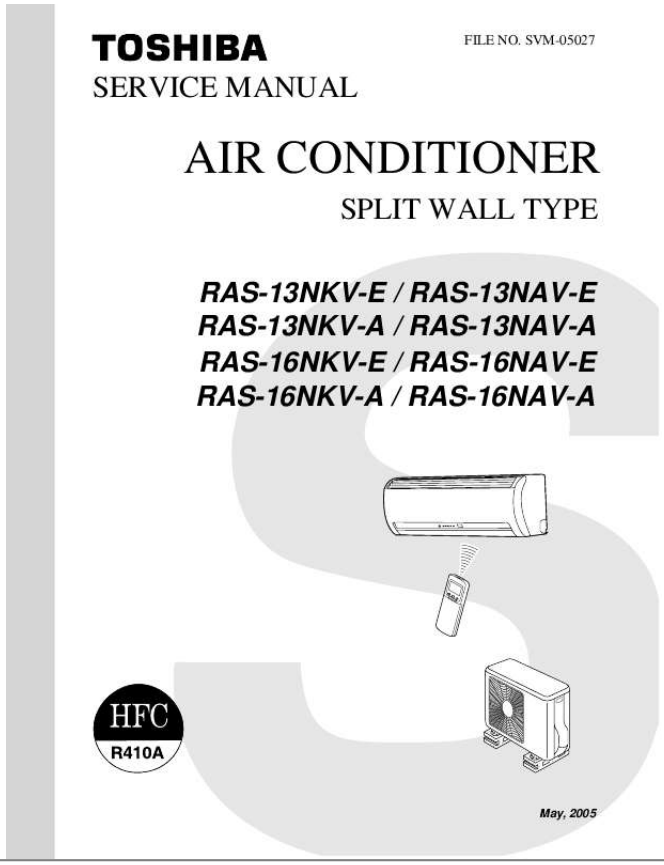

TOSHIBA

FILE NO. SVM-05027

SERVICE MANUAL

AIR CONDITIONER

SPLIT WALL TYPE

RAS-13NKV-E / RAS-13NAV-E
RAS-13NKV-A / RAS-13NAV-A
RAS-16NKV-E / RAS-16NAV-E
RAS-16NKV-A / RAS-16NAV-A

HFC
R410A

May, 2005

Manual abstract:

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2 1.1- 5.8 220- 240V- 1Ph- 50/60Hz Cooling Heating 0.15 0.15 30 30 87 87 Cooling Heating 4.

70 4.97 1040 1100 96 96 3.27/3.72 39/39 33/34 26/28 48/50 RAS-13NKV-E (A) 275 790 218 10 20 590/620 RAS-13NAV-E (A) 550 780 270 36 750 (A) (W) (%) (A) (W) (%) COP (Cooling / Heating) Operation noise Indoor High (Cooling / Heating) (dB A) Medium (Cooling / Heating) (dB A) Low (Cooling / Heating) (dB A) Outdoor (Cooling / Heating) (dB A) Indoor unit Unit model Dimension Height (mm) Width (mm) Depth (mm) Net weight (kg) Fan motor output (W) Air flow rate (Cooling / Heating) (m3/h) Outdoor unit Unit model Dimension Height (mm) Width (mm) Depth (mm) Net weight (kg) Compressor Motor output (W) Type Single rotary type with DC-inverter variable speed control Model DA89X1F-23F Fan motor output (W) 43 Air flow rate (Cooling / Heating) (m3/h) 2410/2410 Piping connection Type Flare connection Indoor unit Liquid side 6.35 Gas side 9.

52 Outdoor unit Liquid side 6.35 Gas side 9.52 Maximum length (Per unit) 15 (m) Maximum chargeless length (m) 15 Maximum height difference (m) 10 Refrigerant Name of refrigerant R410A Weight (kg) 0.8 Wiring connection Power supply 3 Wires:includes earth (Outdoor) Interconnection 4 Wires:includes earth Usable temperature range Indoor (Cooling / Heating) (C) 21 - 32 / Up to 27 C Outdoor (Cooling / Heating) (C) 15 - 43 / - 10 - 24 The specification may be subject to change without notice for purpose of improvement. 3 FILE NO. SVM-05027 Unit model Indoor Outdoor Cooling capacity Cooling capacity range Heating capacity Heating capacity range Power supply Indoor Electric characteristics Outdoor (kW) (kW) (kW) (kW) Operation mode Running current Power consumption Power factor Operation mode Running current Power consumption Power factor RAS-16NKV-E (A) RAS-16NAV-E (A) 4.62 1.2- 5.2 5.9 1.

3- 7.4 1 Ph, 50Hz~ 220- 240V / 60Hz~220V Cooling Heating 0.2 0.2 30 30 65 65 Cooling Heating 7.20 7.60 1590 1700 96 97 2.85/3.41 45/44 40/40 34/34 51/53 RAS-16NKV-E (A) 275 790 218 10 30 760/780 RAS-16NAV-E (A) 550 780 270 39 1100 Twin rotary type with DC-inverter variable speed control (A) (W) (%) (A) (W) (%) COP (Cooling / Heating) Operation noise Indoor High (Cooling / Heating) (dB A) Medium (Cooling / Heating) (dB A) Low (Cooling / Heating) (dB A) Outdoor (Cooling / Heating) (dB A) Indoor unit Unit model Dimension Height (mm) Width (mm) Depth (mm) Net weight (kg) Fan motor output (W) Air flow rate (Cooling / Heating) (m3/h) Outdoor unit Unit model Dimension Height (mm) Width (mm) Depth (mm) Net weight (kg) Compressor Motor output (W) Type Model Fan motor output (W) Air flow rate (Cooling / Heating) (m3/h) Piping connection Type Indoor unit Liquid side Gas side Outdoor unit Liquid side Gas side Maximum length (Per unit) (m) Maximum chargeless length (m) Maximum height difference (m) Refrigerant Name of refrigerant Weight (kg) Wiring connection Power supply Interconnection Usable temperature range Indoor (Cooling / Heating) (C) Outdoor (Cooling / Heating) (C) DA130A1F-24F 43 2410/2410 Flare connection 6.35 12.7 6.

