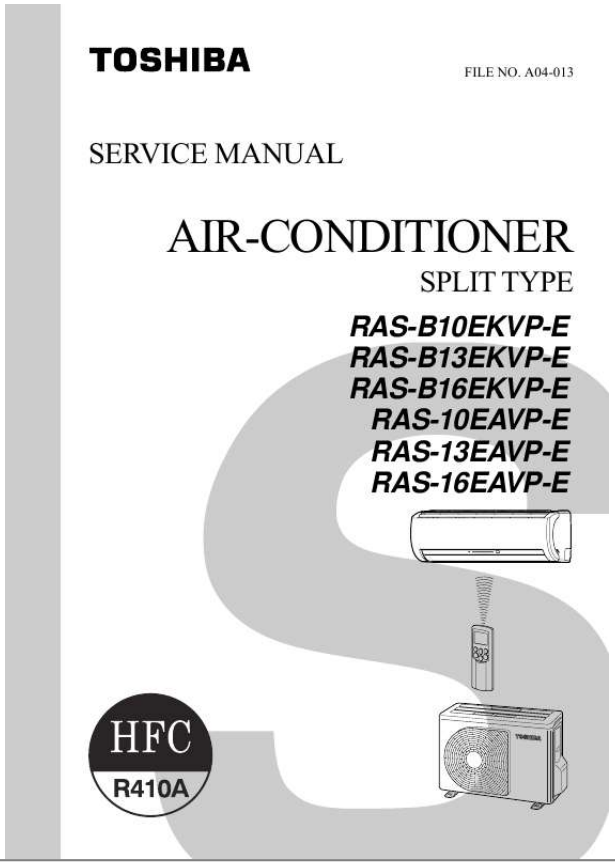

Manual abstract:

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OPERATION DESCRIPTION .....

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..... Appendix-1 2 1. SAFETY PRECAUTIONS For general public use Power supply cord of outdoor unit shall be more than 1.5 mm2 (H07RN-F or 245IEC66) 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. The installation fuse (25A D type) must be used for the power supply line of this air conditioner. 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. · 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. 3 WARNING · Never modify this unit by removing any of the safety guards or by-pass 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 anti freeze heater locally for a safety installation of the air conditioner. For details, contact the dealer. 4 2. SPECIFICATIONS 2-1. Specifications RAS-B10EKVP-E/RAS-10EAVP-E, RAS-B13EKVP-E/RAS-13EAVP-E, RAS-B16EKVP-E/RAS-16EAVP-E Unit m odel Indoor O utdoor Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Indoor O peration m ode Running current Power consum ption Electric characteristics Power factor O utdoor O peration m ode Running current Power consum ption Power factor Star ting current CO P Indoor O perating noise O utdoor Unit m odel Dim ension Indoor unit Net weight Fan m otor output Air flow rate Unit m odel Dim ension Height W idth Depth O utdoor unit Net weight Com pressor M otor output Type M odel Fan m otor output Air flow rate Piping Type connection Indoor unit O utdoor unit (Cooling/Heating) Liquid side G as side Liquid side G as side M axim um length M axim um chargeless length M axim um height difference Refrigerant Nam e of refrigerant W eight W iring Power supply connection Interconnection Usable tem perature range Indoor (Cooling/Heating) (°C) (°C) 2132/028 543/-1524 1 1 2 1 1 6 (Ø 4 x 25L) 2 (Ø 3.

1 x 16L) 1 1 1 1 2 O utdoor (Cooling/Heating) Installation plate W ireless rem ote controller Batteries Rem ote controller holder Zeolite-plus filter Indoor unit Accessory M ounting screw Rem ote controller holder m ounting screw Plasm a P ure filter Installation m anual O wner's m anual O utdoor unit Drain nipple Water-proof rubber cap (kg) (m) (m) (m) (W) (m ³/h) 43 2150/2150 Flare connection Ø 6.35 Ø 9.52 Ø 6.

