MITSUBISHI ELECTRIC

P-SERIES

Air Conditioners

PVA-AA12,18, 24, 30, 36, 42, 48NL*

SERVICE MANUAL

For use with R454B

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1. Safety Precautions

Always observe for safety!
Before obtaining access to terminal, all supply circuits must be disconnected.

1.1. Symbols used in the text

WARNING

Describes precautions that should be observed to prevent danger of injury or death to the user.

CAUTION

Describes precautions that should be observed to prevent damage to the unit.

FLAMMABLE REFRIGERANT WARNING

This unit uses a flammable refrigerant. If refrigerant leaks and comes in contact with fire or heating part, it will create harmful gas and there is risk of fire.

: Indicates a part which must be grounded.

Meaning of symbols displayed on unit			
	Refrigerant Safety Group **A2L**	**Warning!** (Risk of fire)	**<u>This unit uses a flammable refrigerant.</u>** If refrigerant leaks and comes in contact with fire or heating part, it will create harmful gas and there is risk of fire.
	Read the OPERATING INSTRUCTIONS carefully before operation.		
	Service personnel are required to carefully read the OPERATING INSTRUCTIONS and INSTALLATION MANUAL before operation.		
	Further information is available in the OPERATING INSTRUCTIONS, INSTALLATION MANUAL, and the like.		

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1.2. Cautions for service

CAUTION

1. Perform service after recovering the refrigerant left in unit completely.
2. Do not release refrigerant in the air.
3. After completing service, charge the cycle with specified amount of refrigerant.

1.3. Warning for service

WARNING

1. Do not alter the unit.
2. For installation and relocation work, follow the instructions in the Installation Manual and use tools and pipe components specifically made for use with refrigerant specified in the outdoor unit installation manual.
3. Ask a dealer or an authorized technician to install, relocate and repair the unit.
4. This unit should be installed in rooms which exceed the floor space specified in outdoor unit installation manual. Refer to outdoor unit installation manual.
5. Refrigerant pipes connection shall be accessible for maintenance purposes.
6. If the air conditioner is installed in a small room or closed room, measures must be taken to prevent the refrigerant concentration in the room from exceeding the safety limit in the event of refrigerant leakage. Should the refrigerant leak and cause the concentration limit to be exceeded, hazards due to lack of oxygen in the room may result.
7. Keep gas-burning appliances, electric heaters, and other fire sources (ignition sources) away from the location where installation, repair, and other air conditioner work will be performed. If refrigerant comes into contact with a flame, poisonous gases will be released.
8. When installing or relocating, or servicing the air conditioner, use only the specified refrigerant written on outdoor unit to charge the refrigerant lines. Do not mix it with any other refrigerant and do not allow air to remain in the lines. If air is mixed with the refrigerant, then it can be the cause of abnormal high pressure in the refrigerant line, and may result in an explosion and other hazards.
9. After installation has been completed, check for refrigerant leaks. If refrigerant leaks into the room and comes into contact with the flame of a heater or portable cooking range, poisonous gases will be released.
10. Do not use low temperature solder alloy in case of brazing the refrigerant pipes.
11. When performing brazing work, be sure to ventilate the room sufficiently. Make sure that there are no hazardous or flammable materials nearby. When performing the work in a closed room, small room, or similar location, make sure that there are no refrigerant leaks before performing the work. If refrigerant leaks and accumulates, it may ignite or poisonous gases may be released.
12. Do not install the unit in places where refrigerant may build-up or places with poor ventilation such as a semi-basement or a sunken place in outdoor: Refrigerant is heavier than air, and inclined to fall away from the leak source.
13. Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
14. The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an

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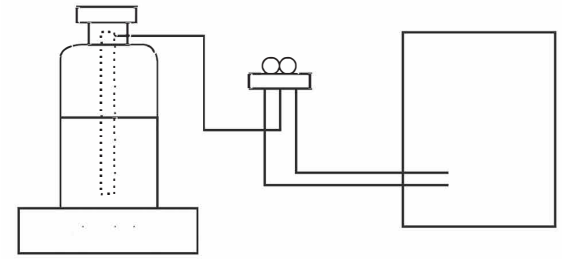
operating gas appliance or an operating electric heater).
15. Do not pierce or burn.
16. Be aware that refrigerants may not contain an odor.
17. Pipe-work shall be protected from physical damage.
18. The installation of pipe-work shall be kept to a minimum.
19. Compliance with national gas regulations shall be observed.
20. Keep any required ventilation openings clear of obstruction.
21. Servicing shall be performed only as recommended by the manufacturer.
22. The appliance shall be stored in a well-ventilated area where the room size corresponds to the room area as specified for operation.
23. Maintenance, service, and repair operations shall be performed by authorized technician with required.

