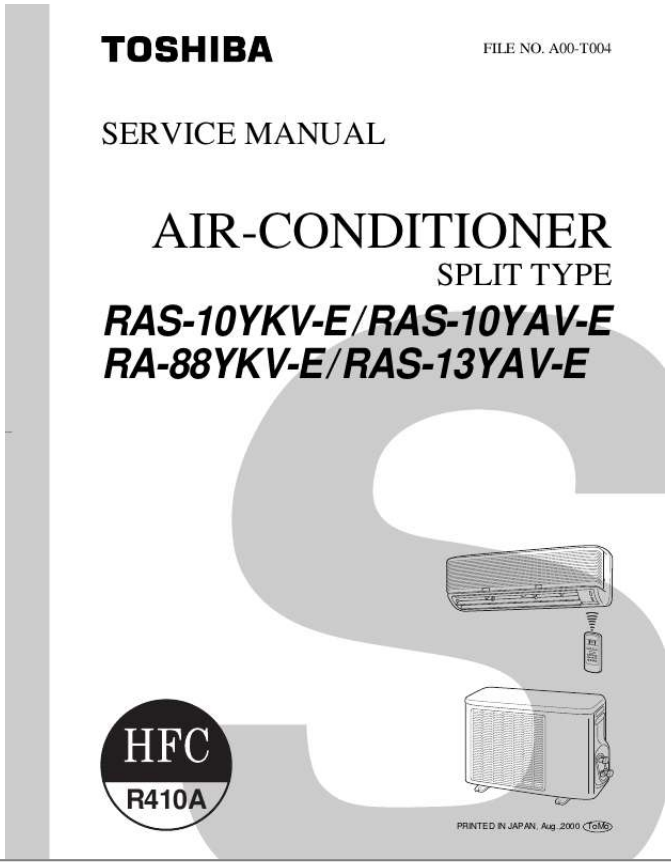

TOSHIBA

FILE NO. A00-T004

SERVICE MANUAL

AIR-CONDITIONER
SPLIT TYPE

RAS-10YKV-E/RAS-10YAV-E
RA-88YKV-E/RAS-13YAV-E

HFC
R410A

PRINTED IN JAPAN, Aug.,2000 (ToMo)

Manual abstract:

@@@@@@@@WIRING DIAGRAM.....

.....

.....

.....

.....

.....

.....

.....

.....16 5. SPECIFICATIONS OF ELECTRICAL PARTS...

.....

..18 6. REFRIGERANT CYCLE DIAGRAM ..

.....

.....

.....

...19 7. CONTROL BLOCK DIAGRAM .

.....

.....

.....

.....

.....

.21 8. OPERATION DESCRIPTION .....

.....

.....

.....

.....

..23 9. INSTALLATION PROCEDURE .....

.....

.....

.....

.....

36 10. HOW TO DIAGNOSE THE TROUBLE ....

.....

.....

.....40 11. HOW TO REPLACE THE MAIN PARTS .

.....

.....

.....

...59 12. EXPLODED VIEWS AND PARTS LIST.....

.....

.....

.....69 2 1.

SPECIFICATIONS 1-1. Specifications RAS-10YKV-E/RAS-10YAV-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 High (Cooling / Heating) Medium (Cooling / Heating) Low (Cooling / Heating) (Cooling / Heating) Height Width Depth RAS-10YKV-E RAS-10YAV-E -- 2,7 0,8 3,4 3,6 0,8 6,2 220 230 240V - 1Ph 50/60Hz Cooling Heating 0,15 0,15 30 30 87 87 Cooling Heating 3,39 / 3,23 / 3,09 4,40 / 4,20 / 4,02 670 870 90 90 4,55 / 4,35 / 4,17 3,86 / 4,00 38 / 39 34 / 35 30 / 30 45 / 46 RAS-10YKV-E 265 790 189 8 19 480 / 520 RAS-10YAV-E 550 780 270 38 750 Twin rotary type with DC-inverter variable speed control DA91A1F-44F 40 2120 / 2120 Flare connection Ø6,35 Ø9,52 Ø6,35 Ø9,52 15 15 10 R410A 0,8 3 Wires : includes earth 4 Wires : includes earth 21 32 / 0 28 10 43 / 10 21 1 1 2 1 2 (Ø3,1 x 16L) 1 1 2 6 (Ø4 x 25L) 1 1 1 Current limited Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Electric Indoor characteristics (A) (W) (%) (A) (W) (%) (A) (dB·A) (dB·A) (dB·A) (dB·A) (mm) (mm) (mm) (kg) (W) (m³/h) (mm) (mm) (mm) (kg) (W) Outdoor COP (Cooling/Heating) Operating noise Indoor Indoor unit Outdoor Unit model Dimension Net weight Fan motor output Air flow rate (Cooling / Heating) Outdoor unit Unit model Dimension Height Width Depth Net weight Compressor Motor output Type Model Fan motor output Air flow rate (Cooling / Heating) Piping connection Type Indoor unit Liquid side Gas side Outdoor unit Liquid side Gas side Maximum length (Per unit) Maximum chargeless length Maximum height difference Refrigerant Name of refrigerant Weight Wiring connection Power supply Interconnection Usable temperature range Indoor (Cooling / Heating) Outdoor (Cooling / Heating) Accessory Indoor unit Installation plate Wireless remote control Label Remote controller holder Pan head wood screw Purifying filter Deodorizing filter Batteries Mounting screw Installation manual Owner's manual Outdoor unit Drain nipple (W) (m³/h) (m) (m) (m) (kg) (°C) (°C) · The specifications may be subject to change without notice for purpose of improvement. 3 RAS-13YKV-

