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You can read the recommendations in the user guide, the technical guide or the installation guide for TOSHIBA RAS-10SKV2-E. You'll find the answers to all your questions on the TOSHIBA RAS-10SKV2-E in the user manual (information, specifications, safety advice, size, accessories, etc.). Detailed instructions for use are in the User's Guide.

User manual TOSHIBA RAS-10SKV2-E
User guide TOSHIBA RAS-10SKV2-E
Operating instructions TOSHIBA RAS-10SKV2-E
Instructions for use TOSHIBA RAS-10SKV2-E
Instruction manual TOSHIBA RAS-10SKV2-E


TOSHIBA

FILE NO. SVM-10001

SERVICE MANUAL

AIR-CONDITIONER
SPLIT TYPE

Indoor Unit <High Wall, Heat Pump Type>	Outdoor Unit <Heat Pump Type>
RAS-10SKV2-E	RAS-10SAV2-E
RAS-13SKV2-E	RAS-13SAV2-E
RAS-16SKV2-E	RAS-16SAV2-E

HFC
R410A

January, 2010

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Manual abstract:

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.... 108 2 FILE NO. SVM-10001 1. SAFETY PRECAUTIONS For general public use Power supply cord of outdoor unit shall be more than 1.5 mm2 (H07RN-F or 60245IEC66) polychloroprene sheathed flexible cord. · · · · Read this "SAFETY PRECAUTIONS" carefully before servicing. The precautions described below include the important items regarding safety.
Observe them without fail. After the servicing work, perform a trial operation to check for any problem. Turn off the main power supply switch (or breaker) before the unit maintenance. CAUTION New Refrigerant Air Conditioner Installation · THIS AIR CONDITIONER ADOPTS THE NEW HFC REFRIGERANT

(R410A) WHICH DOES NOT DESTROY OZONE LAYER. R410A refrigerant is apt to be affected by impurities such as water, oxidizing membrane, and oils because the working pressure of R410A refrigerant is approx.

1.6 times of refrigerant R22. Accompanied with the adoption of the new refrigerant, the refrigeration machine oil has also been changed. Therefore, during installation work, be sure that water, dust, former refrigerant, or refrigeration machine oil does not enter into the new type refrigerant R410A air conditioner circuit. To prevent mixing of refrigerant or refrigerating machine oil, the sizes of connecting sections of charging port on main unit and installation tools are different from those used for the conventional refrigerant units.

Accordingly, special tools are required for the new refrigerant (R410A) units. For connecting pipes, use new and clean piping materials with high pressure fittings made for R410A only, so that water and/or dust does not enter. Moreover, do not use the existing piping because there are some problems with pressure fittings and possible impurities in existing piping. CAUTION TO DISCONNECT THE APPLIANCE FROM THE MAIN POWER SUPPLY This appliance must be connected to the main power supply by a circuit breaker or a switch with a contact separation of at least 3 mm. DANGER · ASK AN AUTHORIZED DEALER OR QUALIFIED INSTALLATION PROFESSIONAL TO INSTALL/MAINTAIN THE AIR CONDITIONER. INAPPROPRIATE SERVICING MAY RESULT IN WATER LEAKAGE, ELECTRIC SHOCK OR FIRE. · TURN OFF MAIN POWER SUPPLY BEFORE ATTEMPTING ANY ELECTRICAL WORK. MAKE SURE ALL POWER SWITCHES ARE OFF. FAILURE TO DO SO MAY CAUSE ELECTRIC SHOCK. DANGER: HIGH VOLTAGE The high voltage circuit is incorporated.

Be careful to do the check service, as the electric shock may be caused in case of touching parts on the P board by hand. .C. · CORRECTLY CONNECT THE CONNECTING CABLE. IF THE CONNECTING CABLE IS INCORRECTLY CONNECTED, ELECTRIC PARTS MAY BE DAMAGED. · CHECK THAT THE EARTH WIRE IS NOT BROKEN OR DISCONNECTED BEFORE SERVICE AND INSTALLATION. FAILURE TO DO SO MAY CAUSE ELECTRIC SHOCK. - 3 FILE NO. SVM-10001 · DO NOT INSTALL NEAR CONCENTRATIONS OF COMBUSTIBLE GAS OR GAS VAPORS. FAILURE TO FOLLOW THIS INSTRUCTION CAN RESULT IN FIRE OR EXPLOSION.

· TO PREVENT THE INDOOR UNIT FROM OVERHEATING AND CAUSING A FIRE HAZARD, PLACE THE UNIT WELL AWAY (MORE THAN 2 M) FROM HEAT SOURCES SUCH AS RADIATORS, HEAT REGISTORS, FURNACE, STOVES, ETC. · WHEN MOVING THE AIR-CONDITIONER FOR INSTALLATION IN ANOTHER PLACE, BE VERY CAREFUL NOT TO ALLOW THE SPECIFIED REFRIGERANT (R410A) TO BECOME MIXED WITH ANY OTHER GASEOUS BODY INTO THE REFRIGERATION CIRCUIT. IF AIR OR ANY OTHER GAS IS MIXED IN THE REFRIGERANT, THE GAS PRESSURE IN THE REFRIGERATION CIRCUIT WILL BECOME ABNORMALLY HIGH AND IT MAY RESULT IN THE PIPE BURSTING AND POSSIBLE PERSONNEL INJURIES. · IN THE EVENT THAT THE REFRIGERANT GAS LEAKS OUT OF THE PIPE DURING THE SERVICE WORK AND THE INSTALLATION WORK, IMMEDIATELY LET FRESH AIR INTO THE ROOM. IF THE REFRIGERANT GAS IS HEATED, SUCH AS BY FIRE, GENERATION OF POISONOUS GAS MAY RESULT.

WARNING · Never modify this unit by removing any of the safety guards or bypass any of the safety interlock switches. · Do not install in a place which cannot bear the weight of the unit. Personal injury and property damage can result if the unit falls. · After the installation work, confirm that refrigerant gas does not leak. If refrigerant gas leaks into the room and flows near a fire source, such as a cooking range, noxious gas may generate.

· The electrical work must be performed by a qualified electrician in accordance with the Installation Manual. Make sure the air conditioner uses an exclusive circuit. An insufficient circuit capacity or inappropriate installation may cause fire. · When wiring, use the specified cables and connect the terminals securely to prevent external forces applied to the cable from affecting the terminals. · Be sure to provide grounding. Do not connect ground wires to gas pipes, water pipes, lightning rods or ground wires for telephone cables. · Conform to the regulations of the local electric company when wiring the power supply. Inappropriate grounding may cause electric shock. CAUTION · Exposure of unit to water or other moisture before installation may result in an electrical short. Do not store in a wet basement or expose to rain or water.

· Do not install in a place that can increase the vibration of the unit. Do not install in a place that can amplify the noise level of the unit or where noise or discharged air might disturb neighbors. · To avoid personal injury, be careful when handling parts with sharp edges. · Perform the specified installation work to guard against an earthquake. If the air conditioner is not installed appropriately, accidents may occur due to the falling unit. For Reference: If a heating operation would be continuously performed for a long time under the condition that the outdoor temperature is 0°C or lower, drainage of defrosted water may be difficult due to freezing of the bottom plate, resulting in a trouble of the cabinet or fan. It is recommended to procure an antifreeze heater locally for a safe installation of the air conditioner. For details, contact the dealer. 4 FILE NO. SVM-10001 2.

SPECIFICATIONS 2-1. Specification Unit model Indoor Outdoor (kW) (kW) (kW) (kW) Operation mode Running current Power consumption Power factor Operation mode Running current Power consumption Power factor Starting current High Medium Low (Cooling / Heating) (Cooling / Heating) (Cooling / Heating) (Cooling / Heating) RAS-10SKV2-E RAS-13SKV2-E RAS-10SAV2-E RAS-13SAV2-E 2.5 3.5 1.1-3.