1.4. Additional refrigerant charge

(When charging directly from cylinder.)

1. Check that cylinder for R454B available on the market is a siphon type.
2. Charging should be performed with the cylinder of siphon stood vertically. (Refrigerant is charged from liquid phase.)



Electronic weighing scale Unit

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1.5. Service tools

Use the below service tools as exclusive tools for R454B refrigerant.

No.	Tool name	Specifications
①	Gauge manifold	Specifications • Only for R454B • Use the existing fitting specifications. (UNF1/2) • Use high-tension side pressure of 768.7 PSIG [5.3 MPa.G] or over.
②	Charge hose	• Only for R454B • Use pressure performance of 738.2 PSIG [5.09 MPa.G] or over.
③	Electronic weighing scale	-
④	Gas leak detector	• Use the detector for R454B.
⑤	Adapter for reverse flow check	• Attach on vacuum pump.
⑥	Refrigerant charge base	-
⑦	Refrigerant cylinder	• Only for R454B • Cylinder with siphon
⑧	Refrigerant recovery equipment	-

2. Refrigerant R454B

FLAMMABLE REFRIGERANT WARNING

- Refrigerant is FLAMMABLE and may cause INJURY, DEATH, or significant DAMAGE to equipment if improperly handled.
  - Carefully read all labels affixed to the unit.
  - Carefully read and follow all safety precautions for the unit.
  - Verify any person performing work near where flammable refrigerant is used is properly informed prior to work commencing of the risks and safety precautions associated with flammable refrigerant and the nature of the work being done.

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2.1. Cautions related to new refrigerant

Cautions for units utilizing refrigerant R454B

⚠ CAUTION

Do not use the existing refrigerant piping.
Contamination inside refrigerant piping can cause deterioration of refrigerant oil etc.

Make sure that the inside and outside of refrigerant piping is clean and it has no contamination such as sulfur hazardous for use, oxides, dirt, shaving particles, etc., which are hazard to refrigerant cycle. In addition, use pipes with specified thickness.
Contamination inside refrigerant piping can cause deterioration of refrigerant oil etc.

Store the piping to be used indoors during installation and both ends of the piping sealed until just before brazing. (Leave elbow joints, etc. in their packaging.)
If dirt, dust or moisture enters into refrigerant cycle, that can cause deterioration of refrigerant oil or malfunction of compressor.

The refrigerant oil applied to flare and flange connections must be ester oil, ether oil or alkylbenzene oil in a small amount.
If large amount of mineral oil enters, that can cause deterioration of refrigerant oil, etc.

Charge refrigerant from liquid phase of gas cylinder.
If the refrigerant is charged from gas phase, composition change may occur in refrigerant and the efficiency will be lowered.

Use a vacuum pump with a reverse flow check valve.
Vacuum pump oil may flow back into refrigerant cycle and that can cause deterioration of refrigerant oil etc.

Use the following tools specifically designed for use with R454B refrigerant.

The following tools are necessary to use R454B refrigerant.

Tools for R454B	
Gauge manifold	Flare tool
Charge hose	Size adjustment gauge
Gas leak detector	Vacuum pump adapter
Torque wrench	Electronic refrigerant charging scale

Do not use a charging cylinder.
If the refrigerant is charged from gas phase, composition change may occur in refrigerant and the efficiency will be lowered.

Handle tools with care.
If dirt, dust or moisture enters into refrigerant cycle, that can cause deterioration of refrigerant oil or malfunction of compressor.

Do not use charging cylinder.
If a charging cylinder is used, the composition of refrigerant will change and the efficiency will be lowered.

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Ventilate the room if refrigerant leaks during operation.
If refrigerant comes into contact with flame, poisonous gases will be released.

Use the specified refrigerant only.

IMPORTANT

Never use any refrigerant other than that specified.

