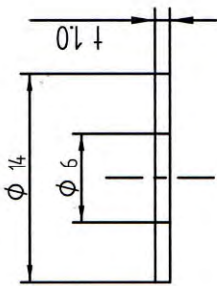
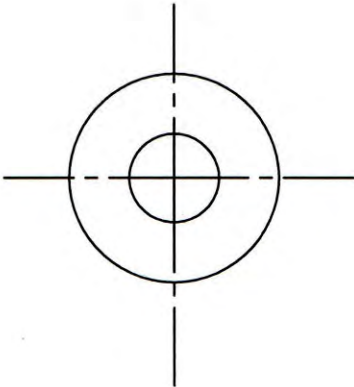
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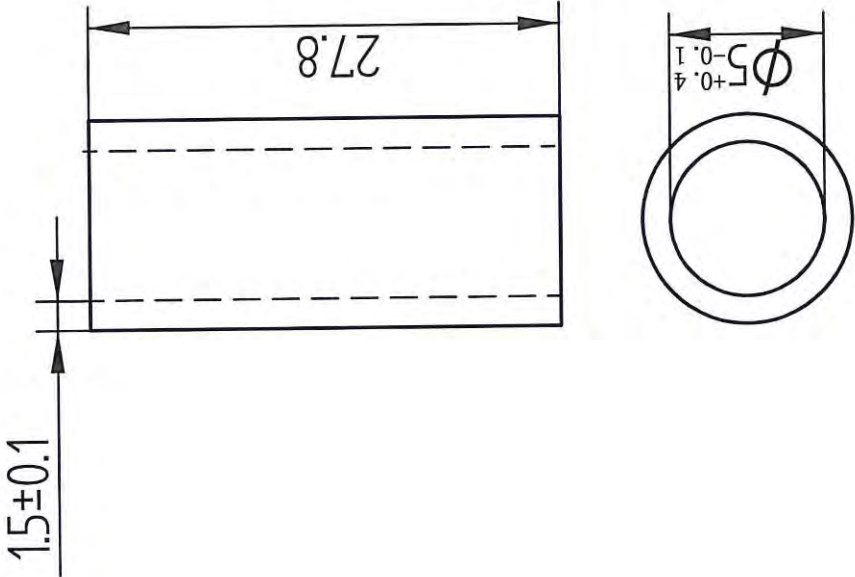
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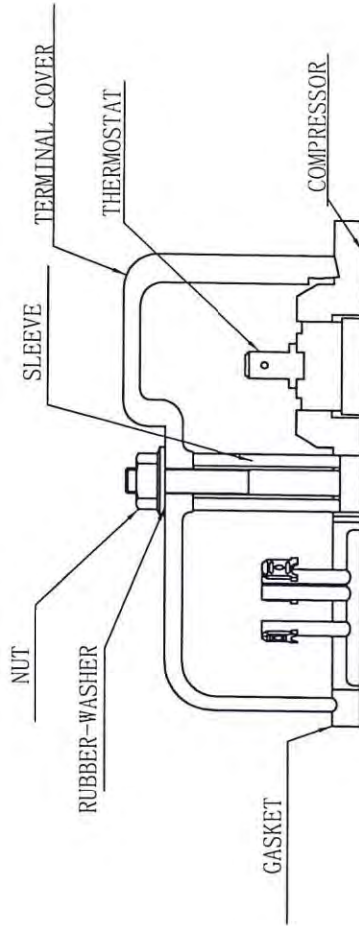
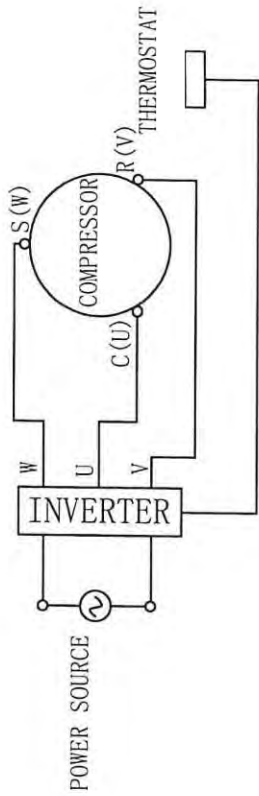
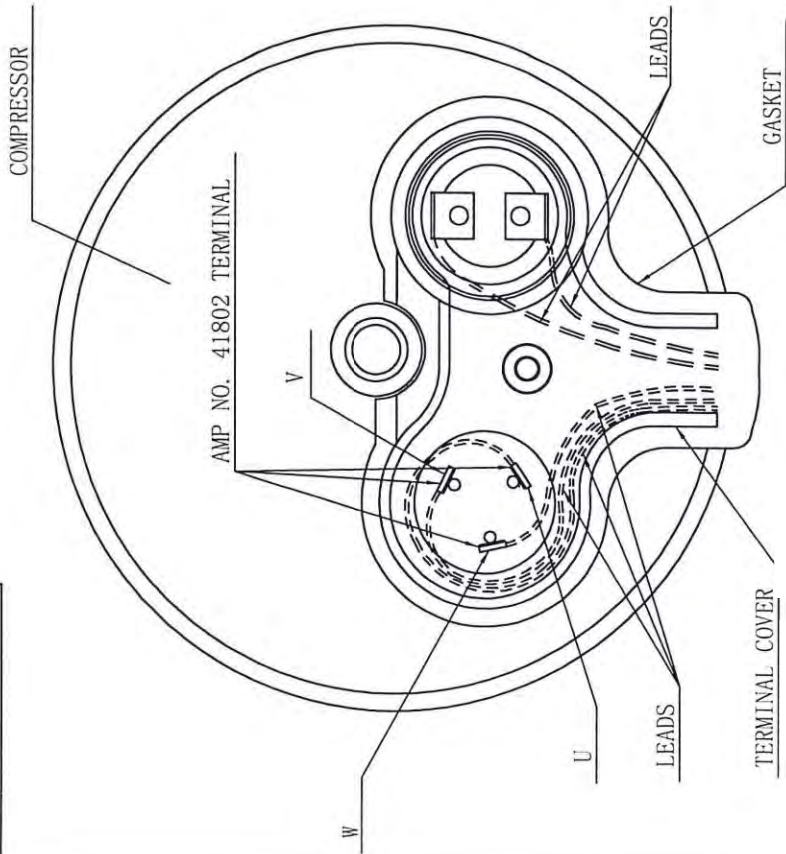
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NOTE:  
 1、COLOR:WHITE  
 2、MATERIAL:SILICONE RUBBER

