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You can read the recommendations in the user guide, the technical guide or the installation guide for TOSHIBA RAS-22SKV-E. You'll find the answers to all your questions on the TOSHIBA RAS-22SKV-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-22SKV-E
User guide TOSHIBA RAS-22SKV-E
Operating instructions TOSHIBA RAS-22SKV-E
Instructions for use TOSHIBA RAS-22SKV-E
Instruction manual TOSHIBA RAS-22SKV-E

TOSHIBA FILE NO. A07-008

SERVICE MANUAL

AIR-CONDITIONER
SPLIT TYPE

Indoor Unit
<High Wall, Heat Pump Type>
RAS-18SKV-E
RAS-22SKV-E
RAS-18SKVR-E
RAS-22SKVR-E

Outdoor Unit
<Heat Pump Type>
RAS-18SAV-E
RAS-22SAV-E

HFC
R410A

PRINTED IN JAPAN, Mar. 2008

The cover features a large, light gray background graphic of the number '3'. To the right of the text, there are three small illustrations: a ceiling-mounted indoor unit, a handheld remote control, and a wall-mounted outdoor unit.



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... 103 2 1. SAFETY PRECAUTIONS For general public use Power supply cord of outdoor unit shall be more than 1.5 mm ² (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.C.

board by hand. · 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 · 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 REGISTERS, 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 2. SPECIFICATIONS 2-1. Specifications

	RAS-18SKV-E	RAS-18SKVR-E	RAS-18SAV-E	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	H/M/L	H	H/M/L	H	Height	Width	Depth
	18	18	18																							
	1	1.1	1.1																							
	8	0.8	6.3	0.8	6.3	1	Ph / 50Hz / 220	240V	1	Ph / 60Hz / 220	230V	Cooling	Heating	Cooling	Heating	0										
	30	0.28	0.30	0.28	0.30	0.28	0.30	0.28	40	40	40	40	60	60	60	60	Cooling	Heating	Cooling	Heating	6.40	5.87	6			

98 6.40 6.40 5.87 6.98 6.40 1380 1520 1380 1520 98 99 98 99 7.



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28-6.68 7.28-6.68 3.

52 3.72 3.52 3.72 44 / 38 / 32 44 / 39 / 32 44 / 38 / 32 44 / 39 / 32 49 50 49 50 59 / 53 / 47 59 / 54 / 47 59 / 53 / 47 59 / 54 / 47 64 65 64 65 RAS-18SKV-E RAS-18SKVR-E 320 320 1050 1050 228 228 13 13 30 30 15.9 / 16.

5 15.7 / 16.2 RAS-18SAV-E RAS-18SAV-E 550 550 780 780 290 290 39 39 1100 1100 Twin rotary type with DC-inverter variable speed control
DA130A1F-27F DA130A1F-27F 43 43 31.9 / 31.9 31.

9 / 31.9 Flare connection Flare connection Ø6.35 Ø6.35 Ø12.70 Ø12.70 Ø6.35 Ø6.35 Ø12.70 Ø12.70 20 20 15 15 10 10 R410A R410A 1.

40 1.40 3 Wires: includes earth (Outdoor) 4 Wires: includes earth 21 ~ 32 / ~ 28 21 ~ 32 / ~ 28 10 ~ 46 / 15 ~ 24 10 ~ 46 / 15 ~ 24 1 1 1 2 2 1 1 2 2 2 -- 6 (Ø4 × 25L) 6 (Ø4 × 25L) 2 (Ø3.1L × 16L) -- 1 1 1 2 2 (Ø3.1L × 16L) 1 1 1 2 Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Indoor Electric characteristic Outdoor (A) (W) (%) (A) (W) (%) (A) (dB-A) (dB-A) (dB-A) (dB-A) (mm) (mm) (mm) (kg) (W) (m³/min) (mm) (mm) (mm) (kg) (W) COP Sound pressure level Sound power level Indoor Outdoor Indoor Outdoor Unit model Dimension Indoor unit Net weight Fan motor output Air flow rate (Cooling/Heating) Unit model Dimension Indoor unit Net weight Fan motor output Air flow rate (Cooling/Heating) Type Liquid side Indoor unit Gas side Piping Liquid side Outdoor unit connection Gas side Maximum length Maximum chargeless length Maximum height difference Name of refrigerant Refrigerant Weight Power supply Wiring connection Interconnection Indoor (Cooling/Heating) Usable temperature range Outdoor (Cooling/Heating) Installation plate Wireless remote controller Batteries Remote controller holder Super Oxi Deo filter Super Sterilizer filter Indoor unit Mounting screw Accessory Remote controller holder Pan head wood screw Plasma air purifier Installation manual Owner's manual Drain nipple Outdoor unit Water-proof rubber cap (W) (m³/min) (mm) (mm) (mm) (mm) (m) (m) (m) (kg) (°C) (°C) · The specifications may be subject to change without notice for purpose of improvement. 5 RAS--22SKV-E, RAS-22SKVR-E / RAS-22SAV-E 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 H/M/L H H/M/L H Height Width Depth RAS-22SKV-E RAS-22SKVR-E RAS-22SAV-E RAS-22SAV-E 6.0 6.0 1.2 6.7 1.2 6.7 7.0 7.0 1.0 7.5 1.