35 Ø 9.52 25 15 10 R410A 0.82 (m m) (m m) (m m) (kg) (W) (Cooling/Heating) Height W idth Depth (m m) (m m) (m m) (kg) (W) (m ³/h) High Low (Cooling/Heating) (Cooling/Heating) (Cooling/Heating) (Cooling/Heating) (dB ·A) (dB ·A) (dB ·A) (dB ·A) M edium (Cooling/Heating) (A) (W) (%) (A) (A) (W) (%) Coo ling 0.15 30 87 Coo ling 520 95 4.55/4.

51 42/43 33/34 27/27 46/47 RAS-B10E KVP -E 250 790 215 9 30 550/610 RAS-10EAV P-E 550 780 290 35 750 DA111A1F-20F1 Heating 0.15 30 87 Heating 680 95 (kW) (kW) (kW) (kW) RAS-B10E KVP -E RAS-10EAV P-E 2.5 0.53.5 3.2 0.65.8 Coo ling 0.15 30 87 Coo ling 890 95 3.80/4.

31 43/44 34/35 27/27 48/50 RAS-B13E KVP -E 250 790 215 9 30 560/640 RAS-13EAV P-E 550 780 290 37 750 Twin rotary type with DC-inverter variable speed control DA111A1F-20F1 43 2410/2410 Flare connection Ø 6.35 Ø 9.52 Ø 6.35 Ø 9.52 25 15 10 R410A 0.96 3 W ires : includes ear th (O utdoor) 4 W ires : includes ear th 2132/028 543/1524 1 1 2 1 1 6 (Ø 4 x 25L) 2 (Ø 3.1 x 16L) 1 1 1 1 2 2132/028 543/1524 1 1 2 1 1 6 (Ø 4 x 25L) 2 (Ø 3.1 x 16L) 1 1 1 1 2 DA111A1F-20F1 43 2410/2410 Flare connection Ø 6.35 Ø 12.7 Ø 6.

35 Ø 12.7 25 15 10 R410A 0.96 RAS-B13E KVP -E RAS-13EAV P-E 3.5 0.64.

5 4.2 0.66.6 1Ph/50Hz/220240 V, 1Ph/60Hz/220 V Heating 0.15 30 87 Heating 945 95 Coo ling 0.

15 30 87 Coo ling 6.45/6.17/5.90 1350 95 7.22/6.91/6.62 3.26/3.64 45/45 36/36 29/29 49/50 RAS-B16E KVP-E 250 790 215 9 30 640/660 RAS-16EAVP -E 550 780 290 37 750 Heating 0.15 30 87 Heating 7.

07/6.76/6.47 1480 95 RAS-B16E KVP-E RAS-16EAV P-E 4.5 0.8-5.0 5.5 0.8-7.8 2.48/2.

37/2.26 3.25/3.10/2.96 4.

25/4.06/3.89 4.52/4.31/4.

13 3.40/3.25/3.11 4.67/4.46/4.28 · The specifications may be subject to change without notice for purpose of improvement. 5 2-2. Operation Characteristic Curve <Cooling> 10 9 8 7 6 5 <Heating> 10 9 8 RAS-B10EKVP-E RAS-B13EKVP-E RAS-B16EKVP-E 7 6 5 RAS-B10EKVP-E RAS-B13EKVP-E RAS-B16EKVP-E Current (A) 4 3 2 1 0 Current (A) · Conditions Indoor : DB 27°C/WB 19°C Outdoor : DB 35°C Air flow : High Pipe length : 7.5m Voltage : 230V 0 20 40 60 80 100 120 140 4 3 2 1 0 · Conditions Indoor : DB 20°C Outdoor : DB 7°C/WB 6°C Air flow : High Pipe length : 7.