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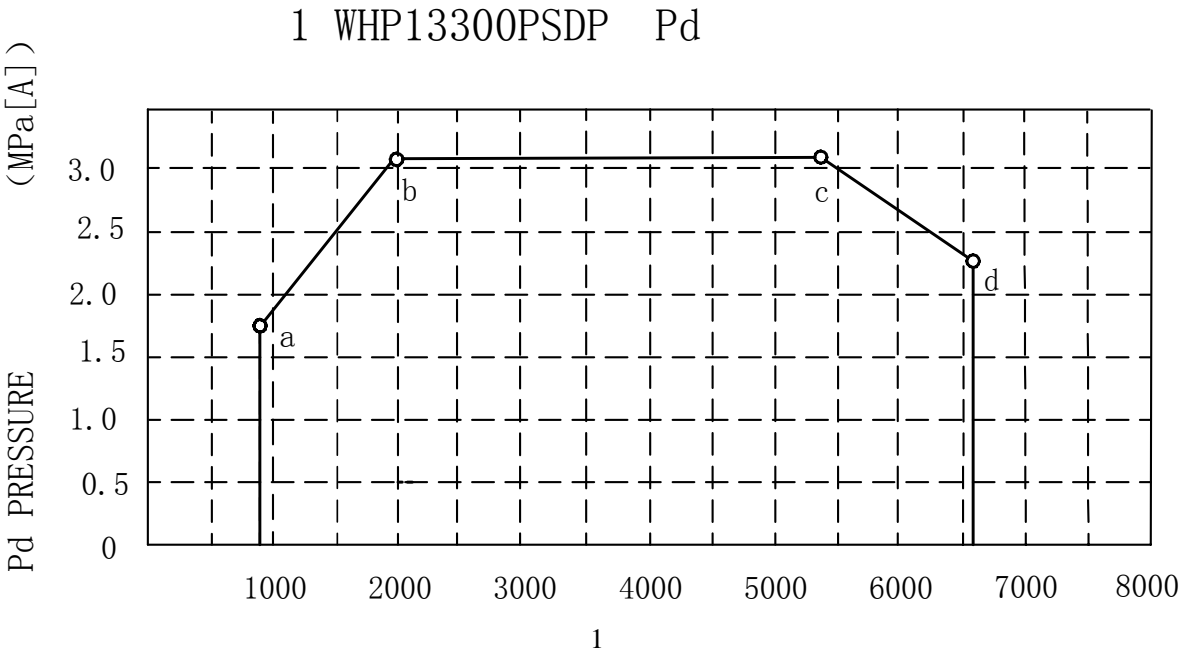
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NOTES:  
1. PLEASE PREPARE LEADS BY YOURSELF.  
2. THE LETTER U, V OR W STANDS FOR EACH TERMINAL.  
3. TABS FOR HERMETIC TERMINAL ARE AMP #250.  
4. THERMOSTAT TO BE SET ON THE TOP OF COMPRESSOR AS SHOWN.

