

Hitachi Highly

Rollkolbenverdichter

Rotary Compressors

Spezifikation

Installation Manual

WHP37600PSKTQ9JK

R 290

84.8 ml/rev

900 - 7200 min⁻¹

DC /BLDC

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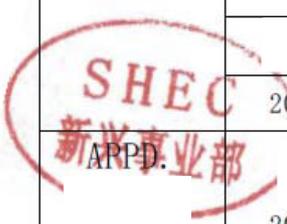
COMPRESSOR TECHNICAL AGREEMENT

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WHP37600PSKTQ9JK

SHEC	
SHEC	SIGNATURE
DWN.	2023-8-14
CHKD.	2023-8-14
	2023-8-14
APPD.	2023-8-14
	2023-8-14



CUSTOMER'S	
APPROVAL	
NAME	
DATE	
AIR CONDITIONER MODEL	

Shanghai Highly Electrical Appliances Co., Ltd.

Inhalt

CONTENTS

I	WHP37600PSKTQ9JK SPECIFICATION	
	1. SCOPE	—————1~4
	2. SPECIFICATION OF THE MODEL	
	3. THE PARAMETER OF MOTOR	
	4. CHARACTERISTICS	
	5. PARTS AND DRAWING LIST	
II	HEAT PUMP WATER HEATER COMPRESSOR CRITERIA	———5~15
III	CHECK UPON DELIVERY	—————16
	1. BASIS FOR CHECKING UPON DELIVERY	
	2. RULE FOR CHECKING UPON DELIVERY	
IV	DRAWINGS	—————17~26
V	ATTACHMENT	
	SPECIFICATION REVISION RECORD	

SUBJECT

Model WHP37600PSKTQ9JK SPECIFICATION

PAGE: 1/32

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	WHP37600PSKTQ9JK
2.2 Power source input to inverter	Rated voltage 380V Rated frequency 50Hz Phase 3 phase Inverter input power for internal test, for reference only
2.3 Application	Heat pump water heater compressor
2.4 Refrigerant	R290
2.5 Displacement	84.8ml/rev (double-cylinder)
2.6 Allowable frequency range	900~7200rpm
2.7 Oil	Synthetic oil or equivalent 2000±20ml
2.8 Allowable amount of refrigerant charge	Below 3200g(R290)
2.9 Space volume of inner case	3200cm ³
2.10 Compressor weight	26.5 kg incl. Oil
2.11 Refrigerant	R 290
2.12 Rated Heating Capacity (W)	21570
2.13 Compressor Rated Input (W)	4820
2.14 COP	4.48
2.15 Current (A)	15.0
2.16 Capacity measuring conditions and noise & vibration measuring condition	Rotational speed 3600rpm Evaporating temp. 7.2 °C Condensing temp. 54.4°C Liquid temp. 46.1°C Ambient temp. 35.0°C Return gas temp. 35.0°C Wind speed 2m/s

$$* \text{COP} = \frac{\text{Heating capacity (W)}}{\text{Motor input (W)}}$$

* Rated Capacity and input are measured with HIGHLY inverter circuit by secondary Refrigerant calorimeter Methods of GB/T 5773-2016.

Nominal heating capacity equals refrigerant capacity adding motor input. Allowable capacity should be more than 95% of the rated capacity. Allowable input should be less than 107% of rated motor input.

3. MOTOR PARAMETER

Item	Spec	Explanation
3.1 Motor Type	Direct current brushless motor	---
3.2 Rotor Pole (Pole)	6	---
3.3 Rated Frequency Range (Hz)	45-36	Electrical Frequency, Relating to VDCmax of Inverter
3.4 Demagnetizing Current (A)	63.00A	Peak Current, at 120°C, -5% Demagnetizing Rate
3.5 Inductance Ld、Lq (mH)	Sheet 2	---
3.6 Stator coil resistance (20°C) Ω	0.499 (20°C)	line-to-line

SUBJECT

Model WHP37600PSKTQ9JK SPECIFICATION

PAGE: 3/32

Item	Spec	Explanation
3.7 Voltage Constant (Vrms/krpm)	59.7V/krpm	line-to-line
3.8 Torque Constant(N •m/Arms)	0.851	Torque/Current
3.9 Inertia (Kg • m2)	0.0020793	
3.10 Flux Φ_a (Wb))	0.15516	ϕ (Per Phase, Peak)= $\frac{\sqrt{2} \times E0}{2\pi f \sqrt{3}}$
3.11 Magnet Material	NdFeB	---
3.12 Insulation class	E class	---

2:

Electric current	1	2	3	4	5	6	8	10	12	14	16	18	20	22	24
q	5.78	6.01	5.98	5.92	5.85	5.78	5.61	5.45	5.29	5.14	4.97	4.82	4.66	4.54	4.4
d	4.06	4.14	4.17	4.18	4.17	4.15	4.09	4.02	3.94	3.86	3.77	3.7	3.61	3.53	3.45

4. CHARACTERISTICS

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

4.2. Indication

Compressor model type, manufacturing data are clearly indicated on the surface of compressor.

4.3. Residual moisture 300mg MAX

4.4. Residual impurities 90mg MAX

SUBJECT

Model WHP37600PSKTQ9JK SPECIFICATION

PAGE: 4/32

5 PARTS AND DRAWING LIST

PARTS NAME		QTY/SET	DRAWING NO.	REMARKS
Compressor		1	4CYCE0104	Dimensioned sketch
Mounting Parts	Rubber grommet Gummifuß	4	4CYC01288	
	Bolt Befestigungsschraube	--	4CYC00700	*
	Nut Befestigungsmutter	--	M8	*
Electrical Parts	Terminal cover E- Abdeckung	1	4CYC00988	
	Gasket Dichtung	1	4CYC01047	
	Thermostat	1	4CYC01403	
	Nut Mutter	1	3CYC00004	
	Rubber washer Gummischeibe	1	4CYC00174	
	Sleeve	1	4CYC01042	
			4CYC01272	Lead routing
			Graph 1	Pressure guarantee Chart
			Graph 2	Oil level datum
			Graph 3	Notes for rotational speed change

*. Out of supply, for reference.