*E/RAS-13YAV-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 High (Cooling / Heating) Medium (Cooling / Heating) Low (Cooling / Heating) (Cooling / Heating) Height Width Depth RAS-13YKV-E RAS-13YAV-E -- 3,7 0,8 4,0 4,8 0,8 6,6 220 230 240V 1Ph 50/60Hz Cooling Heating 0,15 0,15 30 30 87 87 Cooling Heating 5,59 / 5,34 / 5,11 7,03 / 6,71 / 6,43 1170 1470 95 95 7,18 / 6,86 / 6,58 3,08 / 3,20 41 / 41 36 / 36 30 / 30 48 / 50 RAS-13YKV-E 265 790 189 8 19 530 / 560 RAS-13YAV-E 550 780 270 38 750 Twin rotary type with DC-inverter variable speed control DA91A1F-44F 40 2520 / 2520 Flare connection Ø6,35 Ø9,52 Ø6,35 Ø9,52 15 15 10 R410A 0,8 3 Wires : includes earth 4 Wires : includes earth 21 32 / 0 28 10 43 / 10 21 1 1 2 1 2 (Ø3,1 x 16L) 1 1 2 6 (Ø4 x 25L) 1 1 1 Current limited Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Indoor Electric characteristics (A) (W) (%) (A) (W) (%) (A) (dB·A) (dB·A) (dB·A) (dB·A) (mm) (mm) (mm) (kg) (W) (m³/h) (mm) (mm) (mm) (kg) (W) Outdoor COP (Cooling/Heating) Operating noise Indoor Indoor unit Outdoor Unit model Dimension Net weight Fan motor output Air flow rate (Cooling / Heating) Outdoor unit Unit model Dimension Height Width Depth Net weight Compressor Motor output Type Model Fan motor output Air flow rate (Cooling / Heating) Piping connection Type Indoor unit Liquid side Gas side Outdoor unit Liquid side Gas side Maximum length (Per unit) Maximum chargeless length Maximum height difference Refrigerant Name of refrigerant Weight Wiring connection Power supply Interconnection Usable temperature range Indoor (Cooling / Heating) Outdoor (Cooling / Heating) Accessory Indoor unit Installation plate Wireless remote control Label Remote controller holder Pan head wood screw Purifying filter Deodorizing filter Batteries Mounting screw Installation manual Owner's manual Outdoor unit Drain nipple (W) (m³/h) (m) (m) (m) (kg) (°C) (°C) · The specifications may be subject to change without notice for purpose of improvement. 4 1-2. Operation Characteristic Curve <Cooling> 7 <Heating> 7 6 6 RAS-10YKV-E RAS-13YKV-E 5 5 RAS-10YKV-E RAS-13YKV-E Current (A) 4 Current (A) 4 3 3 2 1 · Conditions Indoor : DB 27°C/WB 19°C Outdoor : DB 35°C Air flow : High Pipe length : 5m 230V 0 20 40 60 80 100 2 1 · Conditions Indoor : DB 20°C Outdoor : DB 7°C/WB 6°C Air flow : High Pipe length : 5m 230V 0 20 40 60 80 100 0 0 Compressor speed (rps) Compressor speed (rps) 1-3. Capacity Variation Ratio According to Temperature <Cooling> 105 100 95 90 Current Limited Start 120 110 100 90 RAS-10YKV-E RAS-13YKV-E Capacity ratio (%) 85 80 75 70 65 60 55 Capacity ratio (%) RAS-10YKV-E RAS-13YKV-E 80 70 60 50 40 30 · Conditions Indoor : DB27°C/WB19°C Indoor air flow : High Pipe length 5m 20 10 · Conditions Indoor : DB 20°C Indoor air flow : High Pipe length : 5m 50 32 33 34 35 36 37 38 39 40 41 42 43 Outdoor temp. (°C) * Capacity ratio : 100% = 2,7 kW (RAS-10YKV-E) 100% = 3,7 kW (RAS-13YKV-E) 0 10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10 Outdoor temp. (°C) 5 2. 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, and existing refrigerant or refrigerating oil are not entered in the refrigerant cycle of the air conditioner using the new refrigerant during installation work or servicing time. The next section describes the precautions for air conditioner using the new refrigerant. Conforming to contents of the next section together with the general cautions included in this manual, perform the correct and safe work.

(5) After completion of installation work, check to make sure that there is no refrigeration gas leakage. If the refrigerant gas leaks into the room, coming into contact with fire in the fan-driven heater, space heater, etc.

, a poisonous gas may occur. (6) When an air conditioning system charged with a large volume of refrigerant is installed in a small room, it is necessary to exercise care so that, even when refrigerant leaks, its concentration does not exceed the marginal level. If the refrigerant gas leakage occurs and its concentration exceeds the marginal level, an oxygen starvation accident may result. (7) Be sure to carry out installation or removal according to the installation manual. Improper installation may cause refrigeration trouble, water leakage, electric shock, fire, etc.

(8) Unauthorized modifications to the air conditioner may be dangerous. If a breakdown occurs please call a qualified air conditioner technician or electrician. Improper repair's may result in water leakage, electric shock and fire, etc. 2-1. Safety During Installation/Servicing As R410A's pressure is about 1,6 times higher than that of R22, improper installation/servicing may cause a serious trouble. By using tools and materials exclusive for R410A, it is necessary to carry out installation/servicing safely while taking the following precautions into consideration. (1) Never use refrigerant other than R410A in an air conditioner which is designed to operate with R410A. If other 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, be sure to ventilate fully. If the refrigerant gas comes into contact with fire, a poisonous gas may occur. (4) When installing or removing an air conditioner, do not allow air or moisture to remain in the refrigeration cycle. Otherwise, pressure in the refrigeration cycle may become abnormally high so that a rupture or personal injury may be caused. 2-2. Refrigerant Piping Installation 2-2-1. Piping Materials and Joints Used For the refrigerant piping installation, copper pipes and joints are mainly used. Copper pipes and joints suitable for the refrigerant must be chosen and installed.

Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are less affected by contaminants. (1) Copper Pipes It is necessary to use seamless copper pipes which are made of either copper or copper alloy and it is desirable that the amount of residual oil is less than 40 mg/10 m. Do not use copper pipes having a collapsed, deformed or discolored portion (especially on the interior surface). Otherwise, the expansion valve or capillary tube may become blocked with contaminants. As an air conditioner using R410A incurs pressure higher than when using R22, it is necessary to choose adequate materials.