REGD	REV. MARKS		PROJECTION	SCALE	NTS	SHEC	DRAWING
	DWN.	CHKD.					
	18.6.7						
	18.6.7						

4CYC01272



Compressor running speed range: Min 900min<sup>-1</sup>~Max 6600min<sup>-1</sup>

Rotational speed	Pd limit
900	1.71
2000	3.13
5400	3.13
6600	2.34

# Instructions:

1.

The pressure ratio(Pcr) should satisfy the following conditions:

- 1) 900~2000rpm:  $1.5 \leq P_{cr} \leq 8.0$
- 2) 2000~6600rpm:  $2.0 \leq P_{cr} \leq 8.0$

2.

If the suction pressure, pressure ratio out of the used envelop under normal operating conditions, the following tips should be considered to make the compressor operating reliability.

	Condition 1	Condition 2	Condition 3	Condition 4	Condition 5	Condition 6
Range of the conditions	$P_s \geq P_{smax}$	$0.137 \leq P_s \leq 0.168 \text{MPa [A]}$	Pressure ratio $\geq 8$	Pressure ratio $\leq 1.5$	Pressure difference $\leq 0.39 \text{MPa}$	The oil Temperature SH $\leq 6^\circ\text{C}$
Operations requirement	1 Frequency $\leq 70\text{Hz}$ 2) $P_s \leq 1.3 \text{MPa (A)}$  3) $P_d \leq P_{dmax}$	1) Rotational speed $N \leq 6600\text{rpm}$ 2) Pressure ratio $\leq 10$ 3) Lasting time: $\leq 360\text{hr}$ 4) The oil level should be in the fixed range 5) Td The discharge temperature should be in the fixed range 6) SH $\geq 6^\circ\text{C}$ $\geq 0.5\text{cP}$ The oil temperature SH $\geq 6^\circ\text{C}$ or oil viscosity $\geq 0.5\text{cP}$	1) In the heating mode 2) Pd The discharge pressure should be in the fixed range 3) Ps The suction pressure should be in the fixed range (include ranges under limited conditions) 4) Td The discharge temperature should be in the fixed range	The working compressor has no abnormal noise	The working compressor has no abnormal noise	The oil viscosity $\geq 0.5\text{cP}$

3.