0 7.5 1 Ph / 50Hz / 220 240V, 1 Ph / 60Hz / 220 230V Cooling Heating Cooling Heating 0.38 0.35 0.38 0. 35 0.38 0.35 0.38 0.35 50 50 50 60 60 60 60 Cooling Heating Cooling Heating 8.93 8.19 9.18 8.42 8.93 8.

19 9.18 8.42 1945 2000 1945 2000 99 99 99 99 9.56-8.77 9.56-8.77 3.01 3.41 3.01 3.

41 47 / 41 / 35 47 / 42 / 35 47 / 41 / 35 47 / 42 / 35 52 51 52 51 62 / 56 / 50 62 / 57 / 50 62 / 56 / 50 62 / 57 / 50 67 66 67 66 RAS-22SKV-E RAS-22SKVR-E 320 320 1050 1050 228 228 13 13 30 30 18.0 / 18.3 17.7 / 18.0 RAS-22SAV-E RAS-22SAV-E 550 550 780 780 290 290 40 40 1100 1100 Twin rotary type with DC-inverter variable speed control DA150A1F-20F DA150A1F-20F 43 43 37.

2 / 33.7 37.2 / 33.7 Flare connection Flare connection Ø6.35 Ø6.

35 Ø12.70 Ø12.70 Ø6.35 Ø6.35 Ø12.70 Ø12.70 20 20 15 15 10 10 R410A R410A 1.40 1.40 3 Wires: includes earth (Outdoor) 4 Wires: includes earth 21 ~ 32 / ~ 28 21 ~ 32 / ~ 28 10 ~ 46 / 15 ~ 24 10 ~ 46 / 15 ~ 24 1 1 1 2 2 1 1 2 2 2 -- 6 (Ø4 × 25L) 6 (Ø4 × 25L) 2 (Ø3.1L × 16L) -- 1 1 1 2 2 (Ø3.

1L × 16L) 1 1 1 2 Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Indoor Electric characteristic Outdoor (A) (W) (%) (A) (W) (%) (A) (dB-A) (dB-A) (dB-A) (dB-A) (mm) (mm) (mm) (kg) (W) (m³/min) (mm) (mm) (mm) (kg) (W) COP Sound pressure level Sound power level Indoor Outdoor Indoor Outdoor Unit model Dimension Indoor unit Net weight Fan motor output Air flow rate (Cooling/Heating) Unit model Dimension Indoor unit Net weight Fan motor output Air flow rate (Cooling/Heating) Type Liquid side Indoor unit Gas side Liquid side Piping Outdoor unit connection Gas side Maximum length Maximum height difference Maximum height difference Name of refrigerant than R410A is mixed, pressure in the refrigeration cycle becomes abnormally high, and it may cause personal injury, etc. by a rupture. 2. Confirm the used refrigerant name, and use tools and materials exclusive for the refrigerant R410A. The refrigerant name R410A is indicated on the visible place of the outdoor unit of the air conditioner using R410A as refrigerant. To prevent mischarging, the diameter of the service port differs from that of R22. 3. If a refrigeration gas leakage occurs during installation/servicing Table 3-2-3 Dimensions related to flare processing for R410A Outer diameter (mm) 6.35 9.