Thicknesses of copper pipes used with R410A are as shown in Table 2-2-1. Never use copper pipes thinner than 0,8 mm even when it is available on the market. 6 Table 2-2-1 Thicknesses of annealed copper pipes Thickness (mm) Nominal diameter 1/4 3/8 1/2 5/8 Outer diameter (mm) 6,35 9,52 12,70 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 2-2-3 to 22-6 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 2-2-2. Table 2-2-2 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 2-2-2. 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 flaowing 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 Existence of new equipment for R410A Yes Yes Yes Yes Yes Yes Yes Yes (Note 2) Whether conventional equipment can be used Conventional air conditioner installation Whether new equipment can be used with conventional refrigerant 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) *(Note 1) X X X X X X X ¡ *(Note 1) X X ¡ ¡ ¡ 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) (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 5mm) (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 10 2-4. 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 of 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. Never charge refrigerant exceeding the specified amount. If the specified amount of refrigerant cannot be charged, charge refrigerant bit by bit in COOL mode. 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. 2-4-1 Configuration of refrigerant charging 11 Be sure to make setting so that liquid can be charged.

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. 2-4-2 2-5. Brazing of Pipes 2-5-1. 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. 2-5-2. 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. 12 Refrigerant cylinder Electronic balance Siphon 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.

When performing brazing again at time of servicing, use the same type of brazing filler. (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 2-5-3. 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 Attach a reducing valve and a flow-meter to the Nitrogen gas cylinder. Use a copper pipe to direct the piping material, and attach a flow-meter to the cylinder. 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. When the Nitrogen gas is flowing, be sure to keep the piping end open. 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.

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). Remove the flux completely after brazing. Piping material Copper - Copper Copper - Iron Iron - Iron Used brazing filler Phosphor copper Silver Silver Used flux Do not use Paste flux Vapor flux Stop valve Nitrogen gas cylinder From Nitrogen cylinder M Flow meter Do not enter flux into the refrigeration cycle. When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chlorine.

When adding water to the flux, use water which does not contain chlorine (e.

g. distilled water or ion-exchange water). Remove the flux after brazing. Pipe Nitrogen gas Rubber plug Fig. 2-5-1 Prevention of oxidation during brazing 13 3. CONSTRUCTION VIEWS 3-1. Indoor Unit RAS-10YKV-E, RAS-13YKV-E Air inlet Air filter 790 Heat exchanger 189 ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; Knock out system 50 94 790 Hanger 232 326 232 47 Front panel Back body 47 10 321 External length reference Connecting pipe (0,39m) (Flare ø9,52) 65,5 659 450 344 326 Hanger Drain hose (0,54m) 50 Knock out system Connecting pipe (0,49m) (Flare ø6,35) 65,5 Hanger For stud bolt (ø8~ø10) For stud bolt (ø6) Hanger 66 or more 20 Minimum distance to ceiling 26 2,5 46 20 178,5 265 Minimum distance to wall 17 37 10,5 76 Installation plate outline 319 790 Center line 269 60,5 126 40,5 3,5 Hanger Hanger 37 Wireless remote controller 55 16 14 136 120 or more 120 or more 20 Minimum distance to wall 10 Air outlet 47 50 @@@@@@@@ ;;;;;;;; @@@@@@@@ ;;;;;;;; @@@@@@@@ ;;;;;;;; @@@@@@@@ ;;;;;;;; 265 3-2. Outdoor Unit (Anchor bolt long hole pitch) RAS-10YAV-E RAS-13YAV-E A leg part 115 600 90 50 Ø25 drain hole Ø11 x 17U-shape hole (For Ø8-Ø10 anchor bolt) (ø6 hole pitch) 310 296 270 76 8-Ø6 hole (For fixing outdoor unit) 16 B leg part Ø4,5 embossing (Ø4STS used) (For sunshade roof attaching) 49,5 147 Ø11 x 17 long hole (For Ø8-Ø10 anchor bolt) 21 Fan guard Valve cover 115,5 157 59 Hanger 540 548 21 Z 54 Charging port 8 780 61 322 Earth terminal Connecting pipe port (Pipe dia.Ø6,35) Detailed A leg part 600 50 Connecting pipe port (Pipe dia.Ø9,52) 36 11 R15 Z view Outside line of product 310 296 R5,5 Mounting dimensions of anchor bolt 600 4 x Ø11 x 17U-shape hole (For Ø8-Ø10 anchor bolt) 2-Ø6 hole 50 or more D Intake A 2-Ø6 hole 310 Intake 250 or more 296 11 Outside line of product 310 C 100 or more Outside line of product (Minimum distance from wall) 36 50 R15 R5 200 or more Outlet B 4 x Ø11 × 17 long hole (For Ø8-Ø10 anchor bolt) 600 ,5 Detailed B leg part 15 4. WIRING DIAGRAM FAN MOTOR 4-1. Indoor Unit RAS-10YKV-E, RAS-13YKV-E LOUVER MOTOR BLU PNK YEL ORN RED BRW DC MOTOR 654321 654321 BLK P04 R109 VARISTOR SG01 DSA J04 CN07 R116 IC04 L01 R01 DB01 R21 C15 C01 C02 54321 54321 CN10 5 6 T6,3A 250V F01 FUSE INDOOR TERMINAL BLOCK TO1 DC35V DC12V DC7V 3 2 BLK 1 WHI CN30 2 RED 3 MAIN P.C. BOARD (MCC-772) DC0V C06 IC02 GRN & YEL CN23 OUTDOOR INDOOR UNIT UNIT CN13 IC IC01 4 CN03 CN01 123456789 BLU BLU BLU BLU BLU BLU PNK BLK WHI 12 12 BLK BLK 12 12 BLK BLK 1 123456789 1 2 3 4 5 6 7 8 9 CN25 INFRARED RAYS RECEIVE AND INDICATION PARTS THERMO SENSOR (TA) HEAT EXCHANGER SENSOR (TC) Table 4-1-1 Simple check points for diagnosing faults Check items Diagnosis result Check to see if the OPERATION indicator goes on and off when the main OPERATION switch or breaker is turned on, or the power cord is plugged in the wall indicator outlet.