*5m Voltage : 230V 0 20 40 60 80 100 120 140 Compressor speed (rps) Compressor speed (rps) 2-3. Capacity Variation Ratio According to Temperature <Cooling> 110 <Heating> 120 100 100 Capacity ratio (%) 80 RAS-B10EKVP-E RAS-B13EKVP-E RAS-B16EKVP-E Capacity ratio (%) 90 80 RAS-B10EKVP-E RAS-B13EKVP-E RAS-B16EKVP-E 60 70 40 60 · Conditions Indoor : DB27°C/WB19°C Indoor air flow : High Pipe length : 7.5m 20 · Conditions Indoor : DB 20°C Indoor air flow : High Pipe length : 7.5m 10 5 0 5 10 50 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 Outdoor temp. (°C) 0 15 Outdoor temp. (°C) * Capacity ratio : * Capacity ratio : * Capacity ratio : 100% = 2.5 kW (RAS-B10EKVP-E) 100% = 3.5 kW (RAS-B13EKVP-E) 100% = 4.5 kW (RAS-B16EKVP-E) 6 3. REFRIGERANT R410A This air conditioner adopts the new refrigerant HFC (R410A) which does not damage the ozone layer. The working pressure of the new refrigerant R410A is 1.6 times higher than conventional refrigerant (R22). The refrigerating oil is also changed in accordance with change of refrigerant, so be careful that water, dust, a2.70 15.88 R410A 0.*

80 0.80 0.80 1.00 R22 0.80 0.

80 0.80 1.00 (2) Joints For copper pipes, flare joints or socket joints are used. Prior to use, be sure to remove all contaminants. a) Flare Joints Flare joints used to connect the copper pipes cannot be used for pipings whose outer diameter exceeds 20 mm. In such a case, socket joints can be used. Sizes of flare pipe ends, flare joint ends and flare nuts are as shown in Tables 3-2-3 to 3-26 below. b) Socket Joints Socket joints are such that they are brazed for connections, and used mainly for thick pipings whose diameter is larger than 20 mm. Thicknesses of socket joints are as shown in Table 3-2-2. Table 3-2-2 Minimum thicknesses of socket joints Nominal diameter 1/4 3/8 1/2 5/8 Reference outer diameter of copper pipe jointed (mm) 6.

35 9.52 12.70 15.88 Minimum joint thickness (mm) 0.50 0.60 0.70 0.80 3-2-2. Processing of Piping Materials When performing the refrigerant piping installation, care should be taken to ensure that water or dust does not enter the pipe interior, that no other oil other than lubricating oils used in the installed air conditioner is used, and that refrigerant does not leak. When using lubricating oils in the piping processing, use such lubricating oils whose water content has been removed.

When stored, be sure to seal the container with an airtight cap or any other cover. (1) Flare Processing Procedures and Precautions a) Cutting the Pipe By means of a pipe cutter, slowly cut the pipe so that it is not deformed. b) Removing Burrs and Chips If the flared section has chips or burrs, refrigerant leakage may occur. Carefully remove all burrs and clean the cut surface before installation. c) Insertion of Flare Nut 8 d) Flare Processing Make certain that a clamp bar and copper pipe have been cleaned.

By means of the clamp bar, perform the flare processing correctly. Use either a flare tool for R410A or conventional flare tool. Flare processing dimensions differ according to the type of flare tool. When using a conventional flare tool, be sure to secure "dimension A" by using a gauge for size adjustment. ØD A Fig.

3-2-1 Flare processing dimensions 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 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 0.

8 0.8 0.8 1.0 Table 3-2-4 Dimensions related to flare processing for R22 Outer diameter (mm) 6.35 9.

52 12.70 15.88 A (mm) Thickness (mm) Flare tool for R410A clutch type 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 1/4 3/8 1/2 5/8 0.8 0.8 0.