- Doing so may cause a burst, an explosion, or fire when the unit is being used, serviced, or disposed of.
- Correct refrigerant is specified on name plate of outdoor unit.
- If other refrigerant (R22, etc.) is used, chlorine in refrigerant can cause deterioration of refrigerant oil, etc.
- We will not be held responsible for mechanical failure, system malfunction, unit breakdown or accidents caused by failure to follow the instructions.

2.2. Cautions for units using R454B refrigerant

Basic work procedures are the same as those for conventional units using refrigerant R410A. However, pay careful attention to the following points.

WARNING

1. Checks to the area
   a. Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized.
   b. For repair to the REFRIGERATING SYSTEM, the following checks (i - viii) shall be performed shall be completed prior to conducting work on the system.
      i. Work Procedure
         - Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

      ii. General work area
         - All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out.
         - Work in confined spaces shall be avoided.

      iii. Checking for presence of refrigerant
         - The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres.
         - Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

      iv. Presence of fire extinguisher
         - If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand.
         - Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

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v. No ignition sources
   - No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion.
   - All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space.
   - Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.

vi. Ventilated area
   - Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work.
   - A degree of ventilation shall continue during the period that the work is carried out.
   - The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

vii. Checks to the refrigerating equipment
   - Where electrical components are being changed, they shall be fit for the purpose and to the correct specification.
   - At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.
   - The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:
     A. The actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed.
     B. The ventilation machinery and outlets are operating adequately and are not obstructed.
     C. Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
     D. Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

viii. Checks to electrical devices
   - Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures.
   - If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with.
   - If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used.
     A. This shall be reported to the owner of the equipment so all parties are advised.
   - Initial safety checks shall include:
     A. That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking.

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B. That no live electrical components and wiring are exposed while charging, recovering or purging the system.
C. That there is continuity of earth bonding.

2. Repairs to sealed components
   a. Sealed electrical components shall be replace.
3. Repair to intrinsically safe components
   a. Intrinsically safe components must be replaced.
4. Cabling
   a. Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects.
   b. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.
5. Detection of flammable refrigerants
   a. Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.
   b. The following leak detection methods are deemed acceptable for all refrigerant systems.
      i. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of FLAMMABLE REFRIGERANTS, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.)
      ii. Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used.
      iii. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.
      iv. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.
      v. If a leak is suspected, all naked flames shall be removed / extinguished.
      vi. If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.
      vii. **Removal of refrigerant shall be according to 2-4.6.**
6. Removal and evacuation
   a. When breaking into the refrigerant circuit to make repairs (for any other purpose) conventional procedures shall be used.

IMPORTANT

For flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

- The following procedure shall be adhered to:
  i. Safely remove refrigerant following local and national regulations
  ii. Evacuate
  iii. Purge the circuit with inert gas
  iv. Evacuate
  v. Continuously flush or purge with inert gas when using flame to open circuit
  vi. Open the circuit

IMPORTANT

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes.

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b. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times.

IMPORTANT

Compressed air or oxygen shall not be used for purging refrigerant systems.

- For appliances containing flammable refrigerants, refrigerants purging shall be achieved through the following process:
  i. Break the vacuum in the system with oxygen-free nitrogen and continue to fill until the working pressure is achieved.
  ii. Then, vent to atmosphere.
  iii. Finally, pull down to a vacuum.
  iv. This process shall be repeated until no refrigerant is within the system.
  v. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

IMPORTANT

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

7. Charging procedures
   a. In addition to conventional charging procedures, the following requirements shall be followed:
      i. Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of REFRIGERANT contained in them.
      ii. Cylinders shall be kept in an appropriate position according to the instructions.
      iii. Ensure that the REFRIGERATING SYSTEM is earthed prior to charging the system with refrigerant.
      iv. Label the system when charging is complete (if not already).
      v. Extreme care shall be taken not to overfill the REFRIGERATING SYSTEM.
      vi. Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas.
      vii. The system shall be leak-tested on completion of charging but prior to commissioning.
      viii. A follow up leak test shall be carried out prior to leaving the site.
8. Decommissioning
   a. Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail.