35 12.7 15 15 10 R410A 0.95 3 Wires:includes earth (Outdoor) 4 Wires:includes earth 21 - 32 / Up to 27 C 15 - 43 / - 10 - 24 The specification may be subject to change without notice for purpose of improvement. 4 FILE NO. SVM-05027 1-2.

*Operation Characteristic Curve <Cooling> 10 <Heating> 10 8 16NAV 8 16NAV Current (A) 6 Current (A) Conditions Indoor : DB 27C/WB 19C Outdoor : DB 35C Air flow : High Pipe lenght : 5 m Voltage : 230V 6 4 4 Conditions Indoor : DB 20C Outdoor : DB 7C/WB 6C Air flow : High Pipe lenght : 5 m Voltage : 230V 2 13NAV 2 13NAV 0 0 20 40 60 80 100 120 0 0 20 40 60 80 100 120 Compressor speed (rps) Compressor speed (rps) 1-3. Capacity Variation Ratio According to Temperature <Cooling> 105 100 95 90 Capacity ratio (%) <Heating> 120 Current Limited Start 110 100 90 85 80 75 70 65 60 55 Conditions Indoor : DB27C/WB19C Indoor air flow : High Pipe length 5m Capacity ratio (%) 80 70 60 50 40 30 20 10 Conditions Indoor : DB 20C Indoor air flow : High Pipe length : 5m 50 32 33 34 35 36 37 38 39 40 41 42 43 Outdoor temp. (C) 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) * Capacity ratio : 100% = Nominal Capacity 5 FILE NO. SVM-05027 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 of 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 FILE NO. SVM-05027 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 2-2-6 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 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 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 7 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 d) Flare Processing Make certain that a clamp 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 Whether conventional equipment can be used *(Note 1) *(Note 1) *(Note 1) Conventional air conditioner installation Whether new equipment can be used with conventional refrigerant 1 2 Flare tool Pipe flaring Copper pipe gauge Flaring by for adjusting projection conventional flare margin tool Torque wrench (For 12.*

70) Gauge manifold Charge hose Connection of flare nut Evacuating, refrigerant charge, run check, etc. 3 4 5 6 7 8 9 ! 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 (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 (4) Reamer (9) Hole core drill (65) Use vacuum pump by (5) Pipe bender (10) Hexagon wrench attaching vacuum pump adapter. (6) Level vial (Opposite side 5 mm) (2) Torque wrench (For 6.35) (7) Screwdriver (+,) (11) Tape measure (3) Pipe cutter (8) Spanner of Monkey wrench (12) Metal saw Also prepare the following equipments for other installation method and run check.

(1) Clamp meter (3) Insulation resistance tester (2) Thermometer (4) Electroscope 10 FILE NO. SVM-05027 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. 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 packed valve service port at the outdoor unit's gas side. 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. 2-4-1 Configuration of refrigerant charging 11 FILE NO.

SVM-05027 1 Be sure to make setting so that liquid can be charged. 2 When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down. It is necessary for charging refrigerant under condition of liquid because R410A is mixed type of refrigerant. Accordingly, when charging refrigerant from the refrigerant cylinder to the equipment, charge it turning the cylinder upside down if cylinder is not equipped with siphon. [Cylinder with siphon] Gauge manifold OUTDOOR unit [Cylinder without siphon] Gauge manifold OUTDOOR unit Refrigerant cylinder Electronic balance Refrigerant cylinder Electronic balance Siphon R410A refrigerant is HFC mixed refrigerant.

Therefore, if it is charged with gas, the composition of the charged refrigerant changes and the characteristics of the equipment varies. Fig. 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. 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. 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 FILE NO. SVM-05027 (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 800C. 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 Used brazing filler Used flux Do not use Paste flux Vapor flux From Nitrogen cylinder Nitrogen gas cylinder 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 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 into 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 (0.2 kgf/ cm2) by means of the reducing valve. 6 After performing the steps above, keep the Nitrogen gas flowing until the pipe cools down to a certain extent (temperature at which pipes are touchable with hands). 7 Remove the flux completely after brazing. M Flow meter Stop valve Copper - Copper Phosphor copper Copper - Iron Iron - Iron Silver Silver 1 Do not enter flux into the refrigeration cycle. 2 When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chlorine.

3 When adding water to the flux, use water which does not contain chlorine (e.g. distilled water or ion-exchange water). 4 Remove the flux after brazing. Pipe Nitrogen gas Rubber plug Fig. 2-5-1 Prevention of oxidation during brazing 13 FILE NO. SVM-05027 3. CONSTRUCTION VIEWS 3-1. Indoor Unit Front panel Air inlet Air filter Heat exchanger 790 218 275 60 Air outlet 48 6 Knock out system Knock out system 64 53 120 590 Hanger 80 Drain hose (0.54m) Hanger 320 Connecting pipe (0.

43m) (Flare 6.35) Connecting pipe (0.33m) (For 13 series ; Flare 9.52 For 16 series ; Flare 12.7) 235 215 For stud bolt (8~10) For stud bolt (6) 620 235 215 Minimum distance to ceiling 65 or more Hanger 26 48 45 275 190 Minimum distance to ceiling Minimum distance to ceiling 45 170 or more 170 or more Hanger 90 150 160 160 Hanger 32 40 57 18 90 150 Installation plate outline Center line Wireless remote control 14 160 6 60 FILE NO.

SVM-05027 3-2. Outdoor Unit A A Detail drawing (Back Leg) 600 6 Hole 310 302 52 36 32.5 115 125 B Detail drawing (Front Leg) 310 302 36 52 102 310 302 R15 6 Hole 11 x 14 Hole R5.5 30 Drain outlet B 2-11 x 14 Hole (For 8-10 anchor bolt) R15 436 FAN GUARD COVER PV 530 Z 270 265 600 780 90 62 310 330 Electrical part cover Liquid side (Flare 6.