8 1.0 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 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 9 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 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 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. 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) 10 3-3. Tools 3-3-1. Required Tools The service port diameter of packed valve of the outdoor unit in the air conditioner 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 conditioner installation No. Used tool Usage Whether Existence of conventional new equipment equipment for R410A can be used Yes Yes Conventional air conditioner installation Whether new equipment can be used with conventional refrigerant 1 2 Flare tool Pipe flaring *(Note 1) *(Note 1) X X X X X X X ! Copper pipe gauge for Flaring by adjusting projection conventional flare margin tool Torque wrench (For Ø12.7) Gauge manifold Charge hose Connection of flare nut Evacuating, refrigerant charge, run check, etc. *(Note 1) X X 3 4 5 6 7 8 9 10 Yes Yes Yes Yes Yes Yes (Note 2) Vacuum pump adapter Vacuum evacuating Electronic balance for refrigerant charging Refrigerant cylinder Leakage detector Charging cylinder Refrigerant charge Refrigerant charge Gas leakage check Refrigerant charge ! ! X ! X (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) Reamer (5) (6) (7) (8) (9) Pipe bender Level vial Screwdriver (+,) Spanner or Monkey wrench 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 11 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) (Liquid side) (OUTDOOR unit) Opened (Gas side) Refrigerant cylinder (With siphon pipe) Check valve Closed Open/Close valve for charging Service port Electronic balance for refrigerant charging Fig. 3-4-1 Configuration of refrigerant charging 12 (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. 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. 13 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 (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. Stop valve Nitrogen gas cylinder From Nitrogen cylinder Pipe Nitrogen gas Rubber plug Fig.
3-5-1 Prevention of oxidation during brazing 14 4. CONSTRUCTION VIEWS 4-1. Indoor Unit RAS-B10EKVP-E RAS-B13EKVP-E RAS-B16EKVP-E Parts name of remote control WH-H03JE 15 4-2. Outdoor Unit RAS-10EAVP-E, RAS-13EAVP-E, RAS-16EAVP-E 16 5. WIRING DIAGRAM 5-1. Outdoor Unit RAS-10EAVP-E, RAS-13EAVP-E, RAS-16EAVP-E Color Identification RED : RED WHI : WHITE BLK : BLACK BLU : BLUE BRW : BROWN ORN : ORANGE PUR : PURPUL YEL : YELLOW GRY : GRAY PNK : PINK GRN& GREEN& YEL : YELLOW 5-2. Indoor Unit RAS-B10EKVP-E, RAS-B13EKVP-E, RAS-B16EKVP-E BLK BLK 1234 1234 RED BRW BRW BRW 1 2 3 4 5 6 1 2 3 4 5 6 High-voltage Power supply Air purifier Electrode INDOOR TERMINAL 1 2 3 BLOCK Heat exchanger GRN & YEL CN21 CN34 2 2 (RED) CN10 (WHI) 1234 1234 CN01 (BLU) BLK 11 BLK CN33 (WHI) FUSE F01 AC 250V Ion electrode CN22 BLK WHI RED 3 1 11 BRW Micro SW BLU FAN MOTOR RED BLK CN23 22 HEAT EXCHANGER SENSOR (TC) CN03 (WHI) BLK 11 BLK T3.15A 11 3 4 5 6 LINE FILTER DC5V DB01 DC12V TNR 22 THERMO SENSOR (TA) CN100 (WHI) CN13 (WHI) 11 22 33 44 55 66 77 88 99 MCC-899 10 10 POWER SUPPLY CIRCUIT BLU BLU BLU BLU BLU BLU BLU BLU WHI Wireless Unit Assembly 3 WHI 4 YEL 5 BLU 6 DC MOTOR 9 8 7 6 5 4 3 2 1 9 8 7 6 5 4 3 2 MAIN P.C. BOARD 1 (MCC-5020) CN07 (WHI) 1 2 3 4 5 1 2 3 4 5 WHI YEL YEL YEL YEL 1 2 3 4 5 1 2 3 4 5 CN08 (WHI) LOUVER MOTOR 1234 17 6.