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. Moreover, accessories should be specified parts used in specified way, service must use specified parts too. 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 ϕ 100V, 200V, 3 ϕ 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).

The overload condition should not be continuous.

But the standard condition and overload condition mentioned here refer to condition that specified in GB/T 7725. (The standard condition refers to the rating cooling condition and the overload condition refers to the maximum operating condition.)

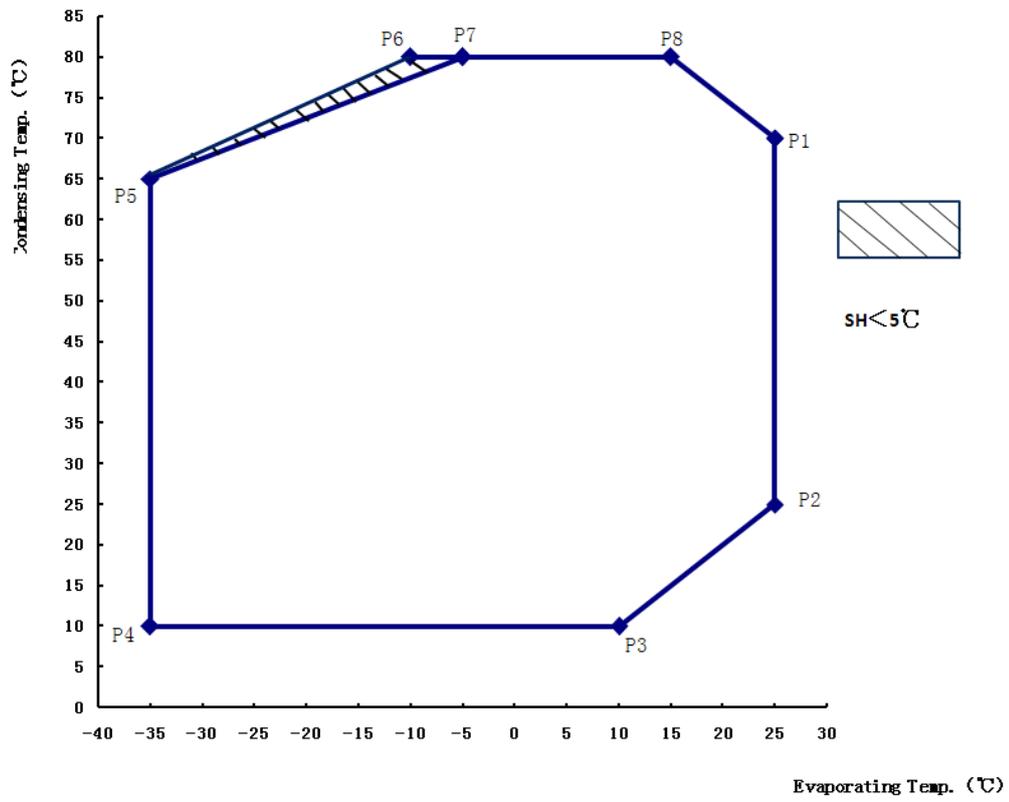
4 Operating temperatures and pressures

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

Table 1

Item	Operating Envelope
	see graph 1
Refrigerant	R290
Discharge pressure MPa[A]	3.13MAX (condensing temperature :80°C)
Suction Pressure MPa[A]	0.139~0.95
	(Evaporation Temperature : -35°C~25°C). Compressor suction side can handle the same maximum pressure as discharge side without damage when compressor is not running.
Compressor case bottom temp	Under steady operating conditions case bottom temperature must be lower than 99 ° C and 6 K higher than condensing temperature and discharge superheat must be 10 K or higher. Under transient operating conditions (e.g. start-up, 4WV switch, ...), the above mentioned conditions must be reached within 15 min. Relevant requirement for high pressure ratio condition can be seen on page 28.
Motor winding temp	R. Voltage $\pm 10\%$: lower than 130°C
Accumulator temp	Higher than outlet pipe of evaporator
Ambient temp	Meet for the condition of above mentioned motor winding temp.

Notes: Overload condition should not be continuous.



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

5 Pressure difference between suction and discharge

In all allowable rotational speed range, the difference of pressure should be more than 0.39MPa{4kgf/cm²}. But if there is no problem of noise when assembled in air conditioner, it can also be below this value.

6 Discharge pipe temperature

Discharge pipe temperature is measured at a distance 300mm from the surface of compressor and should be less than 115°C. But when the compressor is running from 900 to 1800min⁻¹, it should be below 100°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.

7 Air leakage test pressure

The pressure should be less than 4.32MPa{42kgf/cm²G}.

8 Oil back and 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. When the oil can not return to the compressor properly, oil separator should be equipped.

9 Dust of compressor hermetic terminals

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.

10 Lead wire of compressor hermetic terminals

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.

11 Start-stop frequency

The frequency should be less than 6 times per hour. Operating time from start to stop should be more than 3 minutes. Stopping time should be more than 3minutes. But oil level should be met to item 8. Suction and discharge pressure should balance completely before restarting.

12 Rate of rotational speed change

The rate of compressor rotational speed (acceleration) should be less than 120rpm/s, But if The variable range is below 120rpm, rate can also be less than 600rpm/s when rotational Speed is reduced to avoid temporary over- current. The change of compressor rotational speed is referred to chart 3.

13 Air and moisture in refrigerating system

The degree of vacuum in refrigerating system should be less than 50Pa (375×10^{-3} mmHg) at room temperature just before charging refrigerant. The quantity of water should be less than 0.2ml.

14 Impurities in refrigerating system

- (1) The weight of residue on the inside surface of the heat exchanger and tube should be less than 0.2g/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. 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.