52 12.70 15.88 A (mm) Thickness (mm) Flare tool for R410A clutch type 0.8 0.8 0.

8 1.0 0 to 0.5 0 to 0.5 0 to 0.5 0 to 0.

5 Conventional flare tool Clutch type 1.0 to 1.5 1.0 to 1.5 1.0 to 1.5 1.0 to 1.5 Wing nut type 1.5 to 2.

0 1.5 to 2.0 2.0 to 2.5 2.0 to 2.5 Nominal diameter 1/4 3/8 1/2 5/8 Table 3-2-4 Dimensions related to flare processing for R22 A (mm) Thickness (mm) Flare tool for R22 clutch type 0.8 0.8 0.8 1.

0 0 to 0.5 0 to 0.5 0 to 0.5 0 to 0.5 Conventional flare tool Clutch type 0.

5 to 1.0 0.5 to 1.0 0.5 to 1.

0 0.5 to 1.0 Wing nut type 1.0 to 1.5 1.0 to 1.5 1.5 to 2.0 1.5 to 2.

0 Nominal diameter Outer diameter (mm) 6.35 9.52 12.70 15.88 1/4 3/8 1/2 5/8 Table 3-2-5 Flare and flare nut dimensions for R410A Nominal diameter 1/4 3/8 1/2 5/8 Outer diameter (mm) 6.35 9.52 12.70 15.88 Thickness (mm) 0.8 0.

8 0.8 1.0 A 9.1 13.2 16.

0 19.0 Dimension (mm) B 9.2 13.5 16.6 19.

7 C 6.5 9.7 12.9 16.0 D 13 20 23 25 Flare nut width (mm) 17 22 26 29 10 Table 3-2-6 Flare and flare nut dimensions for R22 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 Thickness (mm) 0.

8 0.8 0.8 1.0 1.0 A 9.0 13.0 16.0 19.0 23.3 Dimension (mm) B 9.

2 13.5 16.2 19.7 24.0 C 6.

5 9.7 12.9 16.0 19.2 D 13 20 23 34 Flare nut width (mm) 17 22 24 27 36 45° to 4 6° 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.

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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 3-3. Tools 3-3-1. 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 Yes Yes Yes Yes Yes (Note 2) Whether conventional equipment can be used (Note 1) (Note 1) No No No No No No No No Conventional air-water heat pump installation Whether new equipment can be used with conventional refrigerant Yes (Note 1) No No Yes Yes No Yes No 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) 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. Electro-scope 12 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 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 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.



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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. 14 Refrigerant cylinder Electronic balance Siphon 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 RAS-18SKVR-E, RAS-22SKVR-E 1050 Front panel Air filter Air inlet Plasma air purifier 228 320 73.

5 7 50 Heat exchanger Air ionizer 50 Knock out system Knock out system 50 7 204 24 72 78 Installation plate hanger 132 568 200 150 56 Wireless remote controller 73.5 82 Installation plate hanger Connecting plate (0.39m) (For 18, 22 series; Flare Ø12.70mm) 132 235 215 85 Hanger Drain hose (0.5mm) 786 235 215 23 Connecting pipe (0.49m) (Flare Ø6.35mm) 132 Remote controller holder 320 40 Hanger 47 215.5 Center line 262.5 Hanger 262.5 153.

5 109 Installation plate outline 16 40 163 26 RAS-18SKV-E, RAS-22SKV-E 1050 Front panel Air filter Air inlet 228 73.5 320 7 50 Heat exchanger 50 Knock out system Knock out system 50 72 Installation plate hanger 132 568 200 78 150 56 Wireless remote controller 82 Installation plate hanger Connecting plate (0.39m) (For 18, 22 series; Flare Ø12.70mm) Drain hose (0.5mm) Remote controller holder Connecting pipe (0.49m) (Flare Ø6.35mm) 132 235 215 Hanger 85 786 235 215 132 23 320 40 Hanger 47 215.5 Center line 262.5 Hanger 262.5 153.

5 109 Installation plate outline 17 40 163 26 204 24 7 73.5 4-2. Outdoor Unit A leg part 600 90 Dia.11-14U-shape hole (For dia.8-10 anchor bolt) 306 Dia.