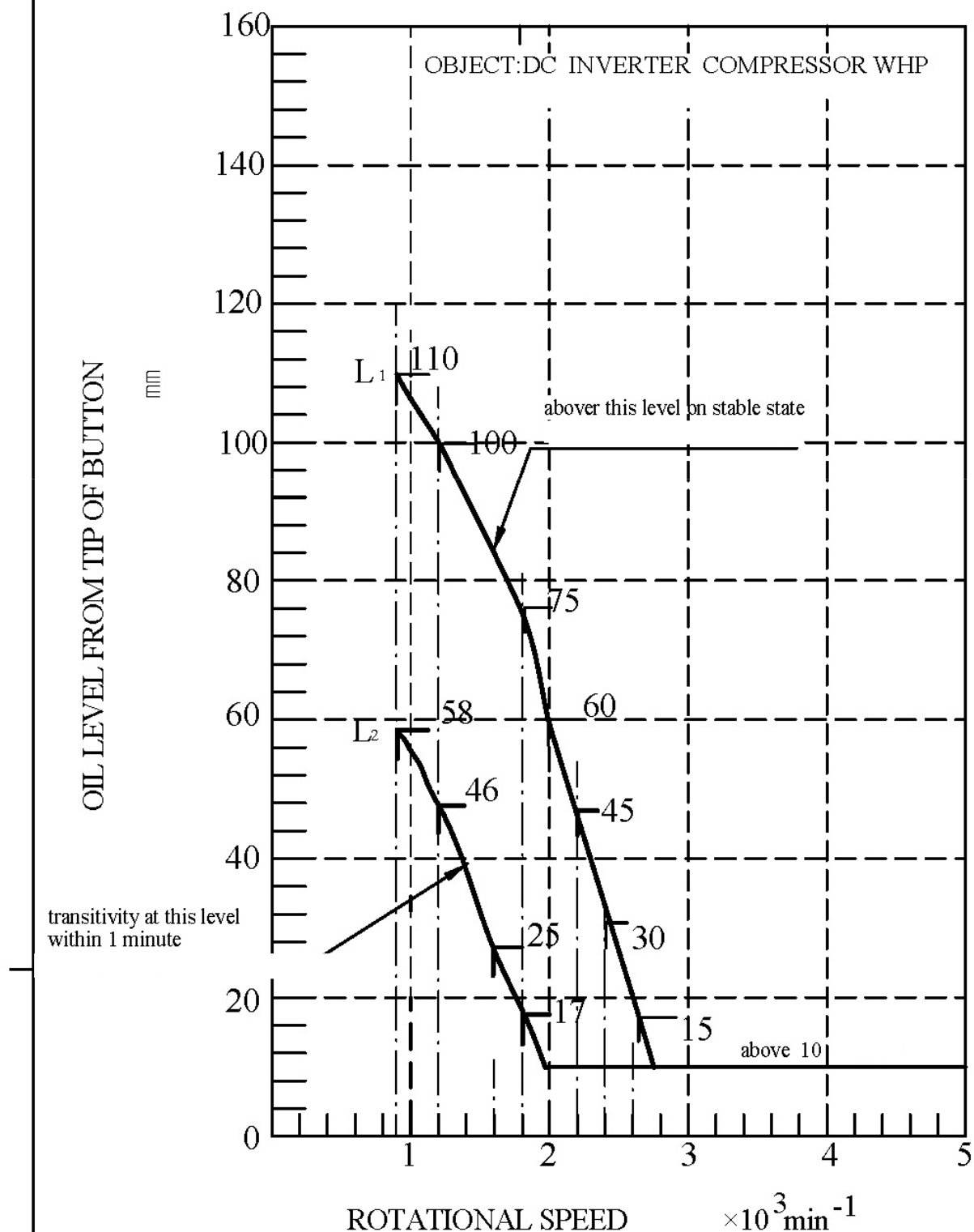
In the transitional stage to the final operating condition, the suction pressure and pressure ratio should satisfy the following conditions. (lasting time  $\leq 5\text{min}$  each time):

- a.) The suction pressure can be lower than 0.168MPa, but should not below 0.137MPa.
- b) Pressure ratio value ten was allowable when the discharge temperature  $< 100^\circ\text{C}$  and oil viscosity  $\geq 0.5\text{cP}$ .

The transitional stage : the system start-up, defrosting or other operating control (on/off or transformation of operating conditions), the stage when pressure or temperature changing rapidly.