35) Gas side (Flare 9.
52 : For RAS-13NAV-E,NAV-A) (Flare 12.7 : For RAS-16NAV-E,NAV-A) 120 75 Z View Installation dimension 100 or more 310 600 Air inlet 600 or more Service port 100 or more Air outlet 600 or more 54 4 x 11 x 14 Long holes (For 8 - 10 anchorbolt) 15 FILE NO. SVM-05027 4. WIRING DIAGRAM 4-1. Indoor Unit (For 13NKV) COLOR INDICATION BRW RED WHI YEL BLU BLK GRY PNK ORN GRN&YEL GRN : : : : : : : : : : BROWN RED WHITE YELLOW BLUE BLACK GRAY PINK ORANGE GREEN & YELLOW GREEN TERMINAL BLOCK 2 1 BLK W HI RED INDOOR OUTDOOR UNIT UNIT BLK BLK CN01 (BLU) CN24 CN23 CN21 HEAT EXCHANGER SENSOR CN03 (W HI) (TC) BLK BLK 11 22 LINE FILTER Power supply circuit 5 CN07 (W HI) +12 VDC +5 VDC FUSE THERMO SENSOR (TA) CN25 (W HI) 11 22 T3.15A 250VAC F01 3 R04 Fan Motor Drive circuit BLU BLU BLU BLU BLU BLU BLU BLU BLU BLU 10 10 10 10 WHI 11 11 11 11 CN13 (W HI) 11 22 33 44 55 W HI YEL YEL YEL YEL 11 22 33 44 55 INFRARED RAYS RECEIVING AND INDICATING PARTS 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 LOUVER MOTOR CN11 123 123 CN10 5 5 3 3 BLK 1 1 RED 6 YEL GRY BRW MAIN P.C. BOARD WP-004 CN08 123456 123456 150C MCC-861 1 4 1234 HA JEM-A WHI AC FAN MOTOR Simple Check for Failure Diagnosis Check Item Diagnosis Result 1 Check to see if the OPERATION indicator goes on OPERATION and off when the main switch or breaker is turned on. INDICATOR (Check the primary and secondary voltage of the transformer.) 2 Check the power supply voltage between 1 and 2 .

(Refer to the name plate.) TERMINAL (Check the primary and secondary voltage of the BLOCK transformer.) Check the fluctuating voltage between 2 and 3 . (15~60VDC) FUSE Check to see if the fuse blows out. 3.15A (Check the R04 of the varistor.) 3 4 Check the voltage at the No.4 pin on CN13 connector DC5V of the infrared receiver. (Check the transformer and the power supply circuit of the rated voltage.) 5 Check the voltage at the white lead of the louver DC12V motor.
(Check the transformer and the power supply circuit of the rated voltage.) 6 (AC 220~240V) Check the voltage at the No.1 pin on CN10 connector and CN24. (Check the F01) Refer to the service data for the detailed failure diagnosis. 16 FILE NO.
SVM-05027 4-2. Indoor Unit (For 16NKV) COLOR INDICATION BRW : RED : WHI : YEL : BLU : BLK : GRY : PNK : ORN : GRN&YEL : GRN : BROWN RED WHITE YELLOW BLUE BLACK GRAY PINK ORANGE GREEN & YELLOW GREEN TERMINAL BLOCK 2 BLK 123 WHI RED INDOOR OUTDOOR UNIT UNIT BLK BLK CN01 (BLU) CN24 CN23 CN21 HEAT EXCHANGER SENSOR CN03 (WHI) (TC) BLK BLK 11 22 6 CN10 (WHI) FAN MOTOR RED BLK WHI YEL BLU 11 FUSE THERMO SENSOR (TA) 11 22 T3.15A 250VAC F01 3 LINE FILTER DC5V DC12V 3 4 5 6 3 4 5 6 DC MOTOR CN13 (WHI) BLU BLU BLU BLU BLU BLU BLU BLU BLU BLU 10 10 10 10 WHI 11 11 11 11 INFRARED RAYS RECEIVING AND INDICATING PARTS 1 2 3 4 5 6 7 8 9 CN25 (WHI) 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 R05 DB01 R04 ~ ~ POWER SUPPLY CIRCUIT 5 CN07 (WHI) + + MAIN P.C. BOARD MCC-867or MCC-5014 C03 1 2 3 4 5 1 2 3 4 5 WHI YEL YEL YEL YEL 11 22 33 44 55 MCC-861 1 4 1234 HA JEM-A CN08 LOUVER MOTOR Simple Check for Failure Diagnosis Check Item Diagnosis Result 1 Check to see if the OPERATION indicator goes on OPERATION and off when the main switch or breaker is turned on.
INDICATOR (Check the primary and secondary voltage of the transformer.) Check the power supply voltage between 1 and 2 . (Refer to the name plate.) TERMINAL (Check the primary and secondary voltage of the BLOCK transformer.) Check the fluctuating voltage between 2 and 3 . (15 60VDC) 2 ~ 3 FUSE Check to see if the fuse blows out. 3.15A (Check the R04 of the varistor.) 4 Check the voltage at the No.4 pin on CN13 connector DC5V of the infrared receiver.