(Check the primary and secondary voltage of transformer.) Terminal block Fuse 6,3A DC 5V DC 12V DC 35V Check for power supply voltage between Q R. (Refer to the name plate.) (Check the primary and secondary voltage of transformer.) Check for fluctuate voltage between R S. (DC 15 to 60V) Check to determine if the fuse is open. (Check Varistor : R109, R21) Check for voltage at the pink lead of the infrared rays receive parts. (Check the transformer and the rated voltage power supply circuit.) Check for voltage at the QS lead of louver motor. (Check the transformer and the rated voltage power supply circuit.) Check for voltage at the CN10 connector side point. (Check the transformer and the rated voltage power supply circuit.) COLOR IDENTIFICATION BRW : BROWN RED : RED WHI : WHITE YEL : YELLOW BLU : BLUE BLK : BLACK GRY : GRAY PNK : PINK ORN : ORANGE GRN : GREEN & &YEL YELLOW For detailed diagnostic procedure, refer to the service data. DSA : Surge Absorber 16 4-2. Outdoor Unit RAS-10YAV-E, RAS-13YAV-E P.M.V. : Pulse Modulating Valve TE TD TO TS REACTOR FAN MOTOR P.M.V.
COIL FOR 4WAY VALVE THERMOSTAT POWER FOR SUPPLY COMPRESSOR 220/240V~ 50/60Hz To INDOOR UNIT ~~~ LN ~~~~ 123 GRN FM GRY PNK 12 12 BLK BLK BLK BLK RED WHI BLK YEL GRY RED BLU ORN YEL WHI 12 12 123 123 12 12 123 123 54321 54321 123 123 123 123 CN600 CN601 CN602 CN603 P08 P07 CN301 CN300 CN701 BLK P06 654321 654321 12 12 CN703 CN500 P01 P02 F01 FUSE 25A P03 P.C. BOARD MCC-808 RELAY P09 ORN P10 CT SURGE ABSORBER VARISTOR ORN P11 BLK WHI 11 22 POWER RELAY C13 P12 P13 REACTOR PUR CONVERTER MODULE G E A ~ ~ + YEL ELECTRONIC STARTER C12 C14 P14 F03 FUSE 15A F04 FUSE 3,15A RELAY DB01 P19 P20 + BU EU BV EV BW EW BX BY BZ P18 P17 P21 RED P22 WHI P23 BLK 11 22 33 Q200 BLU IGBT MODULE CM COMPRESSOR COLOR IDENTIFICATION BLK BLU RED GRY PNK : BLACK : BLUE : RED : GRAY : PINK WHI BRW ORN YEL PUR : WHITE : BROWN : ORANGE : YELLOW : PURPLE 17 5.

SPECIFICATIONS OF ELECTRICAL PARTS 5-1. Indoor Unit RAS-10YKV-E, RAS-13YKV-E No. 1 2 3 4 5 6 7 8 9 Parts name Fan motor (for indoor) Thermo. sensor (TA-sensor) DC-DC transformer (T01) Microcomputer Heat exchanger temp. sensor (TC-sensor) Line filter (L01) Diode (DB01) Capacitor (C02) Fuse (F01) Type TICF-35-19-4 () SWT-34 or SWT-46 TMP87PM40AF or TMP87CM40AF () UF-253Y0R7 RBV-406 or D3SBA60 KMH450VNSN100M25B TSCR6,3A MA2830-FJ 15G561K ERF-5TK5R6 MP35EA7 10k at 25°C 25mH, AC0,7A 4A, 600V 100µF, 450V T6,3A, 250V 4A, 600V 560V 5,6, 5W Output (Rated) 2W, 10poles, 1phase DC12V DC35V, 19W 10k at 25°C DC390V, Secondary DC35V, 12V, 7V Specifications 10 Power supply IC (IC01) 11 Varistor (R21, R109) 12 Resistor (R01) 13 Louver motor 5-2. Outdoor Unit RAS-10YAV-E, RAS-13YAV-E No. 1 2 3 4 5 6 7 8 9 Parts name SC coil (Noise filter) L03 L01 Model name SC-15-S06J SC-20-01J SWT-43 CH38Z-K ICF-140-40-7 AJQ1341 (Inverter attached) (Inverter attached) (Inverter attached) (Inverter attached) ---- For protection of switching power source 11 Fuse 12 Electrolytic capacitor 13 Transistor module 14 Compressor 15 Compressor thermo.