1 0.8-4.1 3.2 4.2 0.

9-4.8 0.9-5.6 1Ph/50Hz/220-240V , 1Ph/60Hz/220-230V Cooling 0.21-0.19 35 76 Cooling 2.81-2.58 563 91 3.67 4.18/4.

27 Heating 0.24-0.22 40 76 Heating 3.43-3.14 710 94 Cooling 0.21-0.19 35 76 Cooling 4.57-4.20 965 96 5.17 3.

50/3.89 Heating 0.24-0.


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22 40 76 Heating 4.93-4.
52 1040 96 Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Electric Indoor characteristic (A) (W) (%) (A) (W) (%) (A) (dB-A) (dB-A) (dB-A) (dB-A) (mm) (mm) (mm) (kg) (W) Outdoor COP (Cooling / Heating) Operating Indoor noise Outdoor Unit model Dimension Indoor unit Height Width Depth Outdoor unit Net weight Fan motor output Air flow rate Unit model Dimension (Cooling / Heating) Height Width Depth Motor output Type Model (Cooling / Heating) Liquid side Gas side Liquid side Gas side 3 (m / min) Net weigh Compressor (mm) (mm) (mm) (kg) (W) Piping connection Fan motor output Air flow rate Type Indoor unit Outdoor unit (W) (m / min) (mm) (mm) (mm) (mm) (m) (m) (m) (kg) 3 38/39 39/40 33/34 33/34 26/28 26/28 46/47 48/50 RAS-10SKV2-E RAS-13SKV2-E 275 275 790 790 205 205 9 9 20 20 8.6/9.5 9.5/10.4 RAS-10SAV2-E RAS-13SAV2-E 550 550 780 780 290 290 33 33 750 750 Single rotary type with DC-inverter variable speed control DA89X1C-23FZ2 43 30/30 37.
5/37.5 Flare connection Flare connection 6.35 6.35 9.52 9.52 6.35 6.35 9.52 9.52 20 20 15 15 10 10 R410A R410A 0.

*80 0.80 3 Wires: Includes earth (Outdoor) 4 Wires: Includes earth 21-32/0-28 -10-46/-15-24 1 1 2 1 2 6 (4 x 25L) 2 (3.1 x 16L) 1 1 1 2 21-32/0-28 -10-46/-15-24 1 1 2 1 2 6 (4 x 25L) 2 (3.1 x 16L) 1 1 1 2 Maximum length Maximum charge-less length Maximum height difference Refrigerant Name of refrigerant Weight Wiring Power supply connection Interconnection Usable temperature range Indoor (Cooling / Heating) Outdoor (Cooling / Heating) Accessory Indoor unit Installation plate Wireless remote controller batteries Remote controller holder Pure Flow Mounting screw Pan head wood screw Plasma air purifier Installation manual Owner's manual Outdoor unit Drain nipple Water proof rubber cap (C) o (C) o * The specification may be subject to change without notice for purpose of improvement. 5 FILE NO. SVM-10001 2-2. Specification Unit model Indoor Outdoor (kW) (kW) (kW) (kW) Operation mode Running current Power consumption Power factor Operation mode Running current Power consumption Power factor Starting current High Medium Low (Cooling / Heating) (Cooling / Heating) (Cooling / Heating) (Cooling / Heating) RAS-16SKV2-E RAS-16SAV2-E 4.5 0.8-5.0 5.*
5 0.9-6.9 1Ph/50Hz/220-240V , 1Ph/60Hz/220-230V Cooling 0.21-0.19 30 65 Cooling 6.
26-5.74 1365 99 7.05 3.23/3.62 45/45 40/40 30/31 49/50 RAS-16SKV2-E 275 790 205 9 30 11.
4/12.3 RAS-16SAV2-E 550 780 290 39 750 Twin rotary type with DC-inverter variable speed control DA111A1F-20F1 43 36/32 Flare connection 6.35 12.7 6.35 12.7 20 15 10 R410A 1.10 3 Wires: Includes earth (Outdoor) 4 Wires: Includes earth 21-32/0-28 -10-46/-15-24 1 1 2 1 2 6 (4 x 25L) 2 (3.1 x 16L) 1 1 1 2 Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Electric Indoor characteristic (A) (W) (%) (A) (W) (%) (A) (dB-A) (dB-A) (dB-A) (dB-A) (mm) (mm) (mm) (kg) (W) Outdoor Heating 0.24-0.22 35 66 Heating 6.

*81-6.24 1485 99 COP (Cooling / Heating) Operating Indoor noise Outdoor Unit model Dimension Indoor unit Height Width Depth Outdoor unit Net weight Fan motor output Air flow rate Unit model Dimension (Cooling / Heating) Height Width Depth Motor output Type Model (Cooling / Heating) Liquid side Gas side Liquid side Gas side 3 (m / min) Net weicht Compressor (mm) (mm) (mm) (kg) (W) Piping connection Fan motor output Air flow rate Type Indoor unit Outdoor unit (W) (m / min) (mm) (mm) (mm) (mm) (m) (m) (m) (kg) 3 Maximum length Maximum charge-less length Maximum height difference Refrigerant Name of refrigerant Weight Wiring Power supply connection Interconnection Usable temperature range Indoor (Cooling / Heating) Outdoor (Cooling / Heating) Accessory Indoor unit Installation plate Wireless remote controller batteries Remote controller holder Pure Flow Mounting screw Pan head wood screw Plasma air purifier Installation manual Owner's manual Outdoor unit Drain nipple Water proof rubber cap (C) o (C) o * The specification may be subject to change without notice for purpose of improvement. 6 FILE NO. SVM-10001 2-3. Operation Characteristic Curve <Cooling> 10 9 8 RAS-16SKV2-E 7 6 RAS-13SKV2-E <Heating> 9 8 7 6 5 4 3 2 1 0 RAS-16SKV2-E RAS-10SKV2-E RAS-13SKV2-E Current (A) 5 4 3 2 1 RAS-10SKV2-E 0 0 10 20 30 40 50 60 70 80 90 100 110 120 Conditions Indoor : DB 27 C/WB 19 C o Outdoor : DB 35 C Air Flow : High Pipt there is no refrigeration gas leakage. If the refrigerant gas leaks into the room, coming into contact with fire in the fan-driven heater, space heater, etc., a poisonous gas may occur. 3-2. Refrigerant Piping Installation 3-2-1. Piping Materials and Joints Used For the refrigerant piping installation, copper pipes and joints are mainly used.*
Copper pipes and joints suitable for the refrigerant must be chosen and installed. Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are leckness (mm) 0.8 0.8 0.8 1.
0 Dimension (mm) A 9.1 13.2 16.6 19.7 B 9.
2 13.5 16.0 19.0 C 6.5 9.7 12.9 16.0 D 13 20 23 25 Flare nut width (mm) 17 22 26 29 10 FILE NO. SVM-10001 Table 3-2-6 Flare and flare nut dimensions for R22 Dimension (mm) A 9.0 13.

0 16.2 19.7 23.3 B 9.2 13.5 16.0 19.0 24.0 C 6.5 9.
7 12.9 16.0 19.2 D 13 20 20 23 34 Nominal diameter 1/4 3/8 1/2 5/8 3/4 Outer diameter (mm) 6.35 9.
52 12.70 15.88 19.05 6° Thickness (mm) 0.8 0.
8 0.8 1.0 1.0 Flare nut width (mm) 17 22 24 27 36 45° to 4 B A C D 43° to 4 5° Fig. 3-2-2 Relations between flare nut and flare seal surface 2. Flare Connecting Procedures and Precautions a) Make sure that the flare and union portions do not have any scar or dust, etc. b) Correctly align the processed flare surface with the union axis. c) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for conventional R22. Incidentally, when the torque is weak, the gas leakage may occur.