7 hole pitch 290 320 Anchor bolt long hole pitch 8-dia.7 hole (For fixing outdoor unit) B leg part 20 Dia.11 × 14 long hole (For dia.8-10 anchor bolt) 147 6 Dia.436 108 Packed valve cover 157 Fan guard 21 69.

5 21 483 257 145 79 Z 483 550 449 Connecting pipe port (Pipe dia.6.35) 22 5 54 Connecting pipe port (Pipe dia.12.7) 25 93 137 35 52 780 500 Drain long hole 71 Charging port 4-dia.4.5 embossment 31 342 143 8 32 88 Di 20 a.2 5 600 88 60 54 38 320 Drain hole 108 125 20 30 28 5 R1 hole 2-dia.7 Outside line 11 of product Detailed A leg part 11 2-dia.7 hole Outside line of product 320 R5 .

5 R5 .5 5 R1 38 54 600 Fin guard Detailed B leg part Z view 600 Intake 2-dia.11 × 14U-shape hole Intake D 50 or more 250 or more When installing the outdoor unit, leave open in at least two of directions (A), (B), (C) and (D) shown in the figure below. 320 100 or more C 200 or more B Outlet A Outside line of product (Minimum distance from wall) 2-dia.11 × 14 long hole Unit : mm Mounting dimensions of anchor bolt 18 5. WIRING DIAGRAM 5-1. Indoor Unit / Outdoor Unit RAS-18SKV-E, RAS-22SKV-E, RAS-18SKVR-E, RAS-22SKVR-E / RAS-18SAV-E, RAS-22SAV-E Compressor RED 11 WHI 22 BLK 33 P25 YEL P23 YEL P21 BRW P35 YEL P19 ORN Reactor 11 22 P18 P11 P08 DB01 Power Relay DB02 CT Q404 P33 PUR Reactor P32 P31 12 12 Relay CN701 123 P30 123 C12 C14 L01 Varistor Varistor Surge Absorber P07 BLK F01 Fuse 250V ~, T25A P03 P10 ORN BLK 33 CN601 2 2 11 P34 P20 L03 C13 P22 P24 P04 P05 P06 BLK 33 WHI 22 RED 11 6 5 4 3 2 1 CM Q200 ~ 205 IGBT R221 R220 R219 Q300 ~ 305 MOS-FET R321 R320 R319 FM Fan Motor CN300 6 5 4 CN700 3 2 1 PMV Pulse Motor Valve P C. Board . MCC-5009 + 33 CN603 2 2 11 (TS) Suction pipe Temp. Sensor (TO) Outdoor Temp.



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Sensor + + F03 Fuse 250V ~, T3.15A 22 CN602 1 1 (TD) Discharge pipe Temp. Sensor 22 CN600 1 1 (TE) P02 Condenser pipe Temp. Sensor WHI Fuse, T6.3A AC 250V Coil for 4-way Valve SKVR-E only Ion Electrode Air Purifier Electrode Micro SW Sheet Metal BRW BLU BLK Indoor Terminal Block BLK WHI 311 CN02 F01 Fuse T3.

15A AC 250V CN01 123LN Power Supply 220 240V~, 50Hz/220 220V~, 60Hz RED High-voltage Power Supply 4321 4321 1 2 3 4 1 2 3 4 RED BRW BRW BRW 1 2 3 4 1 2 3 4 123 Heat Exchanger GRN & YEL 21 21 CN42 (WHI) CN51 Heat Exchanger Sensor (TC) Thermo Sensor (TA) 1 1 CN62 2 2 (BLU) 1 1 CN61 2 2 (WHI) Varistor 11 22 33 44 55 66 77 88 99 10 10 11 11 CN10 (WHI) BLU BLU BLU BLU BLU BLU BLU BLU BLU BLU WHI 1 2 3 4 CN31 5 (WHI) 6 1 CN32 2 (WHI) 3 4 5 1 2 3 4 5 6 1 2 3 4 5 WHI YEL YEL YEL YEL 1 2 3 4 5 1 2 3 4 5 Fan Motor DC Motor 11 22 33 44 55 66 77 88 99 10 10 11 11 CN21 (WHI) Wireless Unit Assembly MCC-5044 Line Filter ~ + DC5V DC12V + Power Supply Circuit Louver Motor 1 2 CN22 3 (WHI) 4 Main P. C. Board. MCC-5045 ~ 19 6. SPECIFICATIONS OF ELECTRICAL PARTS 6-1. Indoor Unit No.