(Check the transformer and the power supply circuit of the rated voltage.) 5 Check the voltage at the white lead of the louver DC12V motor. (Check the transformer and the power supply circuit of the rated voltage.) ~ Refer to the service data for the detailed failure diagnosis. 17 Check the voltage at the No.1 pin on CN10 DC325V connector. (Check the DB01, R05 and C03.) (DC310 340V) 6 FILE NO. SVM-05027 4-2. Outdoor Unit 18 FILE NO. SVM-05027 5. SPECIFICATION OF ELECTRICAL PARTS 5-1. Indoor Unit (For 13NKV) No. 1 2 3 4 5 6 7 8 9 10 11 12 13 Parts name Fan motor (for indoor) Thermo. sensor (TA-sensor) AC-AC transformer (T01) Microcomputer Heat exchanger sensor (TC-sensor) Line filter (L01) Diode (DB01) Capacitor (C50) Fuse (F01) Regulator IC (IC08) Regulator IC (IC11) Varistor (R21, R109) Louver motor Type SKF-220-20-4A-1 ------ TT-10 Specifications AC Motor with 150C thermo fuse 10 k at 25C 187 - 276V, 6VA PD780024AGK ------ SS11V-06270 KBP06M 10 k at 25C 27 H, AC 0.
64A 1.5A, 420V 2200F, 35 V T3.15A, 250 V 12VDC, 1.5A max 5VDC, 1.5A max 560V DC 12V LXV35VB2200MJ20 BET 3.
15A, 250VAC NJM7812 NJM7805 15G561K 24BYJ48 5-2. Incoor Unit (For 16NKV) No. 1 2 3 4 5 6 7 8 9 10 11 12 13 Parts name Fan motor (for indoor) Thermo. sensor (TA-sensor) DC-DC transformer (T01) Microcomputer Heat exchanger sensor (TC-sensor) Line filter (L01 Diode (DB01) Capacitor (C03) Fuse (F01) Power supply IC (IC01) Varistor (R21, R109) Resistor (R01) Louver motor Type ICF-340-30-2 ------ SWT-70 PD780024AGK ------ SS11V-06270 D3SBA60 KMH450VSSN120M25C FCU250V, 3.15A STR-L472 15G561K RF-5TK4R7 24BYJ48 560 V 4.7, 5 W DC 12V Specifications DC 340 V, 30 W 10 k at 25C DC 390 V, Secondary DC 15 V, 12 V, 7 V 10 k at 25C 27mH, AC 0.6A 4A, 600 V 120F, 450 V T3.15A, 250 V 19 FILE NO. SVM-05027 5-3. Outdoor Unit (For 13NAV) No.

1 Parts name SC coil L01 Model name ADR2516-0R6TB 15A, 0.6mH Rating 20A, 0.15mH Primary side DC280V, Secondary side 7.0 V x 1, 12V x 1, 17V x 2 L=10mH, 16A x 2 DC140V, 43W 10 k (25C) 62 k (20C) 10 k (25C) 10 k (25C) (Noise filter) 2 3 4 5 L03 ADR2510-020 T4B SWT-72 CH-57-Z-T ICF-140-43-4 (Inverter attached) (Inverter attached) (Inverter attached) (Inverter attached) DC-DC transformer Reactor Outside fan motor Fan control relay (TS sensor) Discharge temp. sensor (TD sensor) Outside air temp. sensor (TO sensor) Heat exchanger temp. sensor (TE sensor) Terminal block (6P) Fuse Electrolytic capacitor IGBT 6 7 8 9 10 11 12 JXO-6B For protection of switching power source For protection of inverter input overcurrent LLQ2G761KHUBTF GT20J321 30A, 600 VAC 3.15A, AC 250 V 25A, AC 250 V 760F, DC 400 V x 3 pieces 20A, 600 V 13 15 Compressor Rectifier DA89X1F-23F D25XB60-4001 3-phases 4-poles 1100 W 20A, 600V 20 FILE NO. SVM-05027 5-4. Outdoor Unit (For 16NAV) No.

1 Parts name SC coil L01 Model name ADR2516-0R6TB 15A, 0.6m H Rating 20A, 0.15mH Primary side DC280V, Secondary side 7.0 V x 1, 12 V x 1, 17V x 2 L=10mH, 16A x 2 DC140 V, 43 W 10 k (25C) 62 k (20C) 10 k (25C) 10 k (25C) (Noise filter) 2 3 4 5 L03 ADR2520-R15TB SWT-72 CH-57-Z-T ICF-140-43-4 (Inverter attached) (Inverter attached) (Inverter attached) (Inverter attached) DC-DC transformer Reactor Outside 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) Fuse Electrolytic capacitor IGBT 6 7 8 9 10 11 12 JXO-6B For protection of switching power source For protection of inverter input overcurrent LLQ2G761KHUBTF GT20J321 30A, 600 VAC 3.15A, AC 250 V 25A, AC 250 V 760F, DC 400 V x 3 pieces 20A, 600 V 13 14 Compressor Rectifier DA89X1F-23F D25XB60-4001 3-phases 4-poles 1100 W 20A, 600 V, 21 FILE NO. SVM-05027 6.

REFRIGERANT CYCLE DIAGRAM 6-1. Refrigerant Cycle Diagram RAS-13NKV-E / RAS-13NAV-E RAS-13NKV-A / RAS-13NAV-A INDOOR UNIT Indoor heat exchanger T1 Temp. measurement Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port Allowable pipe length Allowable height difference : 10m Strainer NOTE : Deoxidized copper pipe Outer dia. : 6.35 mm Thickness : 0.8 mm Sectional shape of heat insulator Max. : 15 m Deoxidized copper pipe Outer dia. : 9.52 mm Thickness : 0.8 mm Muffler 4-way valve (CHV-0213) Muffler TD Pulse modulating valve at liquid side (SEV16RC3) Compressor DA89X1F-23F TS TO Outdoor heat exchanger Split capillary 1.

5 x 200s 1.5 x 200s TE Temp. measurement T2 Propeller fan Refrigerant amount : 0.8 kg Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT Note : The maximum length of the pipe for this air conditioner is 15 m. The additional charging of refrigerant is unnecessary because this air conditioner is designed with charge-less specification. 22 FILE NO. SVM-05027 RAS-16NKV-E / RAS-16NAV-E RAS-16NKV-A / RAS-16NAV-A INDOOR UNIT Indoor heat exchanger T1 Temp. measurement Cross flow fan P Pressure measurement Gauge attaching port Vacuum pump connecting port Allowable pipe length Allowable height difference : 10m Strainer NOTE : Deoxidized copper pipe Outer dia. : 6.35 mm Thickness : 0.