SPECIFICATIONS OF ELECTRICAL PARTS 6-1. Indoor Unit RAS-B10EKVP-E, RAS-B13EKVP-E, RAS-B16EKVP-E No. 1 2 Parts name Fan motor (for indoor) Room temp. sensor (TA-sensor) Heat exchanger temp. sensor (TC-sensor) Louver motor Type MF-280-30-5 () Specifications DC280340V, 30W 10k at 25°C 3 4 () MP24GA 10k at 25°C Output (Rated) 1W, 16poles, 1phase DC12V 6-2. Outdoor Unit RAS-10EAVP-E, RAS-13EAVP-E, RAS-16EAVP-E No. 1 2 3 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) Compressor Coil for PMV Coil for 4-way valve Parts name Model name CH-57 ICF-140-43-4 (Inverter attached) L=10mH, 16A x 2 DC140V, 43W 10k (25°C) Rating 4 (Inverter attached) 62k (20°C) 5 (Inverter attached) 10k (25°C) 6 7 8 9 10 (Inverter attached) ---- DA111A1F-20F1 CAM-MD12TF VHV 10k (25°C) 20A, AC250V 3-phases 4-poles 750W DC12V AC220-240V 18 7.

REFRIGERANT CYCLE DIAGRAM 7-1. Refrigerant Cycle Diagram RAS-B10EKVP-E/RAS-10EAVP-E INDOOR UNIT Indoor heat exchanger T1 Temp. measurement TC Cross flow fan P Pressure measurement TA Allowable pipe length Allowable height difference : 10m Strainer Strainer NOTE : Gauge attaching port Vacuum pump connecting port Deoxidized copper pipe Outer dia. : 9.
52mm Thickness : 0.8mm Deoxidized copper pipe Outer dia. : 6.35mm Thickness : 0.8mm Sectional shape of heat insulator Max.
: 25m Chargeless : 15m Charge : 20g/m (16 to 25m) Muffler 4-way valve (STF-0108Z) Muffler TD Pulse motor valve at liquid side (CAM-B22YGTF-2) Compressor DA111A1F-20F1 TS TO Outdoor heat exchanger Temp. measurement T2 Propeller fan TE Refrigerant amount : 0.82kg Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 25 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. 200g) 19 RAS-B13EKVP-E/RAS-13EAVP-E RAS-B16EKVP-E/RAS-16EAVP-E T1 INDOOR UNIT Indoor heat exchanger Temp. measurement TC Cross flow fan P Pressure measurement TA Allowable pipe length Allowable height difference : 10m Strainer NOTE : Gauge attaching port Vacuum pump connecting port Deoxidized copper pipe Outer dia. : 9.52mm(13), 12.7mm(16) Thickness : 0.

8mm Deoxidized copper pipe Outer dia. : 6.35mm Thickness : 0.8mm Sectional shape of heat insulator Max. : 25m Chargeless : 15m Charge : 20g/m (16 to 25m) Muffler 4-way valve (STF-0108Z) Muffler TD Pulse motor valve at liquid side (CAM-B22YGTF-2) 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 : 0.96kg Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 25 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. 200g) 20 7-2. Operation Data <Cooling> Temperature condition (°C) Indoor Outdoor Model name RASB10EKVP-E 27/19 35/ B13EKVP-E B16EKVP-E Standard pressure P (MPa) 0.9 to 1.1 0.
8 to 1.0 0.7 to 0.9 Heat exchanger pipe temp. T1 (°C) 13 to 15 11 to 14 8 to 11 T2 (°C) 42 to 44 42 to 45 43 to 47 High High High High High High Indoor fan mode Outdoor fan mode Compressor revolution (rps) 37 59 82 <Heating> Temperature condition (°C) Indoor Outdoor Model name RASB10EKVP-E 20/ 7/6 B13EKVP-E B16EKVP-E Standard pressure P (MPa) 2.
2 to 2.4 2.5 to 2.7 2.8 to 3.0 Heat exchanger pipe temp. T1 (°C) 37 to 39 42 to 45 48 to 49 T2 (°C) 0 to 3 0 to 2 0 to 2 High High High High High High Compressor revolution (rps) 54 65 86 Indoor fan mode Outdoor fan mode NOTES : (1) Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent. (Thermistor themometer) (2) Connecting piping condition : 7.5 m 21 8. CONTROL BLOCK DIAGRAM 8-1.