When it is strong, the flare nut may crack and may be made non-removable. When choosing the tightening torque, comply with values designated by manufacturers. Table 3-2-7 shows reference values. NOTE : When applying oil to the flare surface, be sure to use oil designated by the manufacturer. If any other oil is used, the lubricating oils may deteriorate and cause the compressor to burn out. Table 3-2-7 Tightening torque of flare for R410A [Reference values] Nominal diameter 1/4 3/8 1/2 5/8 Outer diameter (mm) 6.35 9.52 12.70 15.88 Tightening torque N·m (kgf·cm) 14 to 18 (140 to 180) 33 to 42 (330 to 420) 50 to 62 (500 to 620) 63 to 77 (630 to 770) Tightening torque of torque wrenches available on the market N·m (kgf·cm) 16 (160), 18 (180) 42 (420) 55 (550) 65 (650) 11 FILE NO.
SVM-10001 3-3. Tools 3-3-1.


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Required Tools The service port diameter of packed valve of the outdoor unit in the air-water heat pump using R410A is changed to prevent mixing of other refrigerant. To reinforce the pressure-resisting strength, flare processing dimensions and opposite side dimension of flare nut (For Ø12.7 copper pipe) of the refrigerant piping are lengthened.

The used refrigerating oil is changed, and mixing of oil may cause a trouble such as generation of sludge, clogging of capillary, etc. Accordingly, the tools to be used are classified into the following three types. 1. Tools exclusive for R410A (Those which cannot be used for conventional refrigerant (R22)) 2. Tools exclusive for R410A, but can be also used for conventional refrigerant (R22) 3.

*Tools commonly used for R410A and for conventional refrigerant (R22) The table below shows the tools exclusive for R410A and their interchangeability. Tools exclusive for R410A (The following tools for R410A are required.) Tools whose specifications are changed for R410A and their interchangeability R410A air-water heat pump installation No. Used tool Usage Existence of new equipment for R410A Yes Yes Yes Whether conventional equipment can be used *(Note 1) *(Note 1) Conventional air-water heat pump installation Whether new equipment can be used with conventional refrigerant 1 2 3 4 5 6 7 8 9 10 Flare tool Copper pipe gauge for adjusting projection margin Torque wrench (For Ø12.7) Gauge manifold Charge hose Vacuum pump adapter Electronic balance for refrigerant charging Refrigerant cylinder Leakage detector Charging cylinder Pipe flaring Flaring by conventional flare tool Connection of flare nut Evacuating, refrigerant charge, run check, etc. Vacuum evacuating Refrigerant charge Refrigerant charge Gas leakage check Refrigerant charge ¡ *(Note 1) × × × × × × × × × ¡ ¡ Yes Yes Yes Yes Yes (Note 2) × ¡ × (Note 1) When flaring is carried out for R410A using the conventional flare tools, adjustment of projection margin is necessary. For this adjustment, a copper pipe gauge, etc. are necessary. (Note 2) Charging cylinder for R410A is being currently developed. General tools (Conventional tools can be used.*

) In addition to the above exclusive tools, the following equipments which serve also for R22 are necessary as the general tools. 1. Vacuum pump Use vacuum pump by attaching vacuum pump adapter. 2. Torque wrench (For Ø6.35, Ø9.52) 3. Pipe cutter 4. 5. 6.

7. 8. Reamer Pipe bender Level vial Screwdriver (+,) Spanner or Monkey wrench 9. Hole core drill (Ø65) 10. Hexagon wrench (Opposite side 4mm) 11. Tape measure 12. Metal saw Also prepare the following equipments for other installation method and run check. 1. Clamp meter 2. Thermometer 3. Insulation resistance tester 4. Electroscope 12 FILE NO. SVM-10001 3-4. Recharging of Refrigerant When it is necessary to recharge refrigerant, charge the specified amount of new refrigerant according to the following steps. Recover the refrigerant, and check no refrigerant remains in the equipment. Connect the charge hose to packed valve service port at the outdoor unit's gas side. When the compound gauge's pointer has indicated 0.1 Mpa (76 cmHg), place the handle Low in the fully closed position, and turn off the vacuum pump's power switch. Connect the charge hose to the vacuum pump adapter. Keep the status as it is for 1 to 2 minutes, and ensure that the compound gauge's pointer does not return.

Open fully both packed valves at liquid and gas sides. Set the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and charge liquid refrigerant. (For refrigerant charging, see the figure below.) Place the handle of the gauge manifold Low in the fully opened position, and turn on the vacuum pump's power switch. Then, evacuating the refrigerant in the cycle. 1. Never charge refrigerant exceeding the specified amount. 2. If the specified amount of refrigerant cannot be charged, charge refrigerant bit by bit in COOL mode. 3. Do not carry out additional charging. When additional charging is carried out if refrigerant leaks, the refrigerant composition changes in the refrigeration cycle, that is characteristics of the air conditioner changes, refrigerant exceeding the specified amount is charged, and working pressure in the refrigeration cycle becomes abnormally high pressure, and may cause a rupture or personal injury. (Indoor unit) (Outdoor unit) Opened Refrigerant cylinder (with siphon) Check valve Opened Opened Open/close valve for charging Closed Service port Electronic balance for refrigerant charging Fig. 3-4-1 Configuration of refrigerant charging 13 FILE NO. SVM-10001 1.

Be sure to make setting so that liquid can be charged. 2. When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down. It is necessary for charging refrigerant under condition of liquid because R410A is mixed type of refrigerant. Accordingly, when charging refrigerant from the refrigerant cylinder to the equipment, charge it turning the cylinder upside down if cylinder is not equipped with siphon.

[Cylinder with siphon] Gauge manifold OUTDOOR unit [Cylinder without siphon] Gauge manifold OUTDOOR unit Refrigerant cylinder Electronic balance Refrigerant cylinder Electronic balance Siphon R410A refrigerant is HFC mixed refrigerant. Therefore, if it is charged with gas, the composition of the charged refrigerant changes and the characteristics of the equipment varies. Fig. 3-4-2 3-5. Brazing of Pipes 3-5-1. Materials for Brazing 1. Silver brazing filler Silver brazing filler is an alloy mainly composed of silver and copper. It is used to join iron, copper or copper alloy, and is relatively expensive though it excels in solderability. 2. Phosphor bronze brazing filler Phosphor bronze brazing filler is generally used to join copper or copper alloy.

3. Low temperature brazing filler Low temperature brazing filler is generally called solder, and is an alloy of tin and lead. Since it is weak in adhesive strength, do not use it for refrigerant pipes. 1. Phosphor bronze brazing filler tends to react with sulfur and produce a fragile compound water solution, which may cause a gas leakage. Therefore, use any other type of brazing filler at a hot spring resort, etc., and coat the surface with a paint. 2. When performing brazing again at time of servicing, use the same type of brazing filler. 3-5-2.

Flux 1. Reason why flux is necessary · By removing the oxide film and any foreign matter on the metal surface, it assists the flow of brazing filler. · In the brazing process, it prevents the metal surface from being oxidized. · By reducing the brazing filler's surface tension, the brazing filler adheres better to the treated metal.

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14 FILE NO.

SVM-10001 2. Characteristics required for flux · Activated temperature of flux coincides with the brazing temperature. · Due to a wide effective temperature range, flux is hard to carbonize. · It is easy to remove slag after brazing. · The corrosive action to the treated metal and brazing filler is minimum. · It excels in coating performance and is harmless to the human body. As the flux works in a complicated manner as described above, it is necessary to select an adequate type of flux according to the type and shape of treated metal, type of brazing filler and brazing method, etc. 3. Types of flux · Noncorrosive flux Generally, it is a compound of borax and boric acid. It is effective in case where the brazing temperature is higher than 800°C. · Activated flux Most of fluxes generally used for silver brazing are this type. It features an increased oxide film removing capability due to the addition of compounds such as potassium fluoride, potassium chloride and sodium fluoride to the borax-boric acid compound. 4. Piping materials for brazing and used brazing filler/flux Piping material Copper - Copper Copper - Iron Iron - Iron Used brazing filler Phosphor copper Silver Silver Used flux Do not use Paste flux Vapor flux 3-5-3. Brazing As brazing work requires sophisticated techniques, experiences based upon a theoretical knowledge, it must be performed by a person qualified.