1 Fan motor (for indoor) Parts name 18SKV-E, 18SKVR-E 22SKV-E, 22SKVR-E Type ICF-340-30-2 (--) (--) MP24Z3T Specifications DC340V, 30W 10k at 25°C 10k at 25°C Output (Rated) 1W, 16 poles, DC12V 2 3 4 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 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 (6P) 18SAV-E 8 Compressor 22SAV-E 9 10 Coil for PMV Coil for 4-way valve DA150A1F-20F CAM-MD12TF-10 STF DC12V AC220240V Parts name Model name CH-57 ICF-140-43-4R (Inverter attached) (Inverter attached) (Inverter attached) (Inverter attached) ---- DA130A1F-27F 3-phases 4-poles 1100W L = 10mH, 16A DC140V, 43W 10k (25°C) 62k (20°C) 10k (25°C) 10k (25°C) 20A, AC250V Rating 20 7. REFRIGERANT CYCLE DIAGRAM 7-1.

Refrigerant Cycle Diagram RAS-18SKV-E / RAS-18SAV-E RAS-18SKVR-E / RAS-18SAV-E INDOOR UNIT Indoor heat exchanger TC Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port T1 Temp. measurement TA Allowable pipe length Allowable height difference: 10m NOTE: 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 Thickness : 0.8mm Strainer 4-way valve (STF-0108Z) Muffler Muffler TD Pulse Modulating valve at liquid side (CAM-B22YGTF-3) Accumulator tank Compressor DA130A1F-27F TS TO Outdoor heat exchanger Split capillary 2-dia. 1.2 x 80 TE Propeller fan Distributor Refrigerant amount: 1.40kg Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 20m. 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 RAS-22SKV-E / RAS-22SAV-E RAS-22SKVR-E / RAS-22SAV-E INDOOR UNIT Indoor heat exchanger T1 Temp. measurement Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port TA Allowable pipe length TC Allowable height difference: 10m Deoxidized copper pipe Outer dia. : 6.35mm Thickness : 0.8mm Sectional shape of heat insulator Max. : 20m Min. : 2m Chargeless : 20g/m (16 to 20m) Deoxidized copper pipe Outer dia. : 12.7mm Thickness : 0.8mm Strainer 4-way valve (STF-0213Z) Muffler Muffler TD Pulse Modulating valve at liquid side (CAM-B22YGTF-3) Accumulator tank Compressor DA150A1F-20F TS TO Outdoor heat exchanger Split capillary 4-dia. 2 x 66 Distributor Propeller fan TE OUTDOOR UNIT NOTE: Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) NOTE : · The maximum pipe length of this air conditioner is 15m. 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 7-2. Operation Data <Cooling> Temperature condition (°C) Indoor Outdoor 18SKV-E 18SKVR-E 27/19 35/ 22SKV-E 22SKVR-E 0.

9 to 1.1 0.9 to 1.1 11 to 13 11 to 13 41 to 43 41 to 43 High High High High 77 77 Model name RASStandard pressure P (MPa) 0.9 to 1.1 0.9 to 1.1 Heat exchanger pipe temp. T1 (°C) 11 to 13 11 to 13 T2 (°C) 40 to 42 40 to 42 High High High High Indoor fan mode Outdoor fan mode Compressor revolution (rps) 67 67 <Heating> Temperature condition (°C) Indoor Outdoor 18SKV-E 18SKVR-E 20/ 7/6 22SKV-E 22SKVR-E 2.6 to 2.8 2.6 to 2.8 42 to 44 42 to 44 0 to 2 0 to 2 High High High High 84 84 Model name RASStandard pressure P (MPa) 2.5 to 2.6 2.5 to 2.6 Heat exchanger pipe temp. T1 (°C) 40 to 42 40 to 42 T2 (°C) 1 to 3 1 to 3 High High High High Indoor fan mode Outdoor fan mode Compressor revolution (rps) 79 79 NOTES : 1. Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent. (Thermistor thermometer) 2.