16 Converter module For protection of inverter input overcurrent LLQ2G501KHUATF, 400LISN500K35F 6MBI25GS-060-01 or 6MBI25GS-060-01A DA91A1F-44F US-622KXTMQO-SS MP7003 15A, 0,6mH 20A, 150µH Primary side DC280V, Secondary side 7,5V x 1, 13V x 1, 26,5V x 3, 16V x 1, 15V x 1 L=10mH, 16A x 2 DC140V, 40W Coil DC12V Contact AC125V, 3A 10k (25°C) 62k (20°C) 10k (25°C) 10k (25°C) 20A, AC250V 3,15A, AC250V 25A, AC250V 500µF, DC400V X 3 pieces 25A, 600V 3-phases 4-poles 750W OFF: 125 ± 4°C, ON: 90 ± 5° C Diode: 25A, 600V, IGBT: 40A, 600V Rating DC-DC transformer Reactor Outside fan motor Fan control relay Suction temp. sensor (TS sensor) Discharge temp. sensor (TD sensor) Outside air temp. sensor (TO sensor) Heat exchanger temp. sensor (TE sensor) 10 Terminal block (9P) For protection of transistor module breakage 15A, AC250V 18 6. REFRIGERANT CYCLE DIAGRAM 6-1. Refrigerant Cycle Diagram RAS-10YKV-E/RAS-10YAV-E RAS-13YKV-E/RAS-13YAV-E T1 INDOOR UNIT Indoor heat exchanger Temp. measurement Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port Deoxidized copper pipe Outer dia. : 6,35mm Thickness : 0,8mm Sectional shape of heat insulator Allowable pipe length Allowable height difference : 10m Max. : 15m Deoxidized copper pipe Outer dia.
: 9,52mm Thickness : 0,8mm Muffler 4 way valve (CHV-0213) Strainer Muffler TD Pulse modulating valve at liquid side (SEV15RC2) Compressor DA91A1F-44F TS Outdoor heat exchanger Split capillary Ø1,5 x 200 Ø1,5 x 200 TE Temp. measurement T2 Propeller fan Refrigerant amount : 0,8kg NOTE : Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT NOTE : · The maximum pipe length of this air conditioner is 15 m. The additional charging of refrigerant is unnecessary because this air conditioner is designed with charge-less specification. 19 6-2. Operation Data <Cooling> Temperature condition (°C) Indoor Outdoor 10YKV-E 27/19 35/ 13YKV-E 0,8 to 1,0 8 to 10 46 to 48 High High 85 Heat exchanger pipe temp.
T1 (°C) 9 to 11 T2 (°C) 42 to 44 High High Model name Standard pressure P (MPa) Indoor fan mode Outdoor fan mode Compressor revolution (rps) 0,8 to 1,0 56 <Heating> Temperature condition (°C) Indoor Outdoor 10YKV-E 20/ 7/6 13YKV-E 2,5 to 2,7 50 to 52 0 to 3 High High 97 Heat exchanger pipe temp. T1 (°C) 42 to 44 T2 (°C) 2 to 4 High High Model name Standard pressure P (MPa) Indoor fan mode Outdoor fan mode Compressor revolution (rps) 3,5 to 3,7 70 NOTES : (1) Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent. (Thermistor themometer) (2) Connecting piping condition : 5 m 20 7. CONTROL BLOCK DIAGRAM 7-1. Indoor Unit RAS-10YKV-E, RAS-13YKV-E Indoor Unit Control Panel M. C.U Heat Exchanger Sensor Temperature Sensor Infrared Rays Signal Receiver Functions · Louver Control · 3-minute Delay at Restart for Compressor · Motor Revolution Control · Processing (Temperature Processing) · Timer · Serial Signal Communication Power Supply Circuit Indoor Fan Motor Timer Display ECONO. Sign Display PRE DEF. Sign Display Operation Display Infrared Rays Initializing Circuit Clock Frequency Oscillator Circuit Remote Controller Louver ON/OFF Signal Louver Motor Noise Filter Louver Driver Serial Signal Transmitter/Receiver From Outdoor Unit Serial Signal Communication REMOTE CONTROLLER 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 ECONO. Infrared Rays 21 RAS-10YAV-E, RAS-13YAV-E 7-2. Outdoor Unit (Inverter Assembly) For INDOOR UNIT 220230240 V ~ 50/60 Hz MICRO-COMPUTER BLOCK DIAGRAM MCC808 (P.C.B) Inddor unit send/receive circuit OUTDOOR UNIT Rotor position detect circuit Rotor position detect circuit Gate drive circuit Gate drive circuit Over current detect circuit Over current sensor M.C.

U · · · · · · · · · · 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 Discharge temp. sensor Outdoor air temp. sensor 22 Suction temp. sensor Heat exchanger temp.sensor High Power factor Correction circuit Clock frequency 16MHz Noise Filter Input current sensor Converter (AC DC) Over current sensor Inverter (DC AC) Outdoor Fan motor Driver circuit of P.M. V. Relay circuit Over current sensor Inverter (DC AC) Compressor P.M.V. 4-way valve 8.
OPERATION DESCRIPTION 8-1. 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 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 modulating valve. 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. (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. · Temperature setting of the indoor heat exchanger by using heat exchanger sensor (Prevent-freezing control) · Louver motor control · Indoor fan motor operation control · LED 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 (2) Role of outdoor unit controller Receiving the operation command signal (Serial signal) from the indoor controller, the outdoor unit performs its role. · Compressor operation control · Operation control of outdoor fan motor ·P .M.V. control Operations followed to judgment of serial signal from indoor side. · Detection of inverter input current and current release operation · Over-current detection and prevention operation to transistor 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 to indoor unit · 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) 23 (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.) · For these two types of signals ([Operation mode] and [Compressor revolution]), 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. · Temperature of indoor heat exchanger by indoor heat exchanger sensor (Minimum revolution 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. 8-1-1. Capacity Control The cooling and heating capacity is varied by changing compressor motor speed.
The inverter changes compressor motor speed by changing AC 220230240V power to DC once, and controls capacity by changing supply power status to the compressor with transistor module (includes 6 transistors). The outline of the control is as follows: The revolution position and revolution speed of the motor are detected by detecting winding electromotive force of the compressor motor under operation, and the revolution speed is changed so that the motor drives based upon revolution speed of the operation command by changing timing (current transfer timing) to exchange inverter output voltage and supply power winding. Detection of the revolution position for controlling is performed 12 times per 1 revolution of compressor. The range of supply power frequency to the compressor differs according to the operation status (COOL, HEAT, DRY). Table 8-1-1 Compressor revolution range Operation mode COOL HEAT Model name 10YKV-E 13YKV-E 10YKV-E 13YKV-E Compressor revolution (rps) 13 to 74 13 to 94 16 to 110 16 to 114 8-1-2.
Current Release Control The outdoor main circuit control section (Inverter assembly) detects the input current to the outdoor unit. If the current value with compressor motor speed instructed from indoor side exceeds the specified value, the outdoor main circuit control section controls compressor motor speed by reducing motor speed so that value becomes closest to the command within the limited value. 8-1-3. Power Factor Improvement Control Power factor improvement control is performed mainly aiming to reduce the current on much power consumption of cooling/heating operation. Controlling starts from the time when input power has reached at a certain point. To be concrete, IGBT of the power factor improvement circuit is used, and the power factor is improved by keeping IGBT on for an arbitrary period to widen electro-angle of the input current. 24 8-1-4. Prevent-Freezing Control The indoor heat exchanger sensor detects refrigerant vapor temperature in COOL/DRY operation. If the temperature is below the specified value, compressor motor speed is reduced so that operation is performed in temperature below the specified value to prevent-freezing of indoor heat exchanger. 8-1-6.

Louver Control (1) Vertical air flow louvers Positions of vertical air flow louvers are automatically controlled according to the operation status (AUTO, COOL, DRY, HEAT). Besides, positions of vertical air flow louvers can be arbitrarily set by pressing the [SET] button. The louver position which has been set by the [SET] button is stored in microcomputer, and the louver is automatically set at the stored position in the next operation. (2) Swing If the [AUTO] button is pressed during running operation, vertical air flow louvers start swinging. When the [AUTO] button is pressed again, swinging stops.

8-1-5. P. M. V. (Pulse Modulating Valve) Using P .