In order to prevent the oxide film from occurring in the pipe interior during brazing, it is effective to proceed with brazing while letting dry Nitrogen gas (N2) flow. Never use gas other than Nitrogen gas. 1. Brazing method to prevent oxidation 1) Attach a reducing valve and a flow-meter to the Nitrogen gas cylinder. 2) Use a copper pipe to direct the piping material, and attach a flow-meter to the cylinder. 3) Apply a seal onto the clearance between the piping material and inserted copper pipe for Nitrogen in order to prevent backflow of the Nitrogen gas. 4) When the Nitrogen gas is flowing, be sure to keep the piping end open. 5) Adjust the flow rate of Nitrogen gas so that it is lower than 0.05 m3/Hr or 0.02 MPa (0.

2kgf/cm2) by means of the reducing valve. 6) After performing the steps above, keep the Nitrogen gas flowing until the pipe cools down to a certain extent (temperature at which pipes are touchable with hands). 7) Remove the flux completely after brazing. M Flow meter Stop valve Nitrogen gas cylinder From Nitrogen cylinder 1. Do not enter flux into the refrigeration cycle.

2. When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chlorine. 3. When adding water to the flux, use water which does not contain chlorine (e.

g. distilled water or ion-exchange water). 4. Remove the flux after brazing. Pipe Nitrogen gas Rubber plug Fig. 3-5-1 Prevention of oxidation during brazing 15 4. CONSTRUCTION VIEWS 4-1. Indoor Unit 790 FILE NO. SVM-10001 Front panel Air filter Air inlet 205 63 275 48 Heat exchanger 48 7 Knock out system Knock out system 62 116 480 Installation plate hanger 193 69 49 56 Wireless remote controller Installation plate hanger Connecting pipe (0.35m) (For 10,13 series; Flare 9.

52mm) (For 16 series; Flare 12.7mm) 84.5 Drain hose (0.50m) Connecting pipe (0.40m) (Flare 6.35mm) 235 215 621 235 215 65 or more Minimum distance to ceiling 84.5 63 Hanger Minimum distance to wall Remote controller holder Minimum distance 275 170 or more 170 or more 40 84.5 Hanger 150 160.5 Center line 160.5 Hanger 150 84.

5 Installation plate outline 16 40 190 to wall 45 125 26 157 19 7 63 FILE NO. SVM-10001 4-2. Outdoor Unit A 28 600 36 50 108 125 30 R15 320 306 Ø6 hole R5.5 Ø6 hole Ø11x14 hole Ø25 Drain outlet 320 320 306 86 36 50 R15 A detail Drawing (Back leg) FAN-GUARD Ø 436 2- Ø11 x 14 Hole (For Ø8 -Ø10 anchor bolt) B Detail Drawing (Front leg) COVER-PV Z 550 275 290 90 600 90 69 320 342 Electrical part cover Liquid side (Flare Ø 6.35) Gas side (10,13 : Flare 9.

52) (16 : Flare 12 ..7) 137 92 54 Z View 2 - R5-5 x 17L Ushape (For 8 - 10 anchor bolt) Air intlel 600 or more Service port 600 100 or more 320 100 or more Air outlel 600 or more 2 - 11 x 14 Long holes (For 8 - 10 anchor bolt) Installation dimension 17 5. WIRING DIAGRAM FILE NO. SVM-10001 5-1. RAS-10SKV2-E / RAS-10SAV2-E, RAS-13SKV2-E / RAS-13SAV2-E 1 RELAY COIL FOR 4WAY VALVE 11 22 33 44 55 66 77 88 99 10 10 11 11 1 2 3 4 5 6 7 8 9 10 11 YEL 18 FILE NO. SVM-10001 5-2. RAS-16SKV2-E / RAS-16SAV2-E T3.15A 250VAC Fuse F01 11 3 4 5 6 3 4 5 6 11 22 33 44 55 66 77 88 99 10 10 11 11 12 12 13 13 14 14 15 15 11 22 33 44 55 66 77 88 99 10 10 11 11 12 12 13 13 14 14 15 15 19 FILE NO. SVM-10001 6. SPECIFICATIONS OF ELECTRICAL PARTS 6-1. Indoor Unit No. 1 2 3 4 Fan motor (for indoor) Parts name RAS-10,13SKV2-E RAS-16SKV2-E Type AFN-220-20-4D ICF-340-30-4 (-) (-) MP24Z3T Specifications AC 240V, 20W DC 340V, 30W 10k at 25°C 10k at 25°C Output (Rated) 1W, 16 poles, DC12V Room temp. sensor (TA-sensor) Heat exchanger temp. sensor (TC-sensor) Louver motor 6-2.

Outdoor Unit No. 1 2 3 4 5 6 7 8 9 10 Reactor Outdoor fan motor Suction temp. sensor (TS sensor) Discharge temp. sensor (TD sensor) Outside air temp. sensor (TO sensor) Heat exchanger temp. sensor (TE sensor) Terminal block (5P) Compressor COIL FOR P.M.V. Coil for 4-way valve RAS-10,13SAV2-E RAS-16SAV2-E DA89X1C-23FZ2 DA111A1F-20F1 STF Parts name RAS-16SAV2-E RAS-10,13SAV2-E Type CH-57 CH-69 ICF-140-43-4R (Inverter attached) (Inverter attached) (Inverter attached) (Inverter attached) Specifications L = 10mH, 16A L = 19mH, 10A DC140V, 43W 10k (25°C) 62k (20°C) 10k (25°C) 10k (25°C) 20A, AC250V 3-phases 4-poles 750W CAM-MD12TCTH-2 DC12V AC220-240V 20 FILE NO. SVM-10001 7. REFRIGERANT CYCLE DIAGRAM 7-1. Refrigerant Cycle Diagram RAS-10SKV2-E / RAS-10SAV2-E INDOOR UNIT Indoor heat exchanger T1 Temp. measurement TC Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port TA Allowable pipe length Allowable height difference : 10m Deoxidized copper pipe Outer dia. : 6.35mm Thickness : 0.

8mm Sectional shape of heat insulator Max. : 20m Min. : 2m Chargeless : 15m Charge : 20g/m (16 to 20m) Deoxidized copper pipe Outer dia. : 9.52mm Thickness : 0.

8mm Muffler 4-way valve Strainer Muffler TD Pulse Modulating valve at liquid side Compressor DA89X1C-23FZ2 TS TO Strainer Outdoor heat exchanger Temp. measurement T2 Propeller fan TE Refrigerant amount : 0.

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80kg NOTE : Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 20 m. When the pipe length exceeds 15m, the additional charging of refrigerant, 20g per 1m for the part of pipe exceeded 15m is required. (Max. 100g) 21 FILE NO. SVM-10001 RAS-13SKV2-E / RAS-13SAV2-E INDOOR UNIT Indoor heat exchanger T1 Temp. measurement TC Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port TA Allowable pipe length Allowable height difference : 10m Deoxidized copper pipe Outer dia. : 6.35mm Thickness : 0.