8 mm Sectional shape of heat insulator Max. : 15 m Deoxidized copper pipe Outer dia. : 12.7 mm Thickness : 0.8 mm Muffler 4-way valve (CHV-0213) Muffler TD Pulse modulating valve at liquid side (SEV16RC3) Compressor DA130A1F-24F TS TO Outdoor heat exchanger Split capillary 1.

5 x 200s 1.5 x 200s TE Temp. measurement T2 Propeller fan Refrigerant amount : 0.95 kg Gas leak check position Refrigerant flow (Cooling) Refrigerant flow (Heating) OUTDOOR UNIT Note : The maximum length of the pipe for this air conditioner is 15 m. The additional charging of refrigerant is unnecessary because this air conditioner is designed with charge-less specification.

23 FILE NO. SVM-05027 RAS-13NKV-E / RAS-13NAV-E RAS-13NKV-A / RAS-13NAV-A <Cooling> Temperature condition (C) Indoor 27/19 Outdoor 35/- Standard pressure P (MPa) 0.8 to 1.0 Heat exchanger pipe temp. T1 (C) 9 to 11 T2 (C) 49 to 45 Indoor fan mode High Outdoor fan mode High Compressor revolution (rps) 77 6-2. Operation Data <Heating> Temperature condition (C) Indoor 20/- Outdoor 7/6 Standard pressure P (MPa) 2.5 to 2.7 Heat exchanger pipe temp. T1 (C) 42 to 44 T2 (C) 0 to 3 Indoor fan mode High Outdoor fan mode High Compressor revolution (rps) 80 RAS-16NKV-E / RAS-16NAV-E RAS-16NKV-A / RAS-16NAV-A <Cooling> Temperature condition (C) Indoor 27/19 Outdoor 35/- Standard pressure P (MPa) 0.9 to 1.

2 Heat exchanger pipe temp. T1 (C) 79 to 10 T2 (C) 50 to 45 Indoor fan mode High Outdoor fan mode High Compressor revolution (rps) 77 <Heating> Temperature condition (C) Indoor 20/- Outdoor 7/6 Standard pressure P (MPa) 2.7 to 2.9 Heat exchanger pipe temp. T1 (C) 42 to 46 T2 (C) 0 to 3 Indoor fan mode High Outdoor fan mode High Compressor revolution (rps) 82 Note : (1) Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent. (Thermistor themometer) (2) Connecting piping condition : 5m - 24 - FILE NO. SVM-05027 7. CONTROL BLOCK DIAGRAM 7-1. Indoor Unit Indoor Unit Control Panel M.C.

U Heat Exchanger Sensor Functions Louver Control 3-minute Delay at Restart for Compressor Motor Revolution Control Operation Display Timer Display Filter Sign Display PRE DEF. Sign Display Indoor Fan Motor Louver Motor Temperature Sensor Infrared Rays Signal Receiver Initiallizing Circuit Infrared Rays 36.7KHz Processing (Temperature Processing) Timer Serial Signal Communication Clock Frequency Oscillator Circuit Remote Control Power Supply Circuit Louver ON/OFF Signal Noise Filter Louver Driver Louver Motor Serial Signal Transmitter/Receiver From Outdoor Unit Serial Signal Communication REMOTE CONTROL Infrared Rays Remote Control Operation (START/STOP) Operation Mode Selection AUTO, COOL, DRY, HEAT, FAN ONLY Temperature Setting Fan Speed Selection ON TIMER Setting OFF TIMER Setting Louver Auto Swing Louver Direction Setting ECO Hi power Filter Reset 25 For INDOOR UNIT MICRO-COMPUTER BLOCK DIAGRAM 220 - 240 V 50/60 Hz MCC813 (P.C.B) M.

C.U Rotor position detect circuit Gate drive circuit Gate drive circuit Over current detect circuit Over current sensor Rotor position detect circuit OUTDOOR UNIT Inddor unit send/receive circuit 7-2. Outdoor Unit (Inverter Assembly) Discharge temp. sensor Outdoor air temp. sensor 26 High Power factor Correction circuit Clock frequency 16MHz Input current sensor Converter (AC DC) Over current sensor Driver circuit of P.

M.V. Relay circuit Over current sensor 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 Noise Filter Inverter (DC AC) Outdoor Fan motor Inverter (DC AC) Compressor P.M.

V : Pulse Modulating Valve M.C.U : Micro Control Unit 4-way valve FILE NO. SVM-05027 P.M.V. FILE NO. SVM-05027 8. OPERATION DESCRIPTION 8-1. Outline of Air Conditioner Control This air conditioner is a capacity-variable type air conditioner.

The capacity proportional control compressor which can change the motor speed is mounted. The indoor unit motor drive circuit is mounted to the indoor unit. The compressor and the inverter to control outdoor unit 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 control, and transfers the operation command to the outdoor unit controller.

The outdoor unit controller receives operation command from the indoor unit side, and controls the outdoor fan and the pulse modulating valve. (P.M.V) Besides, detecting revolution position of the compressor motor, the outdoor unit controller controls speed of the compressor motor by controlling output voltage of the inverter and switching timing of the supply power (current transfer timing) so that motors drive according to the operation command. And then, the outdoor unit controller transfers reversely the operating status information of the outdoor unit to control the indoor unit controller.