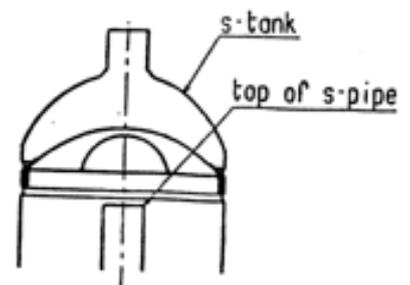
15 Compressor vacuum operation

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

- (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 stank 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 ± 0.1 MpaG. Dew point of dry air: Below -20°C .

Dry nitrogen should be charged in compressor before assembly of system. Welding should be finished within one minute after charge of nitrogen. Dry nitrogen needs to be charged again and weld if over one minute. Always purge the compressor with dry nitrogen during assembly of system.

The motor winding temperature should be less than 149°C and hermetic terminal body temperature should be less than 177°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° at all directions during operation.

21 Pipe vibration

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

Displacement in excess of 0.8mm(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 Water pressure resistance

Keep 17.0Mpa[G]{173.3Kgf/cm² [G]}(over 1 minute), confirm if there is someplace broken and note the pressure data.

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, 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. Do not recharge with the remaining refrigerant in the system when leakage happened. Because the percent component of the refrigerant in the unit system had possibly been changed.
- (10) Temperatures within systems during stable compressor operation should not be less than -35°C to prevent wax precipitation from the oil.
- (11) 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.
- (12) The units of refrigerating system should be connected to earth.
- (13) There should be adequate clearance between the OD23-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°C . Confirm the start-up of compressor if the temperature of compressor surface is below -10°C . Heat up compressor to reach the temperature higher than -10°C with heater if the ambient temperature is below -10°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 direct contact 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 压缩机启动电流及扭距
Adjust the start-up torsion of the compressor to above 0.55Nm by inverter. Confirm and measure the start-up current if change the parts and design.
- (27) The thickness of the refrigerating system using tube
the tube thickness as followed

External diameter (mm) (mm)	Thickness (mm)
6.35	0.5
6.35~11.0	0.5
11.0~13.0	0.6
13.0~15.0	0.6
15.0~19.0	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.

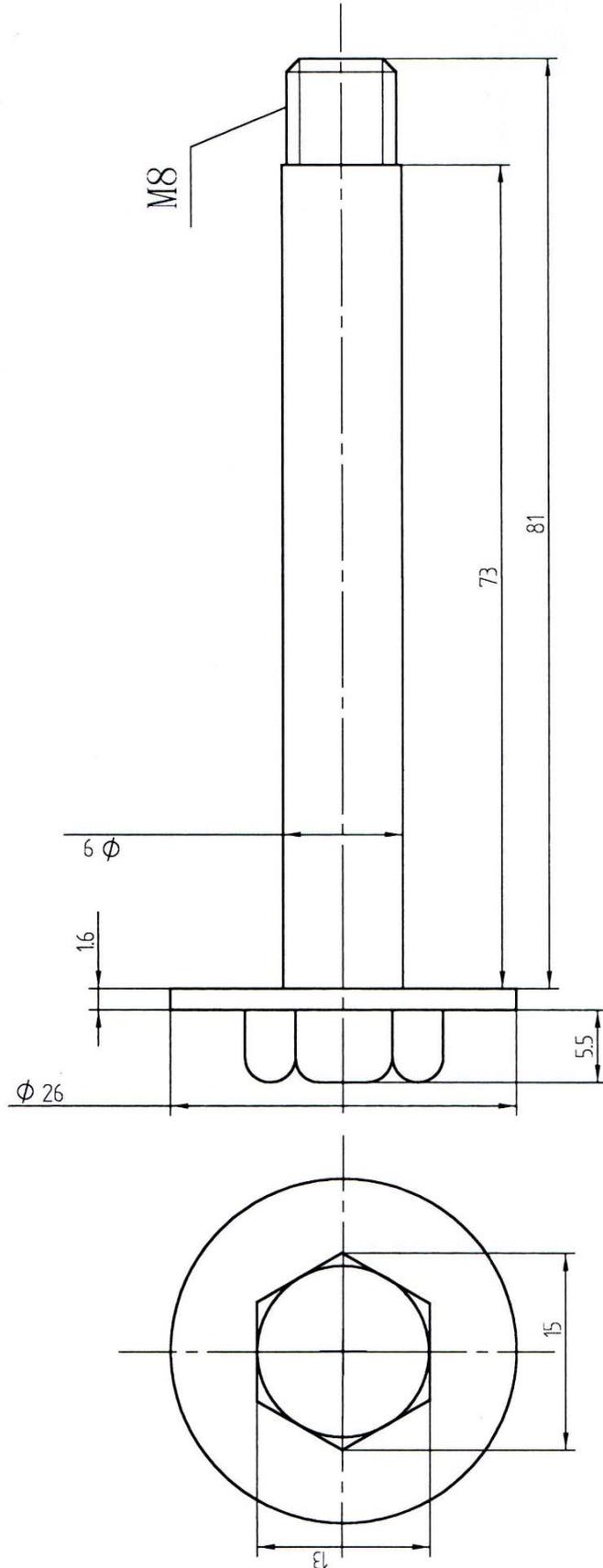
2. Rule for Checking upon Delivery

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.