IMPORTANT

It is recommended good practice that all refrigerants are recovered safely.

   b. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant.
   c. It is essential that electrical power is available before the task is commenced.
   d. Become familiar with the equipment and its operation.
   e. Isolate system electrically.
   f. Before attempting the procedure, ensure that:
      i. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
      ii. All personal protective equipment is available and being used correctly.
      iii. The recovery process is supervised at all times by a competent person

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iv. Recovery equipment and cylinders conform to the appropriate standards.

g. Pump down refrigerant system, if possible.
   i. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.

h. Make sure that cylinder is situated on the scales before recovery takes place.

i. Start the recovery machine and operate in accordance with instructions.

j. Do not overfill cylinders. (no more than 80 % volume liquid charge)

k. Do not exceed the maximum working pressure of the cylinder, even temporarily.

l. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.

m. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

9. Labeling
   a. Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant.
      • The label shall be dated and signed.
   b. For appliances containing FLAMMABLE REFRIGERANTS, ensure that there are labels on the equipment stating the equipment contains FLAMMABLE REFRIGERANT.
10. Recovery

IMPORTANT

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that **all refrigerants are removed safely.**

a. When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed.
   i. Ensure that the correct number of cylinders for holding the total system charge is available.
   ii. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of refrigerant).
   iii. Cylinders shall be complete with pressure-relief valve and associated shutoff valves in good working order.
   iv. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

b. The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant.
   • If in doubt, the manufacturer should be consulted.
   • In addition, a set of calibrated weighing scales shall be available and in good working order.
   • Hoses shall be complete with leak-free disconnect couplings and in good condition.

c. The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged.

d. Do not mix refrigerants in recovery units and especially not in cylinders.

e. If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant.

f. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process.

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IMPORTANT

When oil is drained from a system, it shall be carried out safely.

2.3. Precautions for devices that use R454B

FLAMMABLE REFRIGERANT WARNING

- IGNITION SOURCES: Verify the following safety precautions are followed to prevent refrigerant ignition and ensure proper operation without equipment damage, injury, or death.
  - Verify equipment is installed in a room that does not contain continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater).
  - Verify equipment is installed in a room large enough to properly accommodate the release of the full system charge.
    - Ensure actual system refrigerant charge is in accordance with the room sizes Amin and TAmin, found in ***Appendix A*** of this manual.
      - Improper room sizes can lead to dangerously high concentrations of refrigerant vapor.
    - Ensure appropriate fire extinguishing equipment (dry powder or CO2 fire extinguisher) is available and adjacent to worksite whenever any hot work is required on the refrigerating equipment or any associated parts.
  - DO NOT use ignition methods, such as a halide torch, to detect refrigeration leaks. Electronic leak detectors may be used as long as they pose no risk as potential ignition source.
    - Verify the electronic refrigerant leak sensor is calibrated to the refrigerant used and appropriate percent of gas is confirmed.
  - When installing field pipe joint connections, avoid locations with possible ignition sources such as UV lights, electric heaters, gas appliances, pilot flames, brushed motors and similar devices.
  - Ensure the worksite is free from faulty equipment and appliances that could be a potential ignition source.
    - Failure to do so may result in ignition risk due to outdated and unsafe equipment.
  - Place “No Smoking" signs in the worksite.
  - Markings and labels on the equipment must remain legible. Correct all labels or service markings that are illegible. Labels and service markings contain information that is critical to the next service technician

FLAMMABLE REFRIGERANT WARNING

- VENTILATION: Be aware that refrigerants may not contain an odor. If the refrigerant gas comes into contact with a flame, poisonous gases will be released.
  - Limit or avoid work in confined spaces. Prior to installation, verify service connections and field joints are placed in ventilated and easily accessible areas.
  - Do not perform any hot work without proper ventilation in the work space.
  - Confirm that all ventilation outlets and machinery are not obstructed, and are operating adequately.
    - Failure to provide constant ventilation allows for the concentration of refrigerant vapor in the work area.
  - If refrigerant gas leaks during installation work, ventilate the room.
    - If the refrigerant gas comes into contact with a flame, poisonous gases will be released.

FLAMMABLE REFRIGERANT WARNING

- LEAK DETECTION: Check the work area for any potential toxic or flammable gases using an appropriate refrigerant detector prior to, during, and after work is complete.