8mm Sectional shape of heat insulator Max. : 20m Min. : 2m Chargeless : 15m Charge : 20g/m (16 to 20m) Deoxidized copper pipe Outer dia. : 9.52mm Thickness : 0.8mm Muffler 4-way valve Strainer Muffler TD Pulse Modulating valve at liquid side Compressor DA89X1C-23FZ2 TS TO Outdoor heat exchanger Temp. measurement T2 Propeller fan TE Refrigerant amount : 0.80kg NOTE : Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 20 m. When the pipe length exceeds 15m, the additional charging of refrigerant, 20g per 1m for the part of pipe exceeded 15m is required. (Max.
100g) 22 FILE NO. SVM-10001 RAS-16SKV2-E / RAS-16SAV2-E INDOOR UNIT Indoor heat exchanger T1 Temp. measurement TC Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port TA Allowable pipe length Allowable height difference : 10m Deoxidized copper pipe Outer dia. : 6.35mm Thickness : 0.
8mm Sectional shape of heat insulator Max. : 20m Min. : 2m Chargeless : 15m Charge : 20g/m (16 to 20m) Deoxidized copper pipe Outer dia. : 12.7mm(16) Thickness : 0.
8mm Muffler 4-way valve Strainer Muffler TD Pulse Modulating valve at liquid side Compressor DA111A1F-20F1 TS TO Outdoor heat exchanger Split capillary Ø1.2 x 80 Ø1.2 x 80 TE Temp. measurement T2 Propeller fan Refrigerant amount : 1.10kg NOTE : Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 15 m. When the pipe length exceeds 15m, the additional charging of refrigerant, 20g per 1m for the part of pipe exceeded 15m is required. (Max. 100g) 23 7-2. Operation Data <Cooling> Tempeature Model name condition(°C) RASIndoor Outdoor 27/19 35/10SKV2-E 13SKV2 -E 16SKV2 -E Standard pressure P (MPa) 0.9 to 1.

1 0.8 to 1.0 0.8 to 1.0 Heat exchanger pipe temp. T1 (°C) T2 (°C) 12 to 14 37 to 39 11 to 13 46 to 48 11 to 13 40 to 42 Indoor fan mode High High High FILE NO. SVM-10001 Outdoor fan mode High High High Compressor revolution (rps) 49 75 83 <Heating> Tempeature Model name condition(°C) RASIndoor Outdoor 20/7/6 10SKV2-E 13SKV2 -E 16SKV2 -E Standard pressure P (MPa) 2.5 to 2.7 2.6 to 2.
8 2.7 to 2.9 Heat exchanger pipe temp. T1 (°C) T2 (°C) 39 to 41 0 to 3 41 to 43 0 to 2 43 to 45 0 to 2 Indoor fan mode High High High Outdoor fan mode High High High Compressor revolution (rps) 60 80 83 NOTES : 1. Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent.
(Thermistor themometer) 2. Connecting piping condition : 5 m 24 FILE NO. SVM-10001 8. CONTROL BLOCK DIAGRAM 8-1. Indoor Unit RAS-10SKV2-E, RAS-13SKV2-E M.
C.U. Heat Exchanger Sensor (Tc) Room Temperature Sensor (Ta) · 3-minute Delay at Restart for Compressor Infrared Rays Signal Receiver and Indication · Fan Motor Starting Control · Processing (Temperature Processing) · Timer · Serial Signal Communication · Clean Function Power Supply Circuit Indoor Fan Motor Control Indoor Fan Motor Functions · Cold draft preventing Function Louver Motor Drive Control Indoor Unit Control Unit Louver Motor Initializing Circuit Clock Frequency Oscillator Circuit Converter (D.C circuit) Noise Filter Serial Signal Transmitter/Receiver From Outdoor Unit 220-240V ~50Hz Serial Signal Communication (Operation Command and Information) Remote Controller Infrared Rays, 36.7kHz REMOTE CONTROLLER Operation [ ] Operation Mode Selection AUTO, COOL, DRY, HEAT Thermo. Setting Fan Speed Selection ON TIMER Setting OFF TIMER Setting Louver AUTO Swing Louver Direction Setting ECO Hi-POWER COMFORT SLEEP QUIET 25 FILE NO. SVM-10001 RAS-16SKV2-E M.C.U. Heat Exchanger Sensor (TC) Room Temperature Sensor (Ta) · 3-minute Delay at Restart for Compressor Infrared Rays Signal Receiver and Indication · Fan Motor Starting Control · Processing (Temperature Processing) · Timer · Serial Signal Communication · Clean Function Power Supply Circuit Indoor Fan Motor Control Indoor Fan Motor Functions · Cold draft preventing Function Louver Motor Drive Control Indoor Unit Control Unit Louver Motor Initializing Circuit Clock Frequency Oscillator Circuit Converter (D.

C circuit) Noise Filter Serial Signal Transmitter/Receiver From Outdoor Unit 220-240V ~50Hz Serial Signal Communication (Operation Command and Information) Remote Controller Infrared Rays, 36.7kHz REMOTE CONTROLLER Operation [ ] Operation Mode Selection AUTO, COOL, DRY, HEAT Thermo. Setting Fan Speed Selection ON TIMER Setting OFF TIMER Setting Louver AUTO Swing Louver Direction Setting ECO Hi-POWER COMFORT SLEEP QUIET 26 - For INDOOR UNIT MICRO-COMPUTER BLOCK DIAGRAM 220240 V ~50Hz MCC5009 (P.C.B) M.C.U Current detect OUTDOOR UNIT Indoor unit send/receive circuit 8-2. Outdoor Unit (Inverter Assembly) Discharge temp. sensor Gate drive circuit Outdoor air temp. sensor Current detect 27 Gate drive circuit Clock frequency 4MHz Input current sensor Converter (AC DC) Driver circuit of P.
M.V. Relay circuit Inverter (DC AC) Suction temp. sensor Heat exchanger temp.sensor · · · · · · · · · · · PWM synthesis function Input current release control IGBT over-current detect control Outdoor fan control High power factor correction control Inverter output frequency control A/D converter function P.
M.V. control Discharge temp. control 4-way valve control Signal communication to indoor unit High Power factor Correction circuit Noise Filter Inverter (DC AC) Outdoor Fan motor Compressor P.M.
V. : Pulse Motor Valve M.C.U. : Micro Control Unit 4-way valve FILE NO. SVM-10001 P.M.V. FILE NO. SVM-10001 9.

OPERATION DESCRIPTION 9-1. Outline of Air Conditioner Control This air conditioner is a capacity-variable type air conditioner, which uses AC or DC motor for the indoor for motor and the outdoor fan motor.


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And the capacityproportional control compressor which can change the motor speed in the range from 11 to 96 rps is mounted. The DC motor drive circuit is mounted to the indoor unit. The compressor and the inverter to control fan motor are mounted to the outdoor unit. The entire air conditioner is mainly controlled by the indoor unit controller. The indoor unit controller drives the indoor fan motor based upon command sent from the remote controller, and transfers the operation command to the outdoor unit controller. The outdoor unit controller receives operation command from the indoor unit side, and controls the outdoor fan and the pulse Modulating valve. (P .M.

V) Besides, detecting revolution position of the compressor motor, the outdoor unit controller controls speed of the compressor motor by controlling output voltage of the inverter and switching timing of the supply power (current transfer timing) so that motors drive according to the operation command. And then, the outdoor unit controller transfers reversely the operating status information of the outdoor unit to control the indoor unit controller. As the compressor adopts four-pole brushless DC motor, the frequency of the supply power from inverter to compressor is two-times cycles of the actual number of revolution. · Detection of inverter input current and current release operation · Over-current detection and prevention operation to IGBT module (Compressor stop function) · Compressor and outdoor fan stop function when serial signal is off (when the serial signal does not reach the board assembly of outdoor control by trouble of the signal system) · Transferring of operation information (Serial signal) from outdoor unit controller to indoor unit controller · Detection of outdoor temperature and operation revolution control · Defrost control in heating operation (Temp. measurement by outdoor heat exchanger and control for 4-way valve and outdoor fan) 3.

Contents of operation command signal (Serial signal) from indoor unit controller to outdoor unit controller The following three types of signals are sent from the indoor unit controller. · Operation mode set on the remote controller · Compressor revolution command signal defined by indoor temperature and set temperature (Correction along with variation of room temperature and correction of indoor heat exchanger temperature are added.) · Temperature of indoor heat exchanger · For these signals ([Operation mode] and [Compressor revolution] indoor heat exchanger temperature), the outdoor unit controller monitors the input current to the inverter, and performs the followed operation within the range that current does not exceed the allowable value. 1. Role of indoor unit controller The indoor unit controller judges the operation commands from the remote controller and assumes the following functions.