M.V., refrigerant flow of refrigeration cycle is varied for the optimum temperature. Controlling each unit separately by two P .M. V. corresponds to difference of pipe length, fan speed, and unit temperature. After the power has been turned on, when a serial operation signal is received from indoor at the first time, or when PMV alarm is detected and the equipment is reactivated, move the valve once until it hits on the stopper for positioning of the valve. In this case, ticktack sound may be heard. 8-1-7.

Indoor Fan Control (DC Fan Motor) The indoor fan is operated by motor speed non-step variable DC drive system motor. For flow rate, motor speed is controlled manually in three steps (LOW, MED, HIGH), and with the unit of 10 rpm from upper limit to lower limit in AUTO mode as described in Table 8-1-2. It is not selected by relay, so selecting sound does not generate. Table 8-1-2 RAS-10YKV-E Operation mode Fan mode H COOL M L DRY -- H HEAT M L Motor speed (rpm) 1120 980 850 820 1200 1070 930 Air flow rate (m³/h) 480 400 330 320 520 450 380 RAS-13YKV-E Motor speed (rpm) 1210 1020 850 820 1270 1100 930 Air flow rate (m³/h) 530 420 330 320 560 470 380 25 8-1-8. Outdoor Fan Control (DC Fan Motor) Although the outdoor fan motor drives the outdoor fan by non-step variable system of the revolution speed, the revolution speed is restricted to three steps on the convenience of controlling. If a strong wind is lashing outside of the room, the operation may be continued as the outdoor fan stops in order to protect the outdoor fan motor. If a fan lock occurred due to entering of foreign matter, the air conditioner stops and an alarm is displayed. <COOL, DRY> Table 8-1-3 Model name Compressor revolution (rps) TO 38°C Outdoor temp. sensor TO TO < 38°C TO < 15°C TO 38°C ECONO. operation TO is abnormal TO < 38°C TO < 15°C 630 450 450 To 13,2 450 450 RAS-10YAV-E To 34,1 800 630 390 630 450 390 630 800 700 800 630 450 450 From 34,7 800 800 To 13,2 450 450 RAS-13YAV-E To 34,1 940 700 390 700 450 390 700 940 940 700 From 34,7 940 940 <HEAT> Table 8-1-4 Model name Compressor revolution (rps) Outdoor temp.

*sensor TO ECONO. operation TO is abnormal TO 5°C TO < 5°C TO 5°C TO < 5°C To 16,2 390 580 390 390 390 RAS-10YAV-E To 44,3 580 580 390 580 580 From 44,9 800 800 580 580 800 To 16,2 390 650 390 390 390 RAS-13YAV-E To 44,3 650 650 390 650 650 From 44,9 900 940 650 650 900 8-2. Description of Operation Circuit · Turning [ON] the breaker flashes the operation lamp. This is the display of power-ON (or notification of power failure). · When pushing [START/STOP] button of the remote control, receive sound is issued from the main unit, and the next operations are performed together with opening the vertical air flow louvers. 26 8-2-1. Cooling Operation (The Remote Controller MODE Button is Set to the COOL Position) · Once the setting is made, the operation mode is memorized in the microcomputer so that the same operation can be effected thereafter simply by pushing [START/STOP] button. · A cooling operation signal is transmitted to outdoor unit. · The indoor fan motor operates as shown in Fig. 8-2-1 when FAN button is set to AUTO. · The motor operates with a constant air flow when the FAN button is set to LOW, MED, or HIGH. · The outdoor unit controls the outdoor fan relay R01, R02 and R03, and the compressor motor speed according to the operation command signal sent from the indoor unit. (1) Cooling capacity control · The cooling capacity and room temperature are controlled by changing the compressor motor speed according to both the difference between the temperature detected by the room temperature sensor and the temperature set by TEMP button and also any change in room temperature. · When compressor has been activated or reactivated, it operates with Max. 41 rps for 2 minutes, with Max. 91 rps from 2 minute to 3 minutes, and with Max. 94 rps after 3 minutes passed. · When room temperature is lower than set temperature, indoor fan motor is operated at fan speed L as shown in Fig. 8-2-1 while the outdoor unit stops. (2) Prevent-freezing control If temperature of indoor heat exchanger detected by the indoor heat exchanger sensor is 5°C or lower, compressor motor speed is gradually lowered to prevent freezing of the indoor heat exchanger. If temperature is 7°C or higher, return the operation to the above item (1). (3) Current release control The input current of compressor and outdoor fan motor (Precisely inverter main circuit control section) which occupy most of air conditioner input is detected by the outdoor current sensor, and compressor motor speed is gradually lowered so that current value does not exceed 9,0A if current value exceeds 9,0A. When the current value lowers to 8,5A, return the operation to the above item (1). Current value (A) (Room temp.) (Set temp.) °C +3 +2,5 +2 +1,5 +1 +0,5 0 0,5 M+ *1 *1 *1 L In normal operation Set temp. NOTE : *1: Calculated from difference in motor speed of M+ and L, and controlled. Fig. 8-2-1 Setting of air flow [Fan AUTO] 9,0 Comp. motor speed down 8,5 Normal control Comp.*

motor speed keep Fig. 8-2-2 (4) Outdoor temperature release control The outdoor temperature release is controlled by changing the current release points 9,0 and 8,5 in the above item according to temperature detected by the outdoor temperature sensor. For example, if the outdoor temperature is 43°C, the value of current release point becomes 8,0A. 27 (5) Limit for maximum compressor motor speed by indoor fan speed When outdoor temperature sensor detected 32°C or lower, and indoor heat exchanger sensor detected 17°C or lower, the maximum compressor motor speed is limited by the indoor fan speed. For example, the compressor motor speed is limited as described in the table below. Table 8-2-1 Air flow rate HIGH M+ MED. L, L UL, SUL RAS-10YKV-E (rps) 56 49 43 36 30 RAS-13YKV-E (rps) 85 71 57 44 30 (7) Discharge temperature control (Common control to cooling and heating) The discharge temperature of refrigerant gas from the compressor is detected by the discharge temperature sensor, and controls operating compressor motor speed. 1) Control 1 (A zone) : Normal operation zone When TD detect value is 98°C or lower, the operation is performed with operating motor speed instructed by the serial signal. 2) Control 2 (B zone) : Slow-up zone of motor speed When TD detect value is 98°C or higher, operating motor speed is slowly up. 3) Control 3 (C zone) : Keep zone When TD detect value is 105°C or higher, operating motor speed is not changed if raising operation speed. 4) Control 4 (D zone) : Slow down zone of motor speed (6) Louver control The vertical air flow louvers are automatically set to horizontal or cool memory position.