Indoor Unit RAS-B10EKVP-E, RAS-B13EKVP-E, RAS-B16EKVP-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 Air purifier unit 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) Micro Switch Noise Filter Serial Signal Transmitter/Receiver From Outdoor Unit 220-240V/50Hz 220V/60Hz Serial Signal Communication (Operation Command and Information) Remote Controller Infrared Rays, 36.7kHz REMOTE CONTROLLER Operation (START/STOP) 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 Air Purifier SLEEP 22 For INDOOR UNIT MICRO-COMPUTER BLOCK DIAGRAM 220240 V ~ 50Hz 220 V ~ 60Hz 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 RAS-10EAVP-E, RAS-13EAVP-E, RAS-16EKVP-E Outdoor air temp. sensor Current detect 23 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 P.M.V. 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 13 to 115 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. (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 four-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 control · 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. (4) Contents of operation command signal (Serial · Judgment of suction air temperature of the signal) from outdoor unit controller to indoor unit indoor heat exchanger by using the indoor controller temp. sensor. (TA sensor) The following signals are sent from the outdoor · Judgment of the indoor heat exchanger unit controller.

temperature by using heat exchanger sensor (TC sensor) (Prevent-freezing control, etc.) · The current operation mode · Louver motor control · The current compressor revolution · Indoor fan motor operation control · Outdoor temperature · LED (Light Emitting Diode) display control · Existence of protective circuit operation · Transferring of operation command signal For transferring of these signals, the indoor (Serial signal) to the outdoor unit unit controller monitors the contents of signals, · Reception of information of operation status and judges existence of trouble occurrence. (Serial signal including outside temp. data) to Contents of judgment are described below. the outdoor unit and judgment/display of error · Whether distinction of the current operation · Air purifier operation control status meets to the operation command signal (2) Role of outdoor unit controller · Whether protective circuit operates Receiving the operation command signal (Serial When no signal is received from the outdoor signal) from the indoor unit controller, the outunit controller, it is assumed as a trouble. door unit performs its role. · Compressor operation control · Operation control of outdoor Operations followed to fan motor judgment of serial signal · P.M.V. control from indoor side.

· 4-way valve control 24 9-2. Operation Description No. 9-2 1 1) 2) 3) 4) Contents Page Basic operation .....

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..47 25 Item 1. Basic operation Operation flow and applicable data, etc. 1) Operation control Receiving the user's operation condition setup, the operation statuses of indoor/outdoor units are controlled.
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 · ON timer setup · OFF timer setup · High power Description 1) The operation conditions are selected by the remote controller as shown in the left. 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 left. 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. 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 · Clean function · 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) 2) Cooling/Heating operation The operations are performed in the following parts by controls according to cooling/heating conditions.

*Operation ON Setup of remote controller Indoor unit control Indoor fan motor control Louver control Sending of operation command signal Compressor revolution control Outdoor fan motor control 4-way valve control [In cooling operation: ON In heating operation: OFF Pulse motor valve control Outdoor unit control] 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 motor valve and 4-way valve according to the operation signal sent from the indoor unit. *1. The power coupler of 4-way valve is usually turned on, and it is turned off during defrost operation. (Only in heating) 26 Item 1.*