(1) Role of indoor unit controller The indoor unit controller judges the operation commands from the remote controller and assumes the following functions. Judgment of suction air temperature of the indoor heat exchanger by using the indoor temp. sensor (TA sensor) Temperature setting of the indoor heat exchanger by using heat exchanger sensor (TC sensor) (Prevent-freezing control) Louver motor control Indoor fan motor operation control LED (Light Emitting Diode) display control Transferring of operation command signal (Serial signal) to the outdoor unit Reception of information of operation status (Serial signal including outside temp. data) to the outdoor unit and judgment/display of error (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 Operations followed to judgment of serial control signal from indoor Operation control of side. outdoor fan motor P.M.V. control 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 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 4-way valve and outdoor fan) 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. - 27 - FILE NO. SVM-05027 (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 220-240 V 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 COOL HEAT Model name 13NKV 16NKV Compressor revolution (rps) 20 to 88 20 to 90 13 to 91 13 to 106 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. 28 - FILE NO. SVM-05027 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 preventfreezing of indoor heat exchanger. 8-1-5. P.M.V.

(Pulse Modulating Valve) Using P.M.V., refrigerant flow of refrigeration cycle is varied for the optimum 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. 8-1-6. Louver control (1) Vertical air flow louvers Positions of vertical air flow louvers are automatically controlled according to the operation status (AUTO (A), COOL ( ), DRY ( ), HEAT( ) and FAN ONLY ( ).

Besides, positions of vertical air flow louvers can be arbitrarily set by pushing the [FIX] button. (2) Swing If the [SWING] button is pressed during running operation, vertical air flow louvers start swinging.

When the [SWING] button is pushed, swinging stops. 8-1.7. Indoor fan control (1) The indoor fan is operated by the stepless speed change motor. (2) For air flow level, speed of the indoor fan motor is controlled in five steps (LOW, LOW+, MED, MED+ and HIGH).

If AUTO mode is selected, the fan motor speed is automatically controlled by the difference between the preset temperature and the room temperature. LOW+ = LOW+MED 2 MED+ = MED+HIGH 2 Table 8-1-2 Operation mode Fan mode H M+ Remote Control HIGH MED+ MED LOW+ LOW Cooling and Fan only M L+ L LL+ L LUL SUL H M+ M Dry HIGH MED+ MED LOW+ LOW Heating L+ L LUL SUL 13NKV Speed Air flow (m3/h) (rpm) 1210 590 1130 530 1110 520 1010 460 910 410 880 390 810 350 780 330 880 390 810 350 780 330 720 290 660 260 1290 620 1290 620 1200 570 1110 520 1020 470 1010 460 930 420 880 390 780 330 550 180 29 16NKV Speed Air flow (m3/h) (rpm) 1560 760 1430 700 1440 710 1330 640 1230 600 1230 600 1130 530 1030 470 1230 600 1130 530 1030 470 920 410 860 380 1600 780 1560 760 1510 740 1430 700 1330 640 1330 640 1230 600 1230 600 1030 470 750 310 FILE NO. SVM-05027 8-1-8. Outdoor fan control 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 38C Outdoor temp. sensor TO TO < 38C TO < 15C TO 38C ECONO. operation TO is abnormal <HEAT> Table 8-1-4 Model name Compressor revolution (rps) Outdoor temp. sensor TO ECONO. operation TO is abnormal TO 5C TO < 5C TO 5C TO < 5C To 16.8 390 650 390 390 390 13NAV and 16NAV To 57.4 650 650 390 650 650 From 58.0 840 840 650 650 840 TO < 38C TO < 15C 700 390 390 To 13.8 390 390 13NAV and 16NAV To 34.

7 840 700 390 700 390 390 700 840 840 700 From 35.3 840 840 30 FILE NO. SVM-05027 (1) Cooling capacity control The cooling capacity and room temperature Turning [ON] the breaker flashes the operation are controller by changing the compressor lamp. (1Hz) motor speed according to both the difference This is the display of power-ON (or notification of between the temperature detected by the room power failure). temperature sensor and the temperature set by When pushing [ ] button of the [TEMP] button and also any change in room remote control, receive sound is issued from the temperature. main unit, and the next operations are performed When compressor has been activated or together with opening the vertical air flow louvers. reactivated, it operates with Max.41 rps for 2 minutes, with Max.90 rps from 2 minutes to 3 8-2-1. Cooling operation minutes, and with Max.

88 rps after 3 minutes (The Remote Control [MODE] Button is Set to passed. the COOL Position) When room temperature is lower than set temperature, indoor fan motor is operated at Once the setting is made, the operation mode is fan speed L as shown in Fig. 8-2-1 while the memorized in the microcomputer so that the same outdoor unit stops. operation can be effected thereafter simply by pushing [ ] button. (2) Prevent-freezing control A cooling operation signal is transmitted to If temperature of indoor heat exchanger detected outdoor unit.

by the indoor heat exchanger sensor is 5C lower, The outdoor unit controls the outdoor fan relay compressor motor speed is gradually lowered to R01, R02 and R03, and the compressor motor prevent freezing of the indoor heat exchanger. If speed according to the operation command signal temperature is 7C or higher, return the operation sent from the indoor unit. to the above item (1). When [FAN] button is set to AUTO, the indoor fan motor operates as shown in Fig. 8-2-1.

*When (3) Current release control , [FAN] button is set to LOW , LOW+ The input current of compressor and outdoor fan + MED , MED , HIGH , the motor (Precisely inverter main circuit control motor operates with a constant air flow. section) which occupy most of air conditioner input is detected by the outdoor current sensor, and C compressor motor speed is gradually lowered so +3 that current value does not exceed 9.0A if current M+ value exceeds 9.0A. When the current value +2.5 lowers to 8.5A, return the operation to the above *1 +2 item (1). 8-2. Description of Operation Circuit (Room temp.) - (Set temp.*

*) +1.5 +1 +0.5 0 -0.5 *1 Current value (A) *1 L In normal operation 9.0 Comp. motor speed down Set temp. 8.5 Normal control Comp. motor speed keep NOTE : *1: Calculated from difference in motor speed of M+ and L, and controlled. Fig.*

8-2-1 Setting of air flow [Fan AUTO] Fig. 8-2-2 31 FILE NO. SVM-05027 (4) Limit for maximum compressor motor speed by indoor fan speed When outdoor temperature sensor detected 32C or lower, and indoor heat exchanger sensor detected 17C 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 5) Control 5 (E zone) : Nornal down of motor speed.