版本标识 B

4CYC00700

记录号	来坊	年 月 日	订正	审查	记录号	来坊	年 月 日	订正	审查
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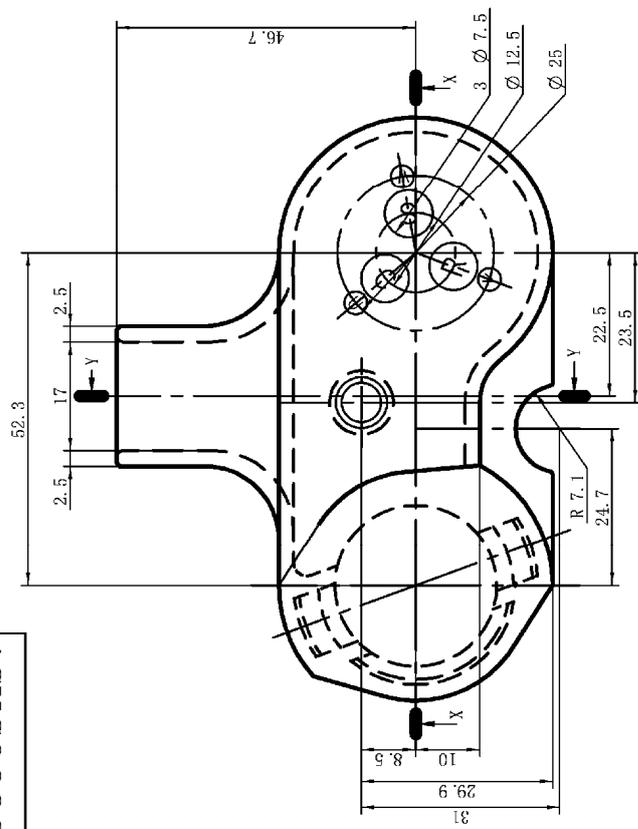


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88600988

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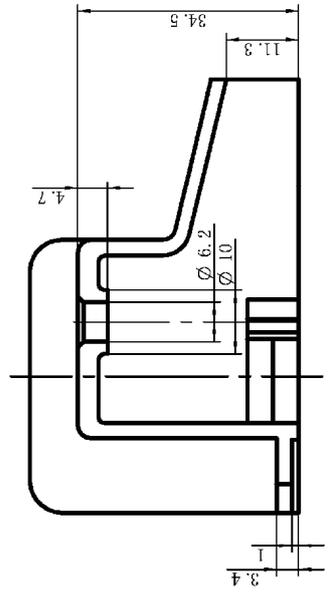
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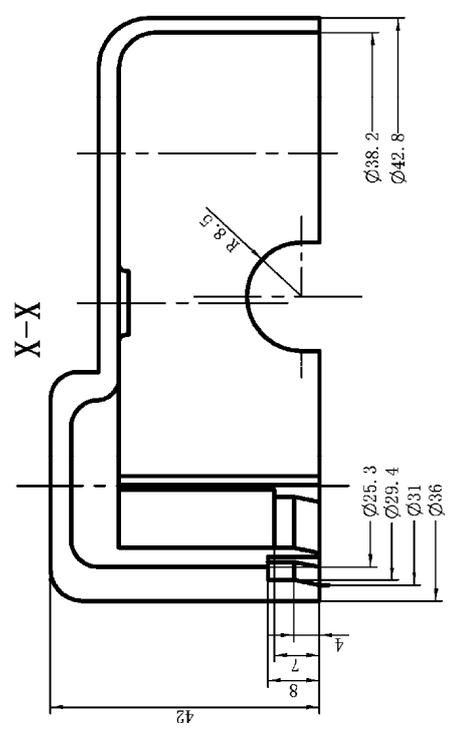
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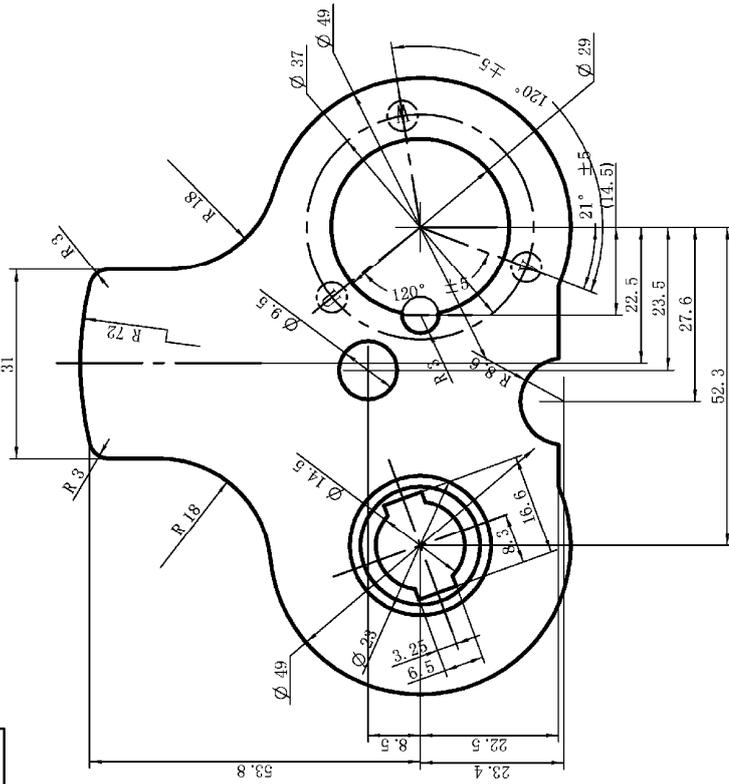
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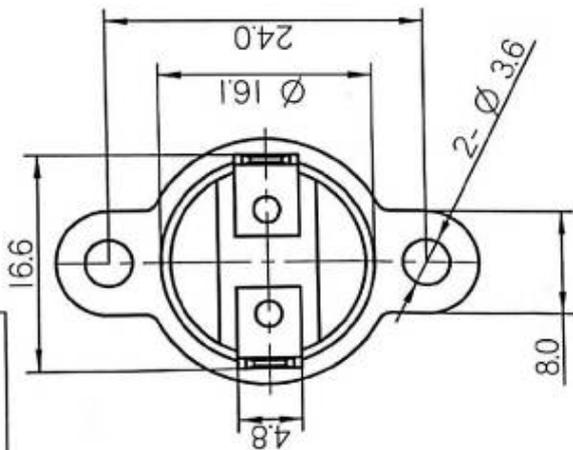
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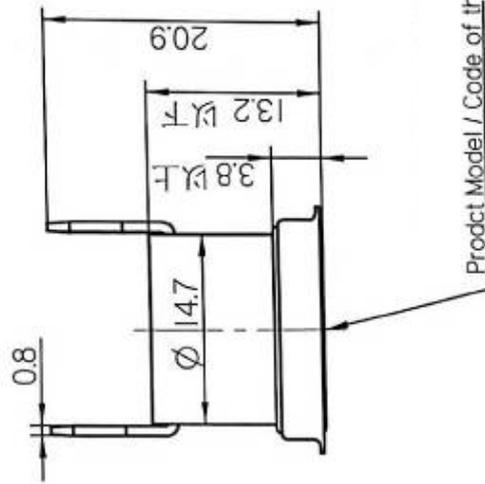
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③					④				