*Basic operation Operation flow and applicable data, etc. 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. Description 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. Ta Cooling operation Ts + 1 Monitoring (Fan) Ts 1 Heating operation *1. When reselecting the operation mode, the fan speed is controlled by the previous 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 L (W5) 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. +1.0 +0.5 (W5+W3) / 2 SL (W3) Tsc Fan speed 27 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) UH H M+ M L+ L LUL SUL Description * Symbols : Ultra High : High : Medium+ : Medium : Low+ : Low : Low : Ultra Low : Super Ultra Low COOL ON Fan speed setup MANUAL (Fig. 1) AUTO Indication L L+ M M+ H Fan speed W6 (L + M) / 2 W9 (M + H) / 2 WC * 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. (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 28 Item 2. Indoor fan motor control Operation flow and applicable data, etc. <In heating operation> HEAT ON 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. Fan speed setup MANUAL (Fig. 3) Indication L L+ AUTO M M+ H YES Fan speed W8 (L + M) / 2 WB (M + H) / 2 WE TC 42°C NO Min air flow rate control Tc 52 51 42 41 Limited to Min WD tap No limit * * Fan speed = (TC (42 + a)) / 10 x (WD W8) + W8 a : In up operation 1, in down operation 0 (Fig. 4) 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 (W8) Cold draft preventive control Tc 46 45 33 32 *A+4 *A-4 *1 *2 *3 46 45 33 32 *A+4 *A-4 34 33 21 20 *A+4 H (WE) Line-approximate H and SUL with Tc. SUL (W2) *A-4 Stop M+ (WD) Fan speed Fan speed AUTO AUTO MANUAL in starting in stability 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. 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 29 Item 3.
Outdoor fan motor control Operation flow and applicable data, etc. Description The blowing air volume at the outdoor unit side is con1) The operation command sent trolled. from the remote controller is processed by the indoor unit Receiving the operation command from the controller of controller and transferred to the indoor unit, the controller of outdoor unit controls fan speed.

*controller of the outdoor unit. * For the fan motor, a DC motor with non-stage variable 2) When strong wind blows at speed system is used. However, it is limited to 8 stages outdoor side, the operation of air for reasons of controlling. conditioner continues with the Air conditioner ON fan motor stopped. (Remote controller) 3) Whether the fan is locked or not is detected, and the operation of air conditioner stops and an Indoor unit controller alarm is displayed if the fan is locked. 1) Outdoor unit 4) According to each operation operation command mode, by the conditions of (Outdoor fan control) outdoor temperature(To) and compressor revolution, the YES speed of the outdoor fan shown OFF status of 2) Fan speed 400 fan motor continues. when the motor stopped.*

in the table is selected. NO Fan motor ON 3) Fan lock NO YES Air conditioner OFF Alarm display 4) Motor operates as shown in the table below. ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° Outdoor fan speed (rpm) 30 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. Remote controller Set temp. (Ts) 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 Indoor unit Room temp. (Ta) 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 control This function prevents troubles on the electronic parts of the 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. 45°C 40°C 16°C 11°C 44°C 39°C 15.5°C 10.

5°C Cooling current Heating current release value release value 6.45A 6.75A 7.72A 8.47A 9.

22A 10.80A 31 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 50°C When the value is in Q zone, the compressor speed is kept.

Q 46°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) 32 Item 7. Quick heating control Operation flow and applicable data, etc. This function quickens the starting of heating operation when indoor/outdoor temperature is low. (Available only in heating operation) When indoor temperature is low, this function stores the heat by heating winding depended on the outdoor temperature and then it enables the hot air blowing out quickly. In case of operation stop Description When the following conditions are satisfied, winding is heated by output varied by the outdoor heat exchanger temperature. Condition 1 : The previous operation was heating.

Condition 2 : 2 hours passed after operation stop. Condition 3 : The room temperature is 20°C or lower. The indoor temperature sensor detects the room temperature. If the detected room temperature is 20°C or lower, the outdoor heat exchanger temperature sensor detects the outdoor heat exchanger temperature. As shown in the left figure, winding of the compressor is heated for each division of the temperature (for each outdoor temperature) and the heat is stored.