· Judgment of suction air temperature of the indoor heat exchanger by using the indoor temp. sensor. (TA sensor) · Judgment of the indoor heat exchanger temperature by using heat exchanger sensor (TC sensor) (Prevent-freezing control, etc.) · Louver motor control · Indoor fan motor operation control · LED (Light Emitting Diode) display control · Transferring of operation command signal (Serial signal) to the outdoor unit · Reception of information of operation status (Serial signal including outside temp. data) to the outdoor unit and judgment/display of error · Air purifier operation control 4. Contents of operation command signal (Serial signal) from outdoor unit controller to indoor unit controller The following signals are sent from the outdoor unit controller. · The current operation mode · The current compressor revolution · Outdoor temperature · Existence of protective circuit operation For transferring of these signals, the indoor unit controller monitors the contents of signals, and judges existence of trouble occurrence. Contents of judgment are described below. · Whether distinction of the current operation status meets to the operation command signal · Whether protective circuit operates When no signal is received from the outdoor unit controller, it is assumed as a trouble. 2.

Role of outdoor unit controller Receiving the operation command signal (Serial signal) from the indoor unit controller, the outdoor unit performs its role. · Compressor operation control · Operation control of outdoor fan motor Operations followed to judgment of serial signal from indoor side. · P.M.V. control · 4-way valve control 28 FILE NO. SVM-10001 9-2. Operation Description 1. Basic operation ..

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1. Operation control Receiving the user's operation condition setup, the operation statuses of indoor/outdoor units are controlled. 1) The operation conditions are selected by the remote controller as shown in the below. 2) A signal is sent by ON button of the remote controller. 3) The signal is received by a sensor of the indoor unit and processed by the indoor controllers as shown in the below. 4) The indoor controller controls the indoor fan motor and louver motor. 5) The indoor controller sends the operation command to the outdoor controller, and sends/receives the control status with a serial signal. 6) The outdoor controller controls the operation as shown in the left, and also controls the compressor, outdoor fan motor, 4-way valve and pulse Modulating valve. Description Remote controller Selection of operation conditions ON/OFF Control contents of remote controller · ON/OFF (Air conditioner/Air purifier) · Operation select (COOL/HEAT/AUTO/DRY) · Temperature setup · Air direction · Swing · Air volume select (AUTO/LOW/LOW+/MED/MED+/HIGH) · ECO · COMFORT SLEEP · QUIET · ON timer setup · PRESET · OFF timer setup · ONE-TOUCH · Hi-POWER Indoor unit Signal receiving Indoor unit control Operation command Serial signal send/receive Indoor unit control · Command signal generating function of indoor unit operation · Calculation function (temperature calculation) · Activation compensation function of indoor fan · Cold draft preventive function · Timer function · Indoor heat exchanger release control · Indoor fan motor · Louver motor Outdoor unit Serial signal send/receive Outdoor unit control Outdoor unit control · Frequency control of inverter output · Waveform composite function · Calculation function (Temperature calculation) · AD conversion function · Quick heating function · Delay function of compressor reactivation · Current release function · GTr over-current preventive function · Defrost operation function Inverter ~ · Compressor · Outdoor fan motor · 4-way valve · Pulse Modulating valve (P.


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M.

V.) 30 FILE NO. SVM-10001 Item 1. Basic operation Operation flow and applicable data, etc. 2. Cooling/Heating operation The operations are performed in the following parts by controls according to cooling/heating conditions. 1) Receiving the operation ON signal of the remote controller, the cooling or heating operation signal starts being transferred form the indoor controller to the outdoor unit. 2) At the indoor unit side, the indoor fan is operated according to the contents of "2. Indoor fan motor control" and the louver according to the contents of "9. Louver control", respectively.

*3) The outdoor unit controls the outdoor fan motor, compressor, pulse Modulating valve and 4-way valve according to the operation signal sent from the indoor unit. Description Operation ON Indoor unit control Setup of remote controller Indoor fan motor control / Louver control / Operation Hz Control (Requierment) Sending of operation command signal Compressor revolution control / Outdoor fan motor control / Operation Hz control (Include limit control) 4-way valve control In cooling operation: ON In heating operation: OFF Pulse Modulating valve control Outdoor unit control [ ] 3. AUTO operation Selection of operation mode As shown in the following figure, the operation starts by selecting automatically the status of room temperature (Ta) when starting AUTO operation. *1. When reselecting the operation mode, the fan speed is controlled by the previous operation mode. Ta Cooling operation Ts + 1 Monitoring (Fan) Ts 1 Heating operation 1) Detects the room temperature (Ta) when the operation started. 2) Selects an operation mode from Ta in the left figure. 3) Fan operation continues until an operation mode is selected. 4) When AUTO operation has started within 2 hours after heating operation stopped and if the room temperature is 20°C or more, the fan operation is performed with "Super Ultra LOW" mode for 3 minutes. Then, select an operation mode.*

*5) If the status of compressor-OFF continues for 15 minutes the room temperature after selecting an operation mode (COOL/HEAT), reselect an operation mode. 4. DRY operation 1) Detects the room temperature (Ta) when the DRY operation started. DRY operation is performed according to the difference between room temperature and the setup temperature as 2) Starts operation under conditions in the shown below. left figure according to the temperature difference between the room temperaIn DRY operation, fan speed is controlled in order to ture and the setup temperature (Tsc). prevent lowering of the room temperature and to avoid air Setup temperature (Tsc) flow from blowing directly to persons. = Set temperature on remote controller (Ts) + (0.0 to 1.0) [°C] 3) When the room temperature is lower Ta L (W5) 1°C or less than the setup temperature, turn off the compressor. +1. 0 +0.5 (W5+W3) / 2 SUL (W3) Tsc Fan speed - 31 - FILE NO. SVM-10001 Item 2. Indoor fan motor control Operation flow and applicable data, etc. <In cooling operation> (This operation controls the fan speed at indoor unit side.) The indoor fan (cross flow fan) is operated by the phasecontrol induction motor. The fan rotates in 5 stages in MANUAL mode, and in 5 stages in AUTO mode, respectively. (Table 1) Description COOL ON UH H M+ M L+ L LUL SUL * Symbols : Ultra High : High : Medium+ : Medium : Low+ : Low : Low : Ultra Low : Super Ultra Low Fan speed setup MANUAL (Fig. 1) AUTO Indication L L+ M M+ H Fan speed W6 (L + M) / 2 W9 (M + H) / 2 WC (Fig. 2) Air volume AUTO Ta [°C] +2. 5 +2.0 +1.5 +1.0 +0.5 Tsc a b c d e M+(WB) *3 *4 *5 L(W6) *3 : Fan speed = (M + L) x 3/4 + L *4 : Fan speed = (M + L) x 2/4 + L *5 : Fan speed = (M + L) x 1/4 + L (Linear approximation from M+ and L) * The fan speed broadly varies due to position of the louver, etc. The described value indicates one under condition of inclining downward blowing. 1) When setting the fan speed to L, L+, M, M+ or H on the remote controller, the operation is performed with the constant speed shown in Fig. 1. 2) When setting the fan speed to AUTO on the remote controller, revolution of the fan motor is controlled to the fan speed level shown in Fig. 2 and Table 1 according to the setup temperature, room temperature, and heat exchanger temperature.*