Connecting piping condition : 7.5 m 23 8. CONTROL BLOCK DIAGRAM 8-1. Indoor Unit RAS-18SKV-E, RAS-22SKV-E M.C.U. Heat Exchanger Sensor (Tc) Room Temperature Sensor (Ta) Infrared Rays Signal Receiver and Indication Functions · Cold draft preventing Function · 3-minute Delay at Restart for Compressor · Fan Motor Starting Control · Processing (Temperature Processing) · Timer Clock Frequency Oscillator Circuit · Serial Signal Communication · Clean Function Power Supply Circuit Indoor Fan Motor Louver Motor Drive Control Indoor Unit Control Unit Louver Motor Initializing Circuit Indoor Fan Motor Control Converter (D.C circuit) Noise Filter Serial Signal Transmitter/Receiver From Outdoor Unit 220-240V ~50Hz 220-230V ~60Hz Serial Signal Communication (Operation Command and Information) REMOTE CONTROLLER Remote Controller Operation (START/STOP) Infrared Rays, 36.7kHz Operation Mode Selection AUTO, COOL, DRY, HEAT, FAN Thermo. Setting Fan Speed Selection ON TIMER Setting OFF TIMER Setting Louver AUTO Swing Louver Direction Setting ECO Hi-POWER COMFORT SLEEP QUIET QUIET SLEEP (1, 3, 5, 9 OFF TIMER) 24 RAS-18SKVR-E, RAS-22SKVR-E M.

C.U. Heat Exchanger Sensor (Tc) Room Temperature Sensor (Ta) Infrared Rays Signal Receiver and Indication Functions · Cold draft preventing Function · 3-minute Delay at Restart for Compressor · Fan Motor Starting Control · Processing (Temperature Processing) · Timer Clock Frequency Oscillator Circuit · Serial Signal Communication · Clean Function Indoor Unit Control Unit Louver Motor Drive Control Louver Motor Indoor Fan Motor Control Initializing Circuit Indoor Fan Motor Air purifier unit Power Supply Circuit Micro Switch Converter (D.



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C circuit) Noise Filter Serial Signal Transmitter/Receiver From Outdoor Unit 220-240V ~50Hz 220-230V ~60Hz Serial Signal Communication (Operation Command and Information) REMOTE CONTROLLER Remote Controller Operation (START/STOP) Infrared Rays, 36.7kHz Operation Mode Selection AUTO, COOL, DRY, HEAT, FAN Thermo. Setting Fan Speed Selection ON TIMER Setting OFF TIMER Setting Lower AUTO Swing Louver Direction Setting ECO Hi-POWER COMFORT SLEEP QUIET QUIET SLEEP (1, 3, 5, 9 OFF TIMER) PURE (Air purifier) 25 For INDOOR UNIT MICRO-COMPUTER BLOCK DIAGRAM 220240 V ~50Hz 220- 230 V ~60Hz MCC5009 (P.C.B) Current detect OUTDOOR UNIT Indoor unit send/receive circuit M.C.U.

8-2. Outdoor Unit (Inverter Assembly) Discharge temp. sensor Gate drive circuit Outdoor air temp. sensor Current detect 26 Gate drive circuit High Power factor Correction circuit Clock frequency 4MHz Input current sensor Converter (AC DC) Relay circuit Inverter (DC AC) Driver circuit of PMV PMV 4-way valve 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 PMV control Discharge temp. control 4-way valve control Signal communication to indoor unit Inverter (DC AC) Outdoor Fan motor Noise Filter Compressor PMV : Pulse Motor Valve M.C.U. : Micro Control Unit 9.

OPERATION DESCRIPTION 9-1. Outline of Air Conditioner Control This air conditioner is a capacity-variable type air conditioner, which uses DC motor for the indoor fan motor and the outdoor fan motor. And the capacityproportional control compressor which can change the motor speed in the range from 11 to 120 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 motor valve. (PMV) 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 Operations followed to judgment · Operation control of outdoor fan motor of serial signal from indoor side.