SPECIFIED LIMITS

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

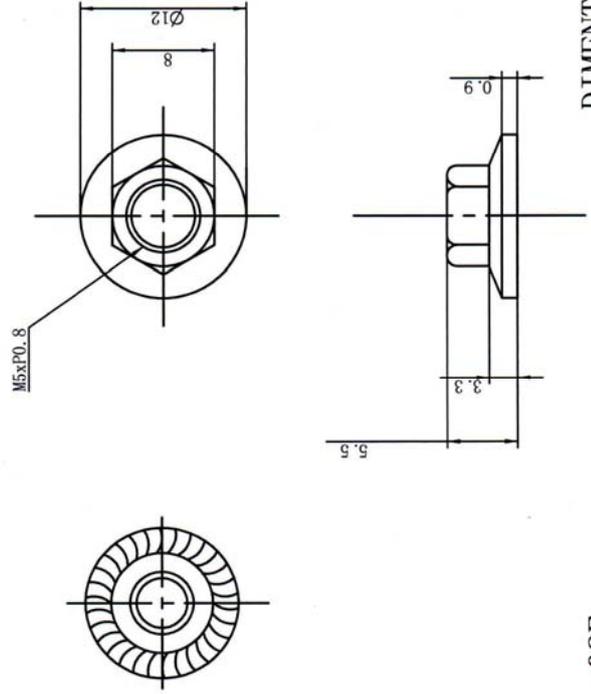


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版本标识 E

3CYC000004

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MATERIAL: 08F

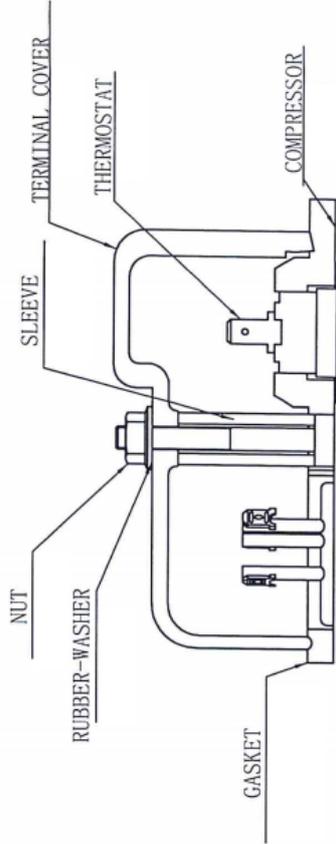
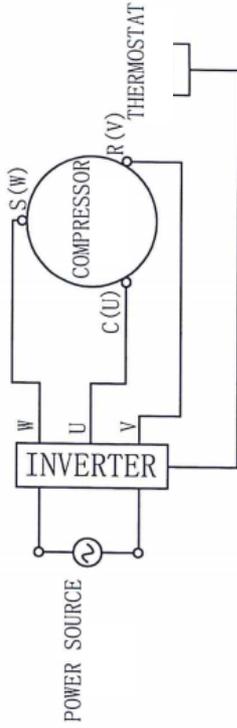
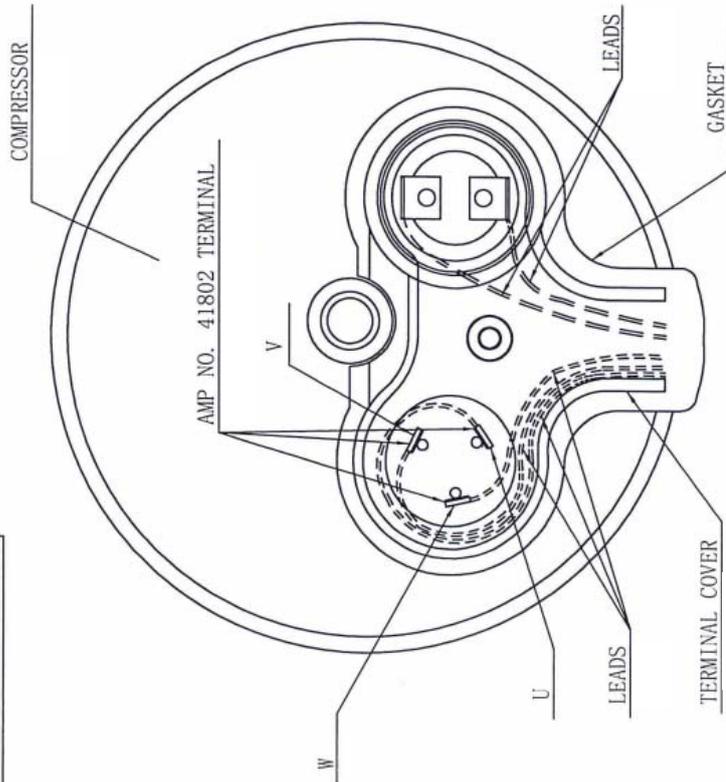
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	NUT				