The previous operation was heating and 2 hours passed after the operation had stopped. YES Winding is not heated 20°C Outdoor heat exchanger temperature NO Heating output for winding 1°C 3°C 6°C 8°C OFF 20W or equivalent 20W or equivalent 8.

Defrost control (This function removes frost adhered to the outdoor heat (Only in heating 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. Indoor temperature 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' 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. 33 Item 9. Louver control 1) Louver position Operation flow and applicable data, etc.*
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°. When the louver closes fully, it directs approx. 49° upward. 1) Louver position in cooling operation Louver angle Hi Power Room temp. (Ta) < Set temp. (Tsc) + 3.5 Room temp. (Ta) Set temp. (Tsc) + 3.5 Horizontal (0°) Description Cooling/AUTO (COOL)/DRY operation Cooling memory position NO Cooling operation/ AUTO (COOL)/Dry Powerful operation YES Room temp. Set temp. +3.5 NO YES Inclined blowing Initial setting of "Cooling storage position" Louver : Directs downward (9°) Initial setting of "Inclined blowing" "Cooling storage position" Louver : Louver : Directs downward (14°) Directs downward (9°) Cooling memory position NO YES Room temp. Set temp. +3.5 2) Louver position in heating operation ECO operation Heating operation/ AUTO (HEAT) Room temp. (Ta) < Set temp.

(Tsc) 3 or 25 minutes after start of operation Room temp. (Ta) Set temp. (Tsc) 3 Heating memory position NO Heating operation ECO operation YES Room temp. Set temp. 3.0 NO YES Initial setting of "Heating storage position" "Cooling storage position" "Heating storage position" Louver : Louver : Louver : Directs downward (76°) Directs downward (9°) Directs downward (76°) Heating memory position YES Horizontal position Room temp. Set temp. 3.0 NO 2) Air direction adjustment Horizontal blowing Inclined blowing Air direction · The louver position can be arbitrarily set up by pushing [FIX] button. Inclined blowing Horizontal blowing Blowing downward 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 pushing [SWING] button during operation, the louver starts swinging. 34 Item 10. ECO operation Operation flow and applicable data, etc. When pushing [ECO] button on the remote controller, a quiet and mild operation is performed by reducing the fan speed and the compressor speed. <Cooling operation> This function operates the air conditioner with the difference between the set and the room temperature as shown in the following figure. The time correction is performed for 8 minutes each. (However, the first correction is performed 150 seconds after start of the operation.) Description TA [°C] +4.0 +3.
*5 +3.0 +2.5 +2.0 +1.5 +1.0 +0.5 TSC 0.5 1.0 2.0 Zone 12 11 10 9 8 7 6 5 4 3 2 1 Frequency DRY max *12 *11 *10 *9 *8 COOL min Fan L+ (W7) Time correction L (W6) +1 <Cooling operation> 1) The room temperature (Tao) at the start time of DRY operation is detected.*

*2) According to difference between the room temperature and the set temperature (Tsc), the operation starts with the conditions shown in the left figure. Set temp. (Tsc) = Set temp. on remote controller (Ts) + (0.0 to 1.0) 3) If the room temperature is down by 2°C or more, turn off the compressor. L (W5) ±0 UL (W4) OFF 1 zone: min 1 0 * 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 <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 A B A A zone 16Hz C B B zone 16 to 52Hz C C zone 52Hz <Heating operation> 1) The indoor fan speed is controlled within W7 as maximum value. 2) Setting the compressor speed to Max. 52Hz, the temperature zone in which the operation can be performed with Max. 16Hz is gradually widened after 30 minutes passed when starting ECO operation. 3) The louver position is set horizontally (Standard cooling position) when the room temperature comes close to the set temperature or when 25 minutes passed after starting ECO operation. (Room temp. Set temp.) 35 Item 11. Temporary operation Operation flow and applicable data, etc. Pushing [RESET] button starts the temporary operation of [AUTO] operation.

When keeping [RESET] button pushed for 10 seconds or more, the temporary [COOL] operation is performed.