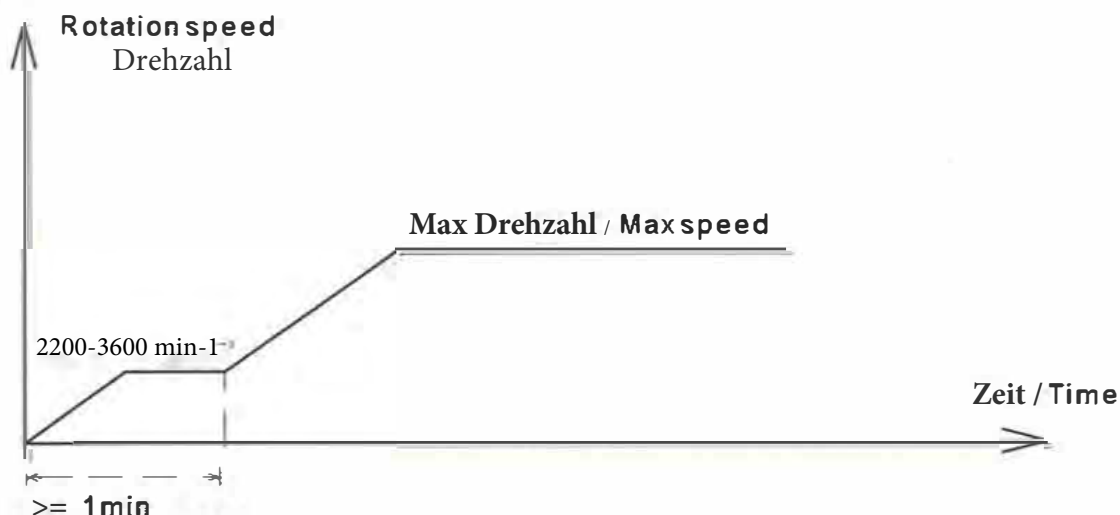
# CHART2 WHP13300PSDP DC INVERTER COMPRESSOR OIL LEVEL DATUM

2 WHP13300PSDP

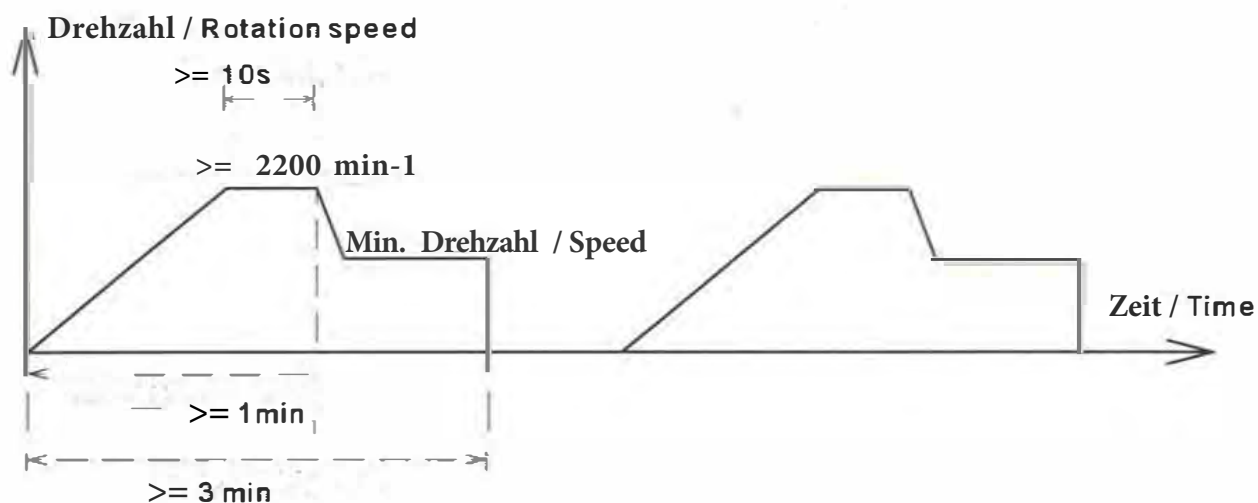


Drehzahländerung / Speed change rate:  $\leq 133 \text{ min}^{-1}/\text{s}$   
Max und Min Drehzahl in den einzelnen Spezifikationen  
Max and min speed is showed in the specification

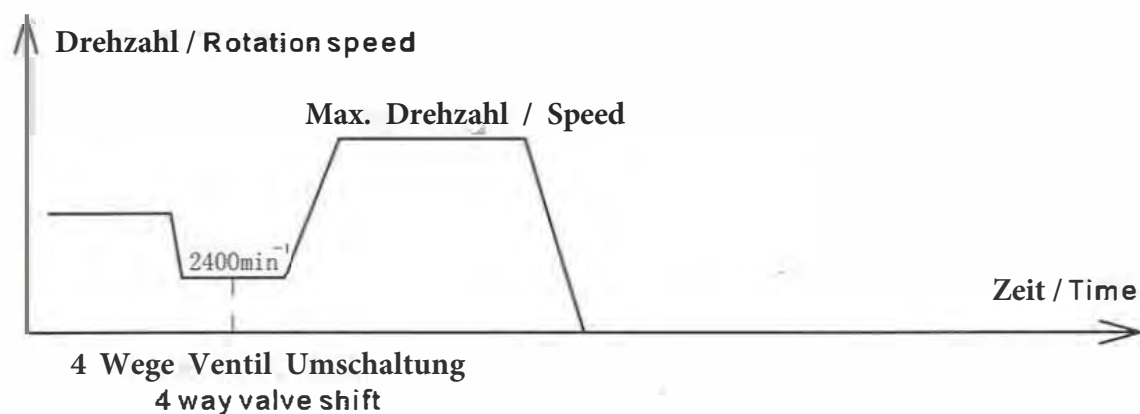
(1) Vom Start zur gewünschten Drehzahl / From starting to normal running



(2) Niedrige Drehzahl und unregelmäßiger Betrieb / Low speed un-continuously running



(3) Abtauung / Defrost mode (unter Verwendung eines 4 Wege Ventiles / by using 4 way valve)





Specification Revision Record				
No.	Date	Page in Spec	Revision Reason	Conclusion Date
A				
B				
C				
D				
E				
F				
G				
H				
J				
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