B

4CYC01272

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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	DRW. 杨世道 18.6.7	CIRD.		CIRD.		APPL.	邱 18.6.7	TITLE	LEAD ROUTING WIRING DIAGRAM	PROJECTION	SHEC	SCALE	NTS	DRAWING NO.	4CYC01272
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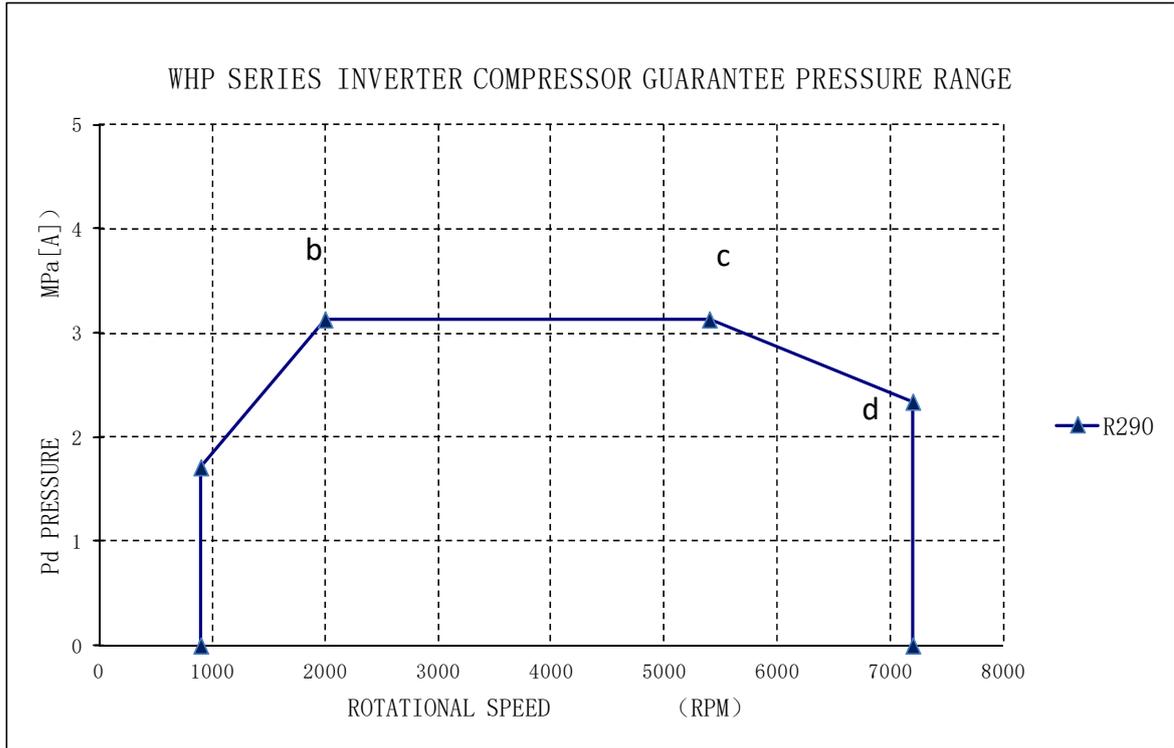


图 1

Compressor running speed range: Min 900min^{-1} ~ Max 7200min^{-1}

Rotational speed	Pd limit
	R290
900	1.71
2000	3.13
5400	3.13
7200	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) 2000~7200rpm: $2.0 \leq P_{cr} \leq 8.0$

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 ≥ 8	pressure ratio ≤ 1.5	Pressure difference $\leq 0.39 \text{MPa}$	The oil temperature SH $\leq 6^\circ\text{C}$
Operations requirement	<ol style="list-style-type: none"> 1) Frequency $\leq 70 \text{Hz}$ 2) $P_s \leq 1.3 \text{MPa (A)}$ 3) $P_d \leq P_{dmax}$ 	<ol style="list-style-type: none"> 1.) Rotational speed $N \leq 6600 \text{rpm}$ 2.) Pressure ratio ≤ 10 3.) Lasting time: $\leq 360 \text{hr}$ 4) The oil level should be in the fixed range 5) The discharge temperature should be in the fixed range 6) $SH \geq 6^\circ\text{C}$ 度 $\geq 0.5 \text{cP}$ The oil temperature $SH \geq 6^\circ\text{C}$ or oil viscosity $\geq 0.5 \text{cP}$ 	<ol style="list-style-type: none"> 1) In the heating mode 2) P_d The discharge pressure should be in the fixed range 3) P_s The suction pressure should be in the fixed range (include ranges under limited conditions) 4) T_d The discharge temperature should be in the fixed range 	The working compressor has no abnormal noise	The working compressor should have 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):

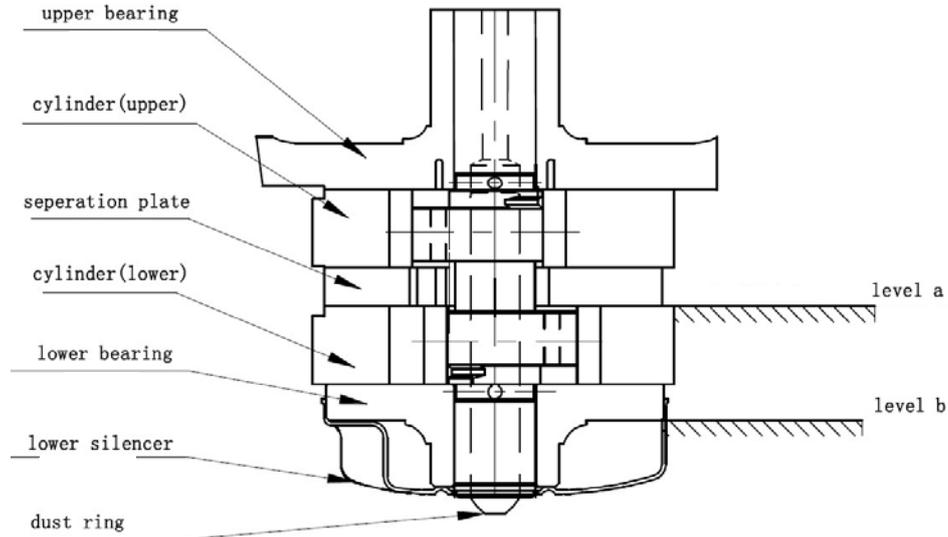
- a.) The suction pressure can be lower than 0.168MPa, but should not below 0.137MPa.
- b) Pressure ratio value ten was allowable when the discharge temperature $< 100^\circ\text{C}$ and oil viscosity $\geq 0.5 \text{cP}$.