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- If a leak is suspected, immediately remove/ extinguish all naked flames.
- Ensure all refrigerant is recovered and system is isolated prior to making repairs. For PAA connections, use flare connection as the equipment as designed for. Mitsubish Electric US, Inc. is not responsible for improper brazing connections done by the installer.
  - Instructions for the removal of refrigerant can be found in *Handling and service of R454B* chapter of this manual.
- Hazardous vapors may exist in mechanical rooms. Use appropriate leak detection equipment (non-sparking) that is adequately sealed and intrinsically safe.
  - Ensure leak detection equipment set at a percentage of the LFL (lower flammability limit) of the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.
- Recover refrigerant via the outdoor unit service ports only. Do not vent refrigerant. Always follow the decommissioning procedure.
- Do not pierce or burn.

CAUTION

- Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
- Some chemicals and cleaning products may be incompatible with the coil materials, and may corrode the coil.
- Verify leak detection fluids do not contain chlorine.
  - Leak detection fluids that contain chlorine may react with refrigerant and corrode pipework.
- Confirm that refrigerant piping and other components are installed in a position/location that is unlikely to be exposed to corrosive materials.
  - Corrosion can reduce the longevity of the product, and possibly lead to a hazardous refrigerant leak.
- When it is necessary to replace electrical components, the new components must be fit for the purpose and to the correct specification. Always follow guidelines in the installation and service manuals, and if in doubt, consult with the manufacturer's technical department for assistance.
  - Improperly sourced parts may lead to reduced functionality and product life.

2.4. Installation of R454B system

FLAMMABLE REFRIGERANT WARNING

- Ensure proper protection from physical damage during installation, operation, and service when performing pipework or handling piping material.
- Verify pipe work performed in compliance with national and local regulations and standards.
- Ensure all field joints in pipe work are inspected prior to covering and enclosing.
  - Verify all field pipe joints are properly pressure tested with inert gas.
  - Verify all field pipe joints are vacuum tested prior to refrigerant charging.
    - Verify all indoor field-made joints are tightness tested with 0.25 times the MAXIMUM ALLOWABLE PRESSURE, with NO LEAK DETECTED.

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FLAMMABLE REFRIGERANT WARNING

Auxiliary devices which may be a POTENTIAL IGNITION SOURCE shall not be installed in the duct work. Examples of such POTENTIAL IGNITION SOURCES are hot surfaces with a temperature exceeding 1292 °F (700 °C) and electric switching devices.

IMPORTANT

Approved electric heater kits manufactured for Mitsubishi Electric US, Inc. includes electric heat kits manufactured for Mitsubishi Electric US, Inc. that are allowed for use with the listed air handlers. These tables are found in the chapter *Indoor unit accessories* found in the Installation manual.

FLAMMABLE REFRIGERANT WARNING

LEAK DETECTION SYSTEM INSTALLED. This air handler is equipped with a refrigerant leak detection system.

See service manual for service and replacement instructions.

- Unit must remain ON, except for service, installation, or inspection.
- Loss of power to the refrigerant leak sensor mounted in the indoor unit will result in an inability to detect a refrigerant leak. This may cause a fire. Refrigerant leak sensor lifetime is 15 years.
- Only replace refrigerant leak sensor devices with sensors approved for use by Mitsubishi Electric US, Inc.
- Do not install equipment in a configuration where false ceilings or drop ceilings are used as a return air plenum.

2.4.1. Safety checks for systems using R454B

1. **Complete prior to installation**
   - Verify the REFRIGERANT CHARGE is in accordance with the room size, found in the charts below in *Minimum floor and minimum conditioned space area*, where refrigerant containing parts are installed.
   - Verify ventilation openings are not obstructed and the required ventilation is present.

     ### IMPORTANT

     Alarm-triggered mechanical ventilation is not supported at this time.

   - Verify markings and signs for the equipment are visible and legible. Correct all illegible markings and signs.
   - Verify refrigeration pipe and components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.
   - Verify common household chemicals and appliances are properly stored away from the return vents and air handler
     – Vapors and gases from chemical such as propane, butane, methane, insecticides,

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aerosol or cleaning sprays, and paint or small smoke producing appliances may falsely trigger the leak detection system and impede the proper function of the unit.