· PMV control · 4-way valve control 27 9-2. Operation Description 9-2. 1. Basic operation

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29 I. Operation control

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29 2. Cooling/Heating operation

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DRY operation

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Indoor fan motor control

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Outdoor fan motor control

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..... 34 5. Current release control .

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..... 34 6.

Release protective control by temperature of indoor heat exchanger

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Defrost control (Only in heating operation)

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36 8. Louver control

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..... 37 1) Louver position

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... 37 2) Air direction adjustment .



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.. 37 3) Swing ...

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ECO operation

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... 38 10. Temporary operation

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... 39 11. Air purifying control .

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..... 39 Air purifying control [Detection of abnormality]

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.... 40 12. Pulse motor valve (PMV) control

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41 13. Self-Cleaning function

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.. 42 14. Remote Controller-A or B selection

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..... 43 15.
QUIET mode

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. 44 16. *COMFORT SLEEP*

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... 44 17. *Short Timer* .

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..... 44 18. *One Touch Comfort* ..

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..... 45 19.
Hi POWER Mode

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..... 45 20. *FILTER Indicator*

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45 9-3. Auto Restart Function

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..... 46 9-3-1. *How to Set the Auto Restart Function*

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... 46 9-3-2. How to Cancel the Auto Restart Function

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..... 47 9-3-3. Power Failure during Timer Operation ...

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47 9-4. Remote Controller

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..... 48 9-4-1. Remote Controller and Its Functions

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..... 48 9-4-2. Operation of Remote Controller

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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 motor valve. 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 · ON timer setup · QUIET · OFF timer setup · PRESET · Hi-POWER · ONE-TOUCH 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 Motor valve (PMV) 29 Item 1. Basic operation Operation flow and applicable data, etc. Description 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 from 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 "8. Louver control", respectively.

3) The outdoor unit controls the outdoor fan motor, compressor, pulse motor valve and 4-way valve according to the operation signal sent from the indoor unit. Operation ON Indoor unit control Setup of remote controller Indoor fan motor control / Louver control / Operation Hz Control (Requirement) 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 Motor 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 DRY operation is performed according to the difference between room temperature and the setup temperature as shown below. In DRY operation, fan speed is controlled in order to prevent lowering of the room temperature and to avoid air flow from blowing directly to persons. [C] Ta +1.

0 +0.5 L (W5) (W5+W3) / 2 SL (W3) 1) Detects the room temperature (Ta) when the DRY operation started. 2) Starts operation under conditions in the left figure according to the temperature difference between the room temperature and the setup temperature (Tsc). Setup temperature (Tsc) = Set temperature on remote controller (Ts) + (0.0 to 1.0) 3) When the room temperature is lower 1°C or less than the setup temperature, turn off the compressor. Tsc Fan speed 30 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 Symbols UH: Ultra High H : High M+: Medium+ M : Medium L+ : Low+ L : Low L- : Low UL : Ultra Low SUL : Super Ultra Low * 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.