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.

WHP SERIES COMPRESSOR OIL/LIQUID LEVEL CONFIRMATION

1 COMPRESSOR OIL LEVEL

In order to ensure the reliability of the compressor, the minimum oil level required for each operating frequency is shown in the following chart:



Operating frequency	Operating Below 30rps	30rps-Maximum speed Stable operation 30rps	Transitional operation
The oil level height	Above level a	Above level b	Above level b

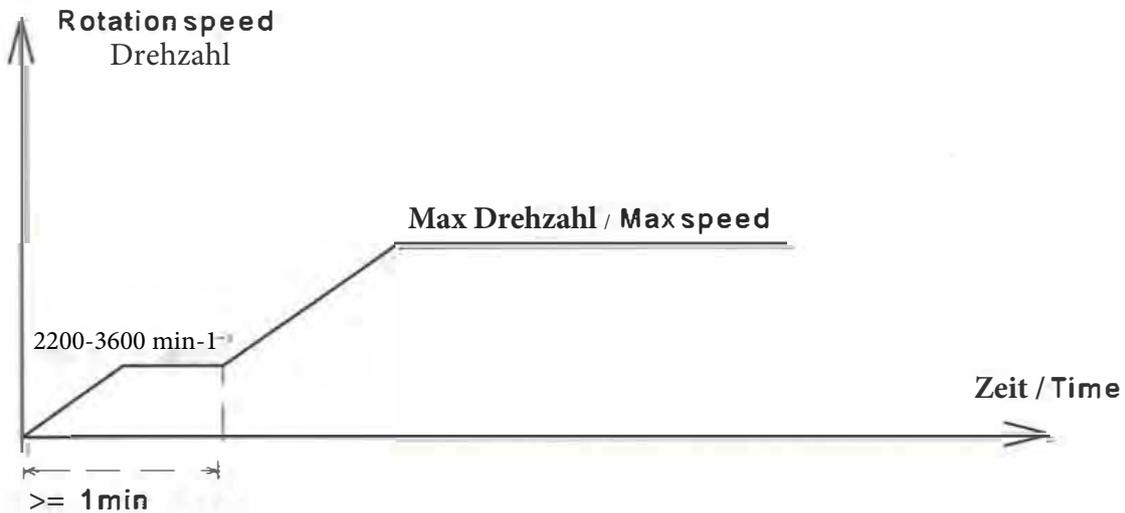
※Transition operation phase refers to the phase of rapid changes in system pressure and temperature caused by the operation control (on/off or working condition switch) of system startup and defrosting or the rapid change of environment.

Recommended specifications of compressor heating belt for low temperature heating

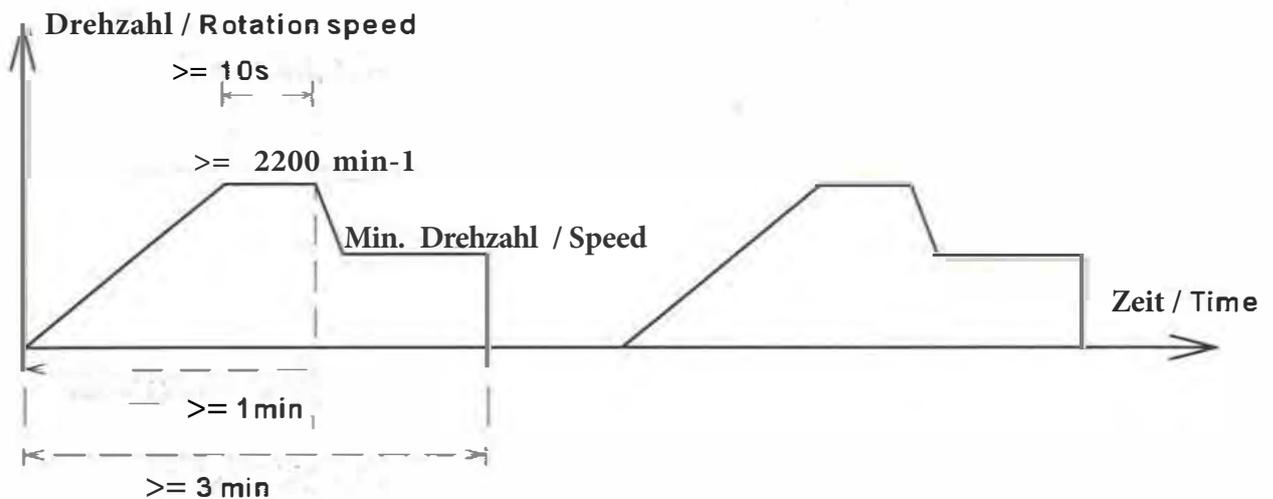
The environment temperature (°C)	0		-10		-20		-30	
Recommended power of the electric heating (W)	90	120	90	120	90	120	90	120
Preheating time (h)	≥1.1	≥0.8	≥1.4	≥1.0	≥1.8	≥1.3	≥2.3	≥1.5