2. **Checks to electrical devices**
   Repair and maintenance of electrical components include initial safety checks and component inspection procedures.
   - Verify capacitors are discharged in a safe manner to avoid possibility of sparking.
   - Verify there are no live electrical components.
   - Ensure wiring is not exposed while charging, recovering, or purging the system.
   - Verify continuity of earth bonding.
   - If a fault exists that could compromise safety, do not connect electrical supply to the circuit until fault is repaired.
   - If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. Report any malfunction or faulty equipment/ operation to the owner of the equipment so all parties are aware.
3. **During repairs to sealed components**
   - Verify all electrical power supplies are disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during service, then permanently operating leak detection must be installed at the most critical point to warn of a potentially hazardous situation.
   - Verify the casing is not altered in any manner that affects protection.
     – Verify no visible physical damage to cables exists.
     – Verify connections are not excessive.
     – Verify terminals are installed according to specification.
     – Verify there is no damage to seals.
     – Verify gland fitting are installed properly and according to specifications.
   - Ensure equipment properly secured.
   - Ensure seals or sealing materials are not degraded and operating properly.
   - Verify all replacement parts in accordance with the manufacturer specifications.
4. **Intrinsically safe components can only be replaced but never repaired**
   - Do not apply any permanent inductive or capacitance loads to the circuit without ensuring it will not exceed the permissible voltage and current permitted for the equipment in use. Intrinsically safe components are the only type of components that may be worked on while live in the presence of a flammable atmosphere.
   - Ensure test apparatus meets correct rating specification.
   - Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

NOTE

The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment.

Intrinsically safe components do not have to be isolated prior to working on them.

5. **Cabling**
   - Verify cabling is installed in a location that avoids wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects.
   - Check the cables for effects of aging or continual vibration from sources such as compressors or fans.

2.4.2. Minimum floor and conditioned space area requirements

For safe and acceptable installation, there are a number of requirements that must be met to ensure that in the event of a refrigerant leak, refrigerant vapors do not have the opportunity to collect and create a hazardous concentration levels of refrigerant vapors.

These requirements are in relation to the following categories:

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- Area of the conditioned space (**TAmin**)
- Area of the indoor unit installation space (**Amin**)
- Installation height of the indoor unit, measured from the floor to the bottom of the air handler (h_0)
- Opening conditions for connected rooms and natural ventilation (**Anv**).
- Ducting and damper configurations

For all installations, the following guidelines must be followed:

- Residential installations and ductwork should be designed to comply with ACCA's Manual D (ANSI / ACCA 1 Manual D 2016, Residential Duct Systems).
  - Failure to comply with industry best practices can result in poor performance, including unbalanced heating / cooling / airflow.
- When zone dampers are used, they must be configured such that they will open fully during a refrigerant leak error.
  - Pre-existing zone dampers that do not meet this requirement must be permanently opened fully and disabled.
- Manual dampers must not be completely closed during or after installation. Balancing is acceptable.
  - Closing dampers can reduce the conditioned space area beyond intended acceptable limits.
- Vent registers, grilles, and covers must not completely obstruct air flow from any vent.
  - A blocked vent can reduce the conditioned space area beyond intended acceptable limits.
- At least one room (not including the indoor unit installation room) must have a dedicated return duct.
  - Spaces without return ducts have a risk of refrigerant accumulation during a leak event.
- The height of the ceiling in the indoor unit installation room must be at least 2.2 m (7 ft - 2.7 in).
  - Area calculations have been calculated using this assumption.
- The area of the indoor unit installation room must be at least 20% of the total area of **Amin**.
- Rooms adjacent to the indoor unit installation room can be considered part of the **Amin** area for the purpose of contributing to **Amin** area when the following conditions are met:
  - The rooms are on the same floor.
  - The rooms are connected by a permanent opening that cannot be closed, with an area greater than **Anv** that is below 300 mm (11.8 in) from the floor, at least 50% of which is below 200 mm (7.8 in) from the floor.
  - The rooms are connected by a second permanent opening that cannot be closed, with an area greater than 50% of **Anv** that is above 1.5 m (4 ft - 11.1 in).
- Natural ventilation requirements can be satisfied by use of ventilation ducting, passive through-wall ducts, drop ceilings, louvered doors, door undercuts, space between wall and floor, etc.
  - For openings which extend to the floor, the minimum height is 20 mm (0.8 in) above the top of the floor covering (i.e. tiles and carpet pile).
- Enhanced tightness refrigeration systems (ETRS) are approved for fixed **Anv** requirements.
  - Almost every combination of Mitsubishi Electric US, Inc. indoor unit / outdoor unit are considered an enhanced tightness refrigeration system (ETRS).
  - **IMPORTANT**

    SVZ-AP12NL indoor unit (IDU) with **SUZ-AA12NL** outdoor unit (ODU) is **the only non-ETRS combination**.