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2 and Table 1 according to the setup temperature, room temperature, and heat exchanger temperature. 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) (Table 1) Indoor fan air flow rate Fan speed level WF WE WD WC WB WA W9 W8 W7 W6 W5 W4 W3 W2 W1 L+ L L UL SUL SUL UL M L+ L L L+ L L UL SUL H M+ M RAS-18SKV-E COOL HEAT UH H M+ DRY RAS-18SKVR-E RAS-22SKV-E RAS-22SKVR-E Fan speed Air flow rate Fan speed Air flow rate Fan speed Air flow rate Fan speed Air flow rate (rpm) (m 3/h) (rpm) (m3/h) (rpm) (m3/h) (rpm) (m3/h) 1100 1100 1090 1070 980 940 890 780 750 740 700 700 650 500 500 991 991 980 957 858 813 758 636 603 591 547 547 492 325 325 1100 1100 1090 1070 980 940 890 780 750 740 700 700 650 500 500 972 972 962 940 843 799 745 626 594 583 540 540 486 324 324 1200 1200 1200 1180 1080 1020 980 850 810 800 760 700 650 500 500 1101 1101 1101 1079 968 902 858 713 669 658 614 547 492 325 325 1200 1200 1200 1180 1080 1020 980 850 810 800 760 700 650 500 500 1080 1080 1080 1059 951 886 843 702 659 648 605 540 485 324 324 31 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) Indication L L+ AUTO M M+ H TC 42°C NO YES Min air flow rate control Fan speed W8 (L + M) / 2 WA (M + H) / 2 WE Tc 52 51 42 41 Limited to Min WD tap No limit * * Fan speed = (TC (42 + a)) / 10 x (WD W8) + W8 (Fig. 4) Basic fan control TA [°C] Cold draft preventive control 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: *2: ÷ * 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. 5) [In starting and in stability] In starting FAN AUTO · Until 12 minutes passed after operation start · When 12 to 25 minutes passed after operation start and room temp. is 3°C or lower than set temp. (Fig. 6) In stability · When 12 to 25 minutes passed after operation start and room temp. is higher than (set temp. 3°C) · When 25 minutes or more passed after operation start · Room temp. Set temp. 3.5°C FAN Manual · Room temp. < Set temp. 4°C 32 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 < 22.1 < 50.3 50.3 < Compressor speed (rps) MIN MAX MIN MAX MIN MAX To > 38 f6 f9 f8 fB fA fE To > 28 f5 f9 f7 fB f9 fE To > 15 f3 f7 f5 f9 f7 fB To To > 5 f1 f3 f1 f7 f3 f9 To > 0.5 f1 f3 f1 f5 f3 f7 To > 0.5 f0 f1 f0 f3 f1 f4 To > 38 f6 f9 f8 fB fA fB To > 28 f5 f9 f7 fB f9 fB During ECO, To > 15 f3 f7 f5 f9 f7 fB QUIET and To > 5 f1 f3 f1 f7 f3 f9 comfort sleep To > 0.5 f1 f3 f1 f5 f3 f7 To > 0.5 f0 f1 f0 f3 f1 f4 When To is abnormal f1 fF f1 fF f1 fF In Heating operation Compressor speed (rps) < 30.5 < 55.
 1 To > 10°C f6 f8 To > 25°C f8 fA To To > 5.5°C fA fB To > 5.5°C fA fB To > 10°C f5 f7 During To > 5°C f7 f9 ECO mode To > 5.5°C f9 fA To > 5.5°C f9 fA When To is abnormal fD fD 55.1 < f9 fC fD fD f9 fB fB fD Outdoor fan speed (rpm) Tap f0 f1 f2 f3 f4 f5 f6 f7 18SAV-E 0 230 300 350 410 480 500 530 22SAV-E 0 230 300 350 410 480 500 530 Tap f8 f9 fA fB fC fD fE fF 18SAV-E 560 640 670 700 800 800 800 22SAV-E 560 640 670 750 840 840 920 920 33 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.



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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 This function prevents troubles on the electronic parts of the release 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 Capacity control continues. High Reduce compressor speed Current decrease 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 18SAV-E 22SAV-E 7.05A 9.30A 10.50A Heating current release value 18SAV-E 22SAV-E 45°C 40°C 16°C 11°C 07A 44°C 39°C 15.5°C 10.5°C 7.12A 8.47A 8.77A 10.88A 34 Item 6. Release protective control by temperature of indoor heat exchanger Operation flow and applicable data, etc. <In cooling/dry operation> (Prevent-freezing control for indoor heat exchanger) In cooling/dry operation, the sensor of indoor heat exchanger detects evaporation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value.

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) 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. 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) 35 Item 7.

Defrost control (Only in heating operation) Operation flow and applicable data, etc. (This function removes frost adhered to the outdoor heat exchanger.) 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. 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. Start of heating operation Outdoor heat exchanger temperature 0' 10' 15' 29' 35' Operation time (Minute) 3°C C zone 7°C A zone 26°C B zone * Te0 detection time * 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. 36 Item 8. Louver control 1) Louver position Operation flow and applicable data, etc. Description This function controls the air direction of the indoor unit. The position is automatically controlled according to the operation 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 horizontal angle is 0°. 1) Louver position in cooling operation Cooling operation/AUTO (COOL) Initial setting of "Cooling storage position" Louver : Horizontal blowing (37.4°) 2) Louver position in heating operation Heating operation/AUTO (HEAT) Initial setting of "Heating storage position" Louver : Directs downward (76.

9°) 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 pushing [FIX] button.

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