When temperature of indoor heat exchanger becomes 5°C or lower by the prevent-freezing control and the compressor is turned off, the vertical air flow louvers close once and then return to the position of previous time. When TD detect value is 108°C or higher, operating motor speed is slowly down. 5) Control 5 (E zone) : Normal down of motor speed When TD detect value is 112°C or higher, operating motor speed is down. 6) Control 6 (F zone) : Operation stop zone If TD detect value exceeds 117°C during operation, stop the operation immediately.
Then, restart the operation when TD detect value becomes 105°C or lower. TD (°C) 117 112 108 Zone F E D Operation stop zone Normal down zone of motor speed Slow down of motor speed Release of motor speed 105 C Keep zone : Motor speed is not changed. 98 B Slow-up zone of motor speed A Normal operation zone Fig. 8-2-3 Compressor motor speed control 28 (8) ECONO. operation control When the ECONO.
button of the remote controller is pushed, quiet and mild operation is performed by restraining air flow and operating motor speed. 1) Indoor air flow is controlled between SUL and L (Low air ()). 2) Setting 10 at 16 rps and 13 at 20 rps as the maximum operating compressor motor speed, the minimum capacity operation range is widened every 1 hour and 2 hours have passed after ECONO. operation had started. Compressor motor speed Air volume L (Room temp.) (Set temp.) 10 16 rps 15 rps 13 20 rps 17 rps 3,5 {(L) + (SUL)}/2 3 2,5 2 SUL 1,5 1 0,5 1H 2H Time 13 rps 13 rps Fig. 8-2-4 8-2-2. DRY Operation (The Remote Controller MODE Button is Set to the DRY Position) · Once the setting is made, the operation mode is memorized in the microcomputer so that the same operation can be effected thereafter simply by pushing [START/STOP] button. · Dry operation signal is transmitted to outdoor unit.

*· The Cooling operation giving priority to dehumidifying, which restrains the indoor fan speed and compressor motor speed, is performed. · The indoor fan motor operates as shown in Fig. 8-2-5. (Fan speed is AUTO only.) · The outdoor unit controls the outdoor fan relay R01, R02 and R03, and the compressor motor speed according to the operation command signal sent from the indoor unit. (Room temp.) (Set temp.) +2,5 +2,0 +1,5 *1 +1,0 SUL +0,5 0 0,5 L Set temp. NOTE : *1 : Middle motor speed between L and SUL Fig. 8-2-5 Setting of air flow 29 8-2-3.*
Heating Operation Transferring of heating operation signal from indoor unit to outdoor unit starts. The indoor fan motor operates by the room temperature when selecting "AUTO" of "FAN" as shown in Fig. 8-2-6, and operates with a set air flow when selecting "Low" to "High". However, to prevent cold draft, revolution speed of the fan is restricted by indoor heat exchanger when air flow is AUTO (Fig. 8-2-7) and starting of FAN Manual.
[In starting and in stability] In starting · 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. · Room temp. < Set temp. 4°C 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 AUTO [Basic control] Set temp. (Room temp.) (Set temp.) FAN Manual LOW 0 0,5 1 1,5 2 *1 *2 M+ The outdoor unit controls the outdoor fan based upon the operation signal sent from the indoor unit, and also controls revolution speed of the compressor motor. The power coupler (IC20) for four-way valve is turned on, and turned off in defrost operation. (1) Heating capacity control Calculate the difference between temperature detected by room temp. sensor every minute and the set temp.*

set on "Temp. indicator" and variation amount of room temp. Then, obtain the correction amount of the command signal, and correct the current frequency command signal. (2) High-temp. release control If temperature of the indoor heat exchanger detected by the indoor heat exchanger sensor is 55°C or higher, compressor motor speed is gradually lowered to prevent over-temp. rising of compressed pressure. If temperature becomes below 48°C, return to above item (1). (3) Current release control The input current of compressor and outdoor fan motor (Precisely inverter main circuit control section) which occupy most of air conditioner input is detected by the outdoor current sensor. The compressor motor speed is lowered gradually according to the range of TO (outside air temp.) if the input current exceeds the current value determined in each zone as shown in Fig.
*8-2-8 so that the input current does not exceed the set value. In case that the current lowered by approx. 0,5A than each set value, return to above item (1). 5,0 5,5 [FAN AUTO] HIGH *1, *2 : Approximate revolution speed of M+ and L to linear according to temperature. Fig.*
*8-2-6 Setting of air flow [Cold draft preventing control] The upper limit of fan revolution speed is shown below. HIGH 44 43 33 32 Approximate revolution speed of HIGH and SUL linear by Tc. 31 30 20 19 A*2 A8 Starting of FAN Manual 3 SUL* A+4 A8 FAN AUTO SUL (NOTE : *1) Stop Fig. 8-2-7 Cold draft preventing control NOTES : (1) Stops for 2 minutes after thermostat-OFF. (2) 24°C when the set temp.*
is 24°C or more Set temp. when the set temp. is below 24°C (3) SUL : Super ultra low 30 2) Defrost operation Outside air temp. (°C) TO 16,0 15,5 11,0 10,5 9,8A 10,3A 10,8A Operation of the compressor is stopped once, turn off power coupler for four-way valve after 10 seconds, and then exchange the four-way valve. After 20 seconds, restart operation of the compressor. Turn off the outdoor fan just when the compressor stopped. If temperature of the indoor heat exchanger lowered than 38°C, stop the indoor fan. 3) Defrost reset Resetting operation from defrost to heating is performed when any one of the following conditions is satisfied. a. Temperature of the outdoor heat exchanger rose to +8°C or higher.

b. A status that temperature of the outdoor heat exchanger is +5°C or higher continued for 80 seconds. c. Defrost operation continued for 10 minutes. In resetting defrost operation, the compressor stops for 50 seconds if defrost has started under condition a. to c. in item 1), but the compressor is reset to heating operation keeping operated if defrost has started under condition d. in item 1). (5) Louver control The vertical air flow louvers are automatically set to heating position or heat memory position. When the compressor is turned off by high-temp.
release control, the vertical air flow louvers close once and then return to the position of previous time.