When TD detect value is 112C or higher, operating motor speed is down. 6) Control 6 (F zone) : Operation stop zone If TD detect value exceeds 117C during operation, stop the operation immediately. Then, restart the operation when TD detect value becomes 105C or lower. TD Zone (C) F 117 112 108 E D Air flow rate HIGH M+ MED. L, L UL, SUL RAS-13NKV / RAS-16NKV (rps) 77 65 53 30 30 rps : round per second 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.

(5) Louver control The vertical air flow louvers are automatically set to horizontal or cool memory position. When temperature of indoor heat exchanger becomes 5C 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. (6) 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 98C 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 98C or higher, operating motor speed is slowly up. 3) Control 3 (C zone) : Keep zone When TD detect value is 105C or higher, operating motor speed is not changed if raising operation speed.

4) Control 4 (D zone) : Slow down zone of motor speed. When TD detect value is 108C or higher, operating motor speed is slowly down. temperature is changed also. 98 B Slow-up zone of motor speed A Normal operation zone Fig.

8-2-3 Compressor motor speed control (7) ECONO operation control When the [ECO] button is pushed, ECONO operation is performed by restraining air flow and compressor motor speed. The set temperature is changed also. 1) The set temperature increased 0.5C per hour up to 2C starting from the set temperature when ECONO has been received. 2) Indoor air flow is controlled between L+ and UL. The compressor motor speed in control as shown in Fig. 8-2-4 Indoor Fan L+ 4.0 3.5 3.0 2.
5 2.0 1.5 1.0 0.5 0.
0 -0.5 -1.0 -1.5 -2.0 Compressor motor speed 13NAV 16NAV 40 rps 34 rps Room tepm.
- Set temp. (oC) L 22 - 40 rps 13 - 34 rps L22 rps UL OFF 13 rps Fig. 8-2-4 - 32 - FILE NO. SVM-05027 (8) COMFORT SLEET operation control. When the [COMFORT SLEEP] button is pushed, the ECONO operation activate together with the timer OFF function. Each time of pressing [COMFORT SLEEP] button the off timer setting changes in the sequence of 1, 3, 5 or 9 hours. (9) Hi POWER operation control. When the [Hi POWER] button is pushed Hi Power operation is performed by change set temperature and air flow (display on the remote control does not change). 1) Changing of set temperature. Setting temperature drop (C) -2.

0 -2.5 -3.0 -3.5 -4.0 -4.5 Hi Power Start 15 30 45 60 and After Time (min) 2) Changing of air flow (Fan setting : AUTO) When the Hi POWER is started, the fan of the indoor unit operates at higher air flow level than normal air flow AUTO (normal air flow AUTO is shown in Fig. 8-2-1). Because of the difference between room temperature and set temperature are increased automatically. 3) Changing of air flow (Fan setting : One of 5 levels) When the Hi POWER is started, the fan of the indoor unit operates at higher consecutive air flow level. (Fan speed on the display of remote control does not change) 4) Changing of louver positing If the room temperature is higher than setting temperature by 3.
5 C or more, the louver is automatically set to the maximum air flow position. If it is not, position of louver is not change. When room temperature is reach to setting temperature. The louver moves back to set position. (10) QUIET operation control.
When the [QUIET] button is pushed, the fan is restricted the revolution speed at L- level until the [QUIET] button is pushed once again (cancel QUIET operation). Remarks : QUIET operation is appropriate to work with less cooling load condition. Because of the fan speed L- may cause not enough the cooling capacity. o Fig. 8-2-5 - 33 - FILE NO.
*SVM-05027 [Basic control] 8-2-2. DRY operation (The Remote Control [MODE] Button is Set to the DRY Position) Set temp. -0.5 Once the setting is made, the operation mode is -1 memorized in the microcomputer so that the same -1.5 *1 operation can be effected thereafter simply by -2 *2 pushing [ ] button. Dry operation signal is transmitted to outdoor unit. M+ The Cooling operation giving priority to dehumidifying, which restrains the indoor fan speed -5.0 and compressor motor speed, is performed. -5.5 The indoor fan motor operates as shown in HIGH [FAN AUTO] Fig.*

*8-2-6. (Fan speed is AUTO only.) The outdoor fan motor operates as described in *1,*2 : Approximate revolution speed of M+ and L to Table 8-1-3, and the compressor motor speed linear accordingly to temperature. according to the operation command signal sent from the indoor unit. Fig. 8-2-7 Setting of air flow +2.5 0 LOW (Room temp.) - (Set temp.) [Cold draft preventing control] +2.0 +1.*
*5 *1 +1.0 SUL +0.5 0 -0.5 L- The upper limit of fan revolution speed is shown below. (Room temp.*
*) - (Set temp.) HIGH 44 43 33 32 Approximate revolution speed of HIGH and SUL linear by Tc. Set temp. 31 30 *2 A+4 A-8 FAN AUTO 20 19 *2 A+4 A-8 Starting of FAN Manual 3 SUL* SUL (NOTE : *1) Stop NOTE : *1 : Middle motor speed between L and SUL Fig. 8-2-6 Setting of air flow Fig.*
*8-2-8 Cold draft preventing control 8-2-3. Heating operation NOTES : Transferring of heat operation signal from indoor unit to *1 : Stops for 2 minutes after thermostat-OFF. outdoor unit starts. *2 : 24C when the set temp. is 24C or more The indoor fan motor operates by the room Set temp. when the set temp. is below 24C temperature when selecting "AUTO" of "FAN" as shown *3 : SUL : Super ultra low in Fig. 8-2-7, 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. 8-2-8) and starting of FAN Manual.*

34 FILE NO. SVM-05027 Outside air temp. (C) [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 3C or lower than set temp. In stability When 12 to 25 minutes passed after operation start and room temp. is higher than (set temp. 3C) When 25 minutes or more passed after operation start TO 16.0 15.5 11.0 10.
5 16NAV / 13NAV 9.8A / 10.8A 9.8A / 10.8A 9.
8A / 10.8A FAN AUTO Fig. 8-2-9 (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 20C 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 7C or lower and temperature lowered by 2.5C 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 -5C or lower and temperature lowered by 3.0C 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. 1 Setting on remote control, HEAT (mode), HIGH (Fan), 30C (temp.).