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

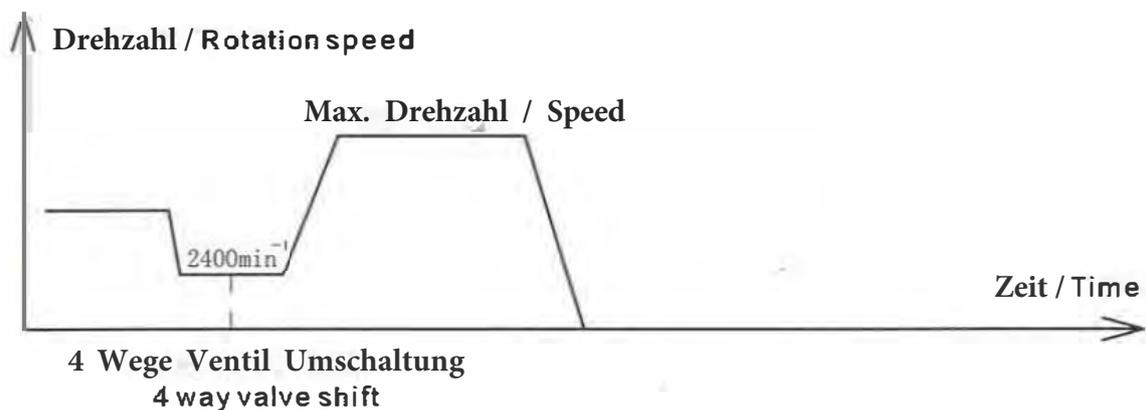
(1) Vom Start zur gewünschten Drehzahl / From starting to normal running



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

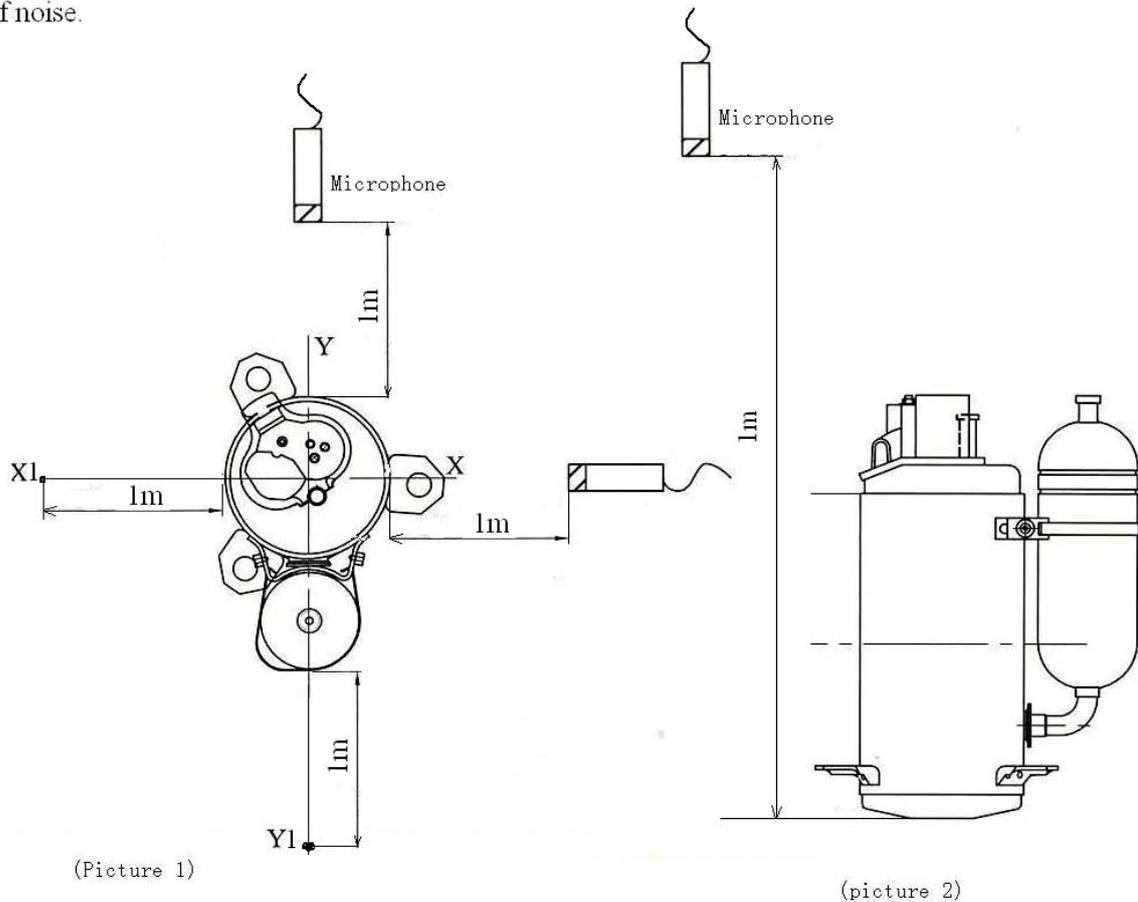


(3) Abtauung / Defrost mode (unter Verwendung eines 4 Wege Ventiles / by using 4 way valve)

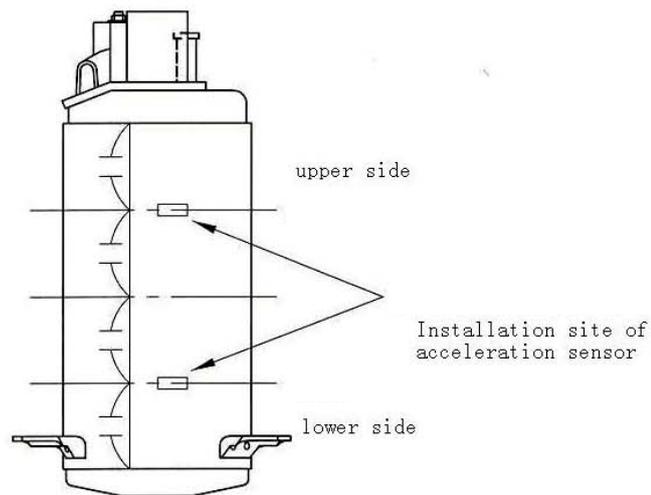


APPENDIX

1. Noise measuring method: Measure from X, Y, X1 and Y1's direction and take the bigger value of noise.



2. Vibration measuring method: Measure vibration in the upper and lower side, and take the bigger value.



View from the Y direction of picture 1

Specification Revision Record

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