Fig. 8-2-8 (4) Defrost control 1) Detection of frost In heating operation, time duration while the compressor operates is counted, and defrost operation starts by any condition described below. a. The counted time is 28 minutes or more, and status that temperature of the outdoor heat exchanger detected by the outdoor heat exchanger is 20°C or lower continued for 2 minutes or more.

b. The counted time is 28 minutes or more, and status that temperature of the outdoor heat exchanger detected by the outdoor heat exchanger is 7°C or lower and temperature lowered by 2,5 °C than the minimum value of the outdoor heat exchanger during 10 to 15-minutes count time continued for 2 minutes or more. c. The counted time is 34 minutes or more, and status that temperature of the outdoor heat exchanger detected by the outdoor heat exchanger is 5°C or lower and temperature lowered by 3,0 °C than the minimum value of the outdoor heat exchanger during 10 to 15-minutes count time continued for 2 minutes or more. d.

If the following three conditions are satisfied, defrost operation (Timer defrost) starts after heating operation for 37 minutes. Q Setting on remote control, HEAT (mode), HIGH (Fan), 30°C (temp.). R Room temp. is 19°C to 24°C, and outside air temp. is 5°C or lower. S Defrost operation has been already performed once. 31 8-2-4. Automatic Operation (1) As shown in Fig. 8-2-9, the operation mode (COOL, DRY, HEAT) is selected according to the outside temperature and room temperature when the operation has started.

The operation in Fan mode continues until an operation mode is selected. If the room temperature is 20°C or higher when "AUTO" operation started within 2 hours after "HEAT" operation had stopped, select an operation mode after Fan operation of ultra low fan. In AUTO operation, the set temperature of each operation can be corrected by the remote controller in the range of 17 to 30°C. TA 28 26 24 23 Heating with setting on remote controller Ts = 25°C 5 2 15 18 1 (2) After selecting the operation mode (COOL, DRY, HEAT), select an operation mode again when a status that the compressor was turned off by the room temperature or outside air temperature continues for 15 minutes. (3) Powerful Cool mode control When the outside temperature is above 32°C and indoor temperature is above 28°C, select Cool mode control. In Cool mode, the air flow louver directs downward. When the room temperature gains access to the set temperature, it becomes cool memory position. Powerful Cooling/Drying with setting on remote controller Ts = 25°C Cooling/Drying with setting on remote controller Ts = 25°C Monitoring (Follow to the Fan control in previous mode when being selected again.) 20 Ts correction by outside temperature (To) 24 0 32 +1 To Fig. 8-2-9 8-3.

Temporary Operation · Temporary Auto operation, existence of Auto Restart, and Temporary Cooling operation can be set by the TEMPORARY button of the indoor controller. 8-3-1. Temporary Auto Operation · When the TEMPORARY button is pushed, the Auto operation with set temperature fixed at 25°C starts. Controlling is same as that of Auto operation by the remote controller. · When the TEMPORARY button is pushed again, the operation stops.

· During Temporary Auto operation, operation by the remote controller is accepted. · Using the Auto Restart function, the Temporary Auto operation starts when power failure is reset. TEMPORARY button TEMPORARY 8-3-2. Temporary Cooling Operation · When the TEMPORARY operation button keeps pushed for 10 seconds, Cooling operation of which compressor motor speed and the indoor fan speed are fixed starts. Table 8-3-1 TEMPORARY button OFF ON After pushing button for 3 seconds After pushing button for 10 seconds Control Temporary Auto operation start Auto Restart control select Temporary Cooling operation start Compressor motor speed : 10 : 30 rps 13 : 30 rps Indoor fan speed : Low · When the TEMPORARY operation button is pushed again, the operation stops.

· Auto Restart function is unavailable. 32 8-4. Auto Restart Function This unit is equipped with an Automatic restarting facility which allows the unit to restart and resume the set operating conditions in the event of a power supply shutdown without the use of the hand control. The operation will resume without warning three minutes after the power is restored. The Auto Restart function is set not to work on shipment from the factory, and so it is necessary to set it to function as required. 8-4-1. How to Set the Auto Restart To set the Auto Restart function, proceed as follows: Access the TEMPORARY button located in the lower right hand corner beneath the hinged front panel of the indoor unit (please refer to Fig. 8-2-9). The power supply to the unit must be on - the function will not be set if the power is off. To enable the Auto Restart function, push the TEMPORARY button continuously for three seconds.

The unit will acknowledge the setting and beep three times. The system will now restart automatically. The above Auto Restart settings can be carried out: · When the system is stand-by (not operating) Operation Push the TEMPORARY button continuously more than three seconds. Motion Stand-by The system starts to operate. The green light goes on. about three seconds after The unit beeps three times. The orange light goes on. The system is operating. If the system is not required to run at this time, push the TEMPORARY button once more or use the remote controller and the unit will stop. 0 3S TEMPORARY · When the system is operating Operation Push the TEMPORARY button continuously more than three seconds.

Motion Operating The green light goes on. The system stops to operate. The green light goes off. about three seconds after The unit beeps three times. The system stops.

If the system is not required to stop at this time, use the remote controller and to restart. 0 3S TEMPORARY During subsequent operation, the orange light goes on. · The Auto Restart function will not accept an instruction if timer operation with the remote controller is selected. · During louver swing (AUTO) operation, after restart by the Auto Restart function the louver swing stops. 33 8-4-2.

How to Cancel the Auto Restart To cancel the Auto Restart function, proceed as follows: Repeat the setting procedure: the unit will acknowledge the instruction and beep three times. · When the system is stand-by (not operating) Operation Push the TEMPORARY button continuously more than three seconds. 0 3S The system will now be required to manually restart with the remote controller after the main supply is turned off. Cancellation is carried out: Motion Stand-by The system starts to operate. The orange light goes on. about three seconds after The unit beeps three times.