*(Table 1) Indoor fan air flow rate Fan speed level COOL HEAT DRY WF WE WD WC WB WA W9 W8 W7 W6 W5 W4 W3 W2 W1 L+ L LUL SUL SUL UL M L+ L LL+ L LUL SUL UH H M+ M RAS-10SKV2-E Fan speed (rpm) Air flow rate (m3/h) RAS-13SKV2-E Fan speed (rpm) Air flow rate (m3/h) RAS-16SKV2- E Fan speed (rpm) Air flow rate (m3/h) UH H M+ UH H M+ M 1210 1210 1170 1120 1040 1000 960 870 850 760 760 700 650 500 500 571 571 546 515 465 440 415 359 347 291 291 253 222 129 129 1300 1300 1250 1200 1080 1050 990 870 860 770 770 720 670 520 500 620 620 590 570 490 465 434 359 353 297 297 266 234 141 129 1510 1510 1480 1430 1280 1220 1150 1000 980 920 900 840 770 620 520 735 735 717 686 594 557 514 421 409 372 360 323 280 187 126 32 FILE NO. SVM-10001 Item 2. Indoor fan motor control HEAT ON Operation flow and applicable data, etc. <In heating operation> Description 1) When setting the fan speed to L, L+, M, M+ or H on the remote controller, the operation is performed with the constant speed shown in Fig. 3 and Table 1. 2) When setting the fan speed to AUTO on the remote controller, revolution of the fan motor is controlled to the fan speed level shown in Fig. 5 according to the set temperature and room temperature. 3) Min air flow rate is controlled by temperature of the indoor heat exchanger (Tc) as shown in Fig. 4. 4) Cold draft prevention, the fan speed is controlled by temperature of the indoor heat exchanger (Tc) as shown in Fig. 6. 5) In order to prevent Cold draft when compressor step during heating operation. Then louver will move to upper position and fan speed will reduce or off. Fan speed setup MANUAL (Fig. 3) Fan speed W8 (L + M) / 2 WA (M + H) / 2 WE Indication L L+ AUTO M M+ H TC 42°C NO YES Min air flow rate control Tc 52 51 42 41 (Fig. 4) Limited to Min WD tap No limit * * Fan speed = (TC W8) + W8 Cold draft preventive control Basic fan control TA [°C] TSC 0.5 1.0 1.5 2.0 2. 5 5.0 5.5 b c d e f g Fan speed AUTO L+ (W9) 46 45 33 32 *A+4 Tc 46 45 33 32 *A+4 *A-4 34 33 21 20 *A+4 H (WE) *1 *2 Line-approximate H and SUL with Tc. SUL (W2) *3 *A-4 *A-4 Stop M+ (WD) Fan speed MANUAL in starting Fan speed AUTO in stability Fan speed AUTO in starting H (WE) *1: Fan speed = (M + -L+) x 1 4 + L+ *2: Fan speed = (M + -L+) x 2 4 + L+ *3: Fan speed = (M + -L+) x 3 4 + L+ (Calculated with linear approximation from M+ and L+) * No limitation while fan speed MANUAL mode is in stability. * A: When Tsc 24, A is 24, and when Tsc < 24, A is Tsc Tsc: Set value (Fig.*

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5) [In starting and in stability] In starting FAN AUTO (Fig. 6) In stability · Until 12 minutes passed after operation start · When 12 to 25 minutes passed after operation start and room temp. is higher than (set temp. 3°C) · When 12 to 25 minutes passed after operation start and room temp. is 3°C or lower than set temp.

· When 25 minutes or more passed after operation start · Room temp. Set temp. 3.5°C FAN Manual · Room temp. < Set temp. 4°C 33 FILE NO. SVM-10001 Item 3. Outdoor fan motor control Operation flow and applicable data, etc. The blowing air volume at the outdoor unit side is controlled. Receiving the operation command from the controller of indoor unit, the controller of outdoor unit controls fan speed.

** For the fan motor, a DC motor with non-stage variable speed system is used. However, it is limited to 8 stages for reasons of controlling. Description 1) The operation command sent from the remote controller is processed by the indoor unit controller and transferred to the controller of the outdoor unit. 2) When strong wind blows at outdoor side, the operation of air conditioner continues with the fan motor stopped. 3) Whether the fan is locked or not is detected, and the operation of air conditioner stops and an alarm is displayed if the fan is locked.*

4) According to each operation mode, by the conditions of outdoor temperature (To) and compressor revolution, the speed of the outdoor fan shown in the table is selected. Air conditioner ON (Remote controller) Indoor unit controller 1) Outdoor unit operation command (Outdoor fan control) 2) Fan speed 400 when the motor stopped. NO Fan motor ON YES Air conditioner OFF Alarm display YES OFF status of fan motor continues. 3) Fan lock NO 4) Motor operates as shown in the table below. In cooling operation Compressor speed (rps) To > 38°C To > 28°C To To > 15°C To > 5.

5°C To > 0°C To < 0°C During ECO mode To > 38°C To < 38°C ~ 13.8 f2 f2 f2 f1 f1 f0 f2 f2 fD f3 f3 f3 f3 f1 f0 f3 f3 fF ~ 31.7 fC fA f7 f2 f1 f0 fB f2 fD fD fC fA f5 f2 f1 fC f3 fF 32.3 ~ MAX fE fD f9 f4 f2 f1 fC fB fD fF fF fC f7 f4 f2 fD fC fF During ECO mode MIN MAX MIN MAX MIN MAX In Heating operation Compressor speed (rps) ~16.8 ~47.9 48.5 ~ MAX To > 15°C f3 f8 f9 To To < 15°C To < 5.5°C To < -5.0°C To > 15°C To < 15°C To < 5.5°C To < -5.

5°C When To is abnormal f3 f8 fB f3 f3 f5 f7 fA f9 fA fC f3 f3 f9 fA fB fA fD fD f6 f8 f9 fB fD When To is abnormal Outdoor fan speed (rpm) Tap f0 f1 f2 f3 f4 f5 f6 f7 f8 10SAV2-E 13SAV2-E 16SAV2-E Tap f9 fA fB fC fD fE fF 10SAV2-E 13SAV2-E 16SAV2-E 0 200 300 370 440 440 500 550 600 0 200 300 370 440 440 500 550 600 0 200 300 370 440 440 500 550 600 600 600 650 700 700 700 700 650 700 700 800 800 800 800 650 700 700 800 800 800 900 34 FILE NO. SVM-10001 Item 4. Capacity control Operation flow and applicable data, etc. The cooling or heating capacity depending on the load is adjusted. According to difference between the setup value of temperature and the room temperature, the capacity is adjusted by the compressor revolution. Indoor unit Room temp. (Ta) Description 1) The difference between set temperature on remote controller (Ts) and room temperature (Ta) is calculated. 2) According to the temperature difference, the correction value of Hz signal which determines the compressor speed is set up. 3) The rotating position and speed of the motor are detected by the electromotive force occurred on the motor winding with operation of the compressor. 4) According to the difference resulted from comparison of the correction value of Hz signal with the present operation Hz, the inverter output and the commutation timing are varied.

*5) Change the compressor motor speed by outputting power to the compressor. * The contents of control operation are same in cooling operation and heating operation Remote controller Set temp. (Ts) Ts Ta Correction of Hz signal Detection of electromotive force of compressor motor winding Detection of motor speed and rotor position Correction value of Hz signal Operating Hz Inverter output change Commutation timing change Change of compressor speed 5. Current release This function prevents troubles on the electronic parts of the control compressor driving inverter. This function also controls drive circuit of the compressor speed so that electric power of the compressor drive circuit does not exceed the specified value.*

Outdoor unit inverter main circuit control current Outdoor temp. To Setup of current release point Operating current Setup value Low High Reduce compressor speed Current decrease Capacity control continues. 1) The input current of the outdoor unit is detected in the inverter section of the outdoor unit. 2) According to the detected outdoor temperature, the specified value of the current is selected. 3) Whether the current value exceeds the specified value or not is judged.

4) If the current value exceeds the specified value, this function reduces the compressor speed and controls speed up to the closest one commanded from the indoor unit within the range which does not exceed the specified value. Outdoor temp. Cooling current release value 10SAV2-E 13SAV2-E 16SAV2-A Heating current release value 10SAV2-E 13SAV2-E 16SAV2-E 45°C 40°C 16°C 11°C 44°C 39°C 15.5°C 10.5°C 3.97A 4.35A 6.30A 4.27A 4.88A 6.