2 Room temp. is 19C to 24C, and outside air temp. is 5C or lower. 3 Defrost operation has been already performed once. FAN Manual Room temp. < Set Room temp. Set temp. 3.5C temp. 4C 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 4-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 55C or higher, compressor motor speed is gradually lowered to prevent over-temp. rising of compressed pressure. If temperature becomes below 48C, 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 occupies 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. 8-2-9 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). 35 FILE NO. SVM-05027 2) Defrost operation Operation of the compressor is stopped once, turn off power coupler for 4-way valves after 10 seconds, and then exchange the 4-way valves. 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 38C, stop the indoor fan. 3) Defrost reset Resetting operation from defrost to heating is performed when anyone of the following conditions is satisfied. a. Temperature of the outdoor heat exchanger rose to +8C or higher. b. A status that temperature of the outdoor heat exchanger is +5C or higher continued for 80 seconds. c. Defrost operation continued for 15 minutes. In resetting defrost operation, the compressor stops for 50 seconds if defrost has started under condition a.
to c. in item1), but the compressor is reset to heating operation keeping operated if defrost has started under condition d. in item 1). (5) Louver control 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.
(6) ECONO operation control. When the [ECO] button is pushed, ECONO operation is performed by restraining air flow and compressor moter speed. 1) The indoor fan speed is controlled within Las maximum speed. 2) Compressor motor speed is controlled by the difference value of room temperature and set temperature as shown in Fig. 8-2-10 The different value of room temperature and set temperature are separated to A, B and C zone.
Then compressor motor speed in each zone are controlled by different speed. After 30 minutes passed, the different value of room temperature and set temperature is separated zone again by more different value than before. Then compressor motor speed after 30 minute passed is lower than before by the same different value of room temperature and set temperature. 0.0 -0.5 -1.0 -1.5 -2.0 -2.5 A-Zone Room tepm.

- Set temp. (C) B-Zone o Zone A-Zone 13NAV 16NAV C-Zone -5.0 -5.5 A 20 rps 13 rps B-Zone B -11.0 -11.5 30 Min C-Zone Time C 20-45 rps 45 rps 13-43 rps 43 rps Fig. 8-2-10 (7) COMFORT SLEEP operation control. When the [COMFORT SLEEP] button is pushed, the ECONO operation actrvate together with the timer OFF function. Each time of pressing [COMFORT SLEEP] button the off timer setting changes in the sequence of 1, 3, 5 or 9 hours. (8) Hi POWER operation control.
When the [Hi POWER] button is pushed Hi Power operation is performed by changing setting temperature and air flow (display on the remote control does not change). 1) Changing of setting temperature. Setting temperature increase (oC) +4.0 +3.5 +3.
0 +2.5 +2.0 +1.5 Hi Power Start 15 30 45 60 and After Time (min) Fig. 8-2-11 2) Changing of air flow (Fan setting : AUTO) When the Hi POWER is started, the fan of the indoor unit operates at higher air flow level than normal air flow AUTO (normal air flow AUTO is shown in Fig.
8-2-7). Because of the difference between room temperature and setting temperature are increased automatically. 3) Changing of air flow (Fan setting : One of 5 levels) When the Hi POWER is started, the fan of the indoor unit operates at higher consecutive air flow level. (Fan speed on the display of remote control does not change) - 36 - FILE NO. SVM-05027 (9) QUIET operation control. When the [QUIET] button is pushed, the fan is restricted the revolution speed at L- level until the [QUIET] button is pushed once again (cancel QUIET operation). Remarks : QUIET operation is appropriate to work with less heating load condition. Because of the fan speed L- may cause not enough the heating capacity. 8-3. Temporary Operation Temporary Auto operation, existence of Auto Restart, and Temporary Cooling operation can be set by the [RESET] button of the indoor controller.

RESET 8-2-4. Automatic operation (1) As shown in Fig. 8-2-12, the operation mode (COOL, DRY, HEAT) is selected according to the Preset temperature and room temperature when the operation has started. - If room temperature is higher than 1C of perset temperature. "Cooling" operation is performed. - If room temperture is within 1C of perset temperature. "Fan only" operation is performed. (at UL speed). - If room temperture is lower than 1C of perset temperture. "Heating operation is performed.
Ta Ts+1 Ts Ts-1 Cool Operation Fan Only Heat Operation Fig. 8-3-1 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 8-3-1. Temporary auto operation When the [RESET] button is pushed, the Auto operation with set temperature fixed at 25C starts. Controlling is same as that of Auto operation by the remote controller. When the [RESET] 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. Fig. 8-2-12 8-3-2. Temporary cooling operation When the [RESET] operation button keeps pushed for 10 seconds, Cooling operation of which compressor motor speed and the indoor fan speed are fixed starts.
Compressor motor speed : 30 rps Indoor fan speed : Low When the [RESET] operation button is pushed again, the operation stops. Auto Restart function is unavailable. - 37 - FILE NO. SVM-05027 8-4. Auto Restart Function The indoor unit is equipped with an automatic restarting function which allows the unit to restart operating with the set operating conditions in the event of power supply being accidentally shut down. The operation will resume without warning three minutes after power is restored. This function is not set to work when shipped from the factory. Therefore it is necessary to set it to work. 8-4-1. How to set auto restart function To set the auto restart function, proceed as follows: The power supply to the unit must be on; the function will not set if the power is off.