30A 6.45A 6.75A 8.47A 6.30A 6.30A 7.72A 6.30A 6.30A 6.30A 6.

30A 9.22A 10.80A 35 FILE NO. SVM-10001 Item Operation flow and applicable data, etc. Description 1) When temperature of the indoor heat exchanger drops below 5°C, the compressor speed is reduced.

(P zone) 2) When temperature of the indoor heat exchanger rises in the range from 6°C to under 7°C, the compressor speed is kept. (Q zone) 3) When temperature of the indoor heat exchanger rises to 7°C or higher, the capacity control operation returns to the usual control in cooling operation. (R zone) 6. Release protective <In cooling/dry operation> control by tempera- (Prevent-freezing control for indoor heat exchanger) ture of indoor heat In cooling/dry operation, the sensor of indoor heat exchanger exchanger detects evaporation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value. Indoor heat exchanger temperature Usual cooling capacity control R 7°C Q 6°C 5°C P When the value is in Q zone, the compressor speed is kept.

Reduction of compressor speed <In heating operation> (Prevent-overpressure control for refrigerating cycle) In heating operation, the sensor of indoor heat exchanger detects condensation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value.

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Indoor heat exchanger temperature Reduction of compressor speed P 55°C 52°C When the value is in Q zone, the compressor speed is kept. Q 48°C R Usual heating capacity control 1) When temperature of the indoor heat exchanger rises in the range from 50°C to 55°C, the compressor speed is kept. (Q zone) When temperature of the indoor heat exchanger drops in the range from 46°C to under 55°C, the compressor speed is kept. (Q zone) 2) When temperature of the indoor heat exchanger rises to 55°C or higher, the compressor speed is reduced. (P zone) 3) When temperature of the indoor heat exchanger does not rise to 50°C, or when it drops below to 46°C, the capacity control operation returns to the usual control in heating operation. (R zone) 36 FILE NO. SVM-10001 Item Operation flow and applicable data, etc. Description The necessity of defrost operation is detected by the outdoor heat exchanger temperature. The conditions to detect the necessity of defrost operation differ in A, B, or C zone each.

(Table 1) <Defrost operation> · Defrost operation in A to C zones 1) Stop operation of the compressor for 20 seconds. 2) Invert (ON) 4-way valve 10 seconds after stop of the compressor. 3) The outdoor fan stops at the same time when the compressor stops. 4) When temperature of the indoor heat exchanger becomes 38°C or lower, stop the indoor fan. <Finish of defrost operation> · Returning conditions from defrost operation to heating operation 1) Temperature of outdoor heat exchanger rises to +8°C or higher. 2) Temperature of outdoor heat exchanger is kept at +5°C or higher for 80 seconds. 3) Defrost operation continues for 15 minutes. <Returning from defrost operation> 1) Stop operation of the compressor for approx. 50 seconds. 2) Invert (OFF) 4-way valve approx.
40 seconds after stop of the compressor. 3) The outdoor fan starts rotating at the same time when the compressor starts. 7. Defrost control (This function removes frost adhered to the outdoor (Only in heating heat exchanger.) operation) The temperature sensor of the outdoor heat exchanger (Te sensor) judges the frosting status of the outdoor heat exchanger and the defrost operation is performed with 4-way valve reverse defrost system.
*Start of heating operation Outdoor heat exchanger temperature 0' 10' 15' 27'40" 34' Operation time (Minute) 5°C C zone 7°C A zone 20°C B zone * * The minimum value of Te sensor 10 to 15 minutes after start of operation is stored in memory as Te0. Table 1 A zone B zone C zone When Te0 - TE 2.5 continued for 2 minutes in A zone, defrost operation starts. When the operation continued for 2 minutes in B zone, defrost operation starts. When Te0 - TE 3 continued for 2 minutes in C zone, defrost operation starts.*
37 FILE NO. SVM-10001 Item Operation flow and applicable data, etc. Description 8. Louver control This function controls the air direction of the indoor unit. 1) Louver · The position is automatically controlled according to the operation position mode (COOL/HEAT). · The set louver position is stored in memory by the microcomputer, and the louver returns to the stored position when the next operation is performed. (Cooling/Heating memory position) The angle of the louver is indicated as the louver closes fully is 0°. 1) Louver position in cooling operation Initial setting of "Cooling storage position" Louver : Directs downward (35.3°) 2) Louver position in heating operation Heating operation/ AUTO (HEAT) Initial setting of "Heating storage position" Louver : Directs downward (80.5°) 2) Air direction adjustment Air direction Horizontal blowing Inclined blowing Blowing downward Inclined blowing Horizontal blowing · The louver position can be arbitrarily set up by pressing [FIX] button.

3) Swing · Swing operation is performed in width 35° with the stop position as the center. · If the stop position exceeds either upper or lower limit position, swing operation is performed in width 35° from the limit which the stop position exceeded. · Swing When pressing [SWING] button during operation, the louver starts swinging. 38 FILE NO. SVM-10001 Item 9. ECO operation Operation flow and applicable data, etc. When pressing [ECO] button on the remote controller, a Economic operation is performed. <Cooling operation> This function operates the air conditioner with the difference between the set and the room temperature as shown in the following figure. Description <Cooling operation> 1) The control target temperature increase 0.5ºC per hour up to 2ºC starting from the set temperature when ECONO has been received.
2) The indoor fan speed is depend on presetting and can change every speed after setting ECO operation. 3) The compressor speed is controlled as shown in the left figure. TA +6.5 +6.0 +5.
*5 +5.0 +4.5 +4.0 Zone Frequency 12 11 10 9 8 7 6 5 4 3 2 1 Dry Max *12 *11 *10 *9 *8 FAN Fan speed depend on presetting and can change every speed. +3.*
*5 +3.0 +2.5 +2.0 +1.5 +1.0 +0.5 TSC -0.5 -1.0 -2.0 Min Hz OFF 1H 2H 3H 4H Time * 12 (DRY max - COOL min) /6 x 5 + COOL min * 11 (DRY max - COOL min) /6 x 4 + COOL min * 10 (DRY max - COOL min) /6 x 3 + COOL min * 9 (DRY max - COOL min) /6 x 2 + COOL min * 8 (DRY max - COOL min) /6 x 1 + COOL min Hz Cool min DRY max 10SKV2-E 13SKV2-E 16SKV2-E 20 35 20 37 13 35 <Heating operation> 30 minutes 0 0.*

5 1.0 1.5 2.0 2.5 3.0 4.0 5.0 6.0 7.0 8.
0 9.0 10.0 11.0 Time Compressor speed 0Hz <Heating operation> 1) Setting the compressor speed to Max. aHz, the temperature zone in which the operation can be performed with Max.
cHz is gradually widened after 30 minutes passed when starting ECO operation. 2) The indoor fan speed is depend on presetting and can change every speed after setting ECO operation. A B (Room temp. Set temp.) A A zone aHz C B B zone a to cHz C Hz a c 10SKV2-E 13SKV2-E 20 50 C zone cHz 16SKV2-E 13 50 39 FILE NO.
SVM-10001 Item Operation flow and applicable data, etc. Description 1) When pressing [RESET] button, the temporary [AUTO] operation starts. 2) When keeping [RESET] button pressed for 3 seconds or more, Pi, Pi, Pi sound is heard and [AUTO RESTART] control is changed. 3) When keeping [RESET] button pressed for 10 seconds or more, "Pi" sound is heard and the temporary [COOL] operation starts. 4) If the filter lamp goes on, press [RESET] button to go off the filter lamp, and then press [RESET] button again. 5) To stop the temporary operation, press the button again. 10. Temporary Pressing [RESET] button starts the temporary operaoperation tion of [AUTO] operation. When keeping [RESET] button pressed for 10 seconds or more, the temporary [COOL] operation is performed.


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