    For ETRS-compliant systems, the value for:

    $$A_{nvETRS} \geqslant 114cm^2 \ or \ 22in^2$$

    .
  - For Non-ETRS-compliant systems, the minimum opening size can be determined from the following equation:

    $$A_{nv} = 0.0317 \times \left(m_c - 0.337 \times \left(\sqrt{A}\right)\right) \times \sqrt{0.563 \times \sqrt{A}}$$

  - Where **A** is the area of the installation room in square meters, and m_c is the planned total system charge in kilograms.
- Use the tables on the following pages to determine **Amin** and **TAmin** requirements.
  1. Match the chart title to the outdoor unit being paired with the air handler.
  2. Use the following flow chart to determine which case line is correct for your application.
  3. Confirm the planned system charge, m_c, and trace up to the correct case line.

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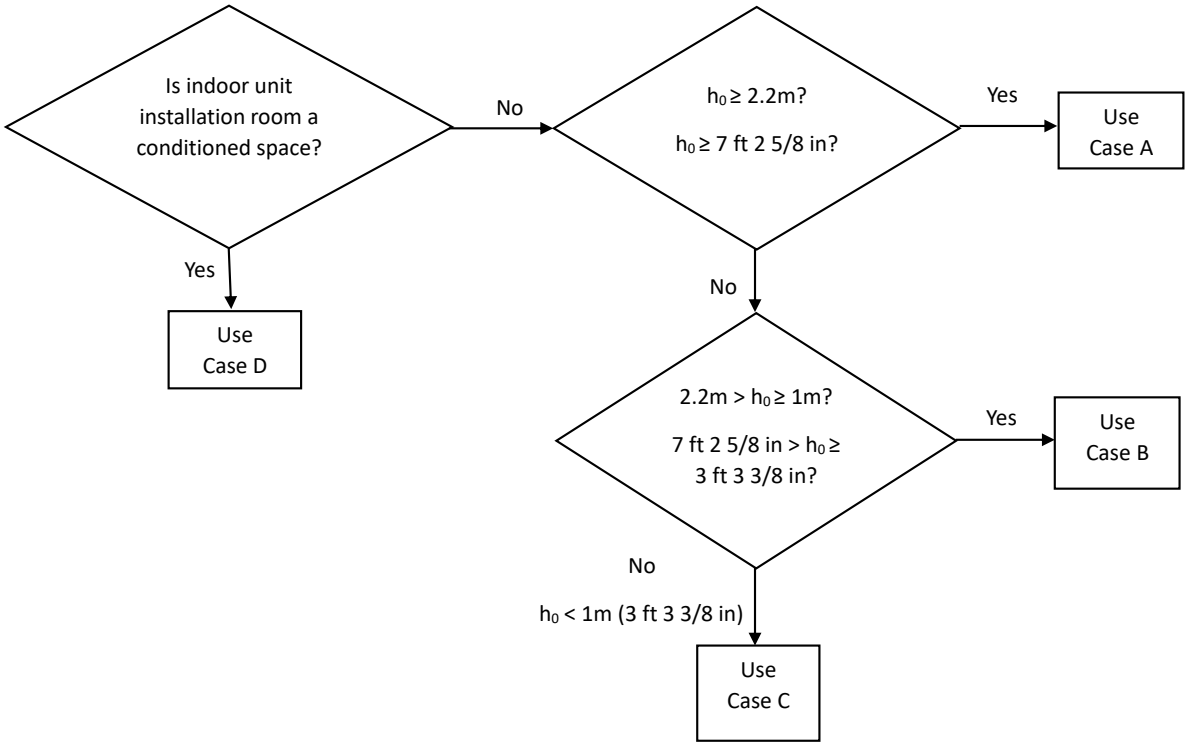
4. Trace left from the intersection with the correct case line to determine **Amin** and **TAmin**.
5. This information is available in ***Appendix A*** at the end of this manual.



NOTE

For systems certified as ETRS the following ventilation requirement can be substituted:

$$A_{nvETRS} \geqslant 114cm^2 \ or \ 22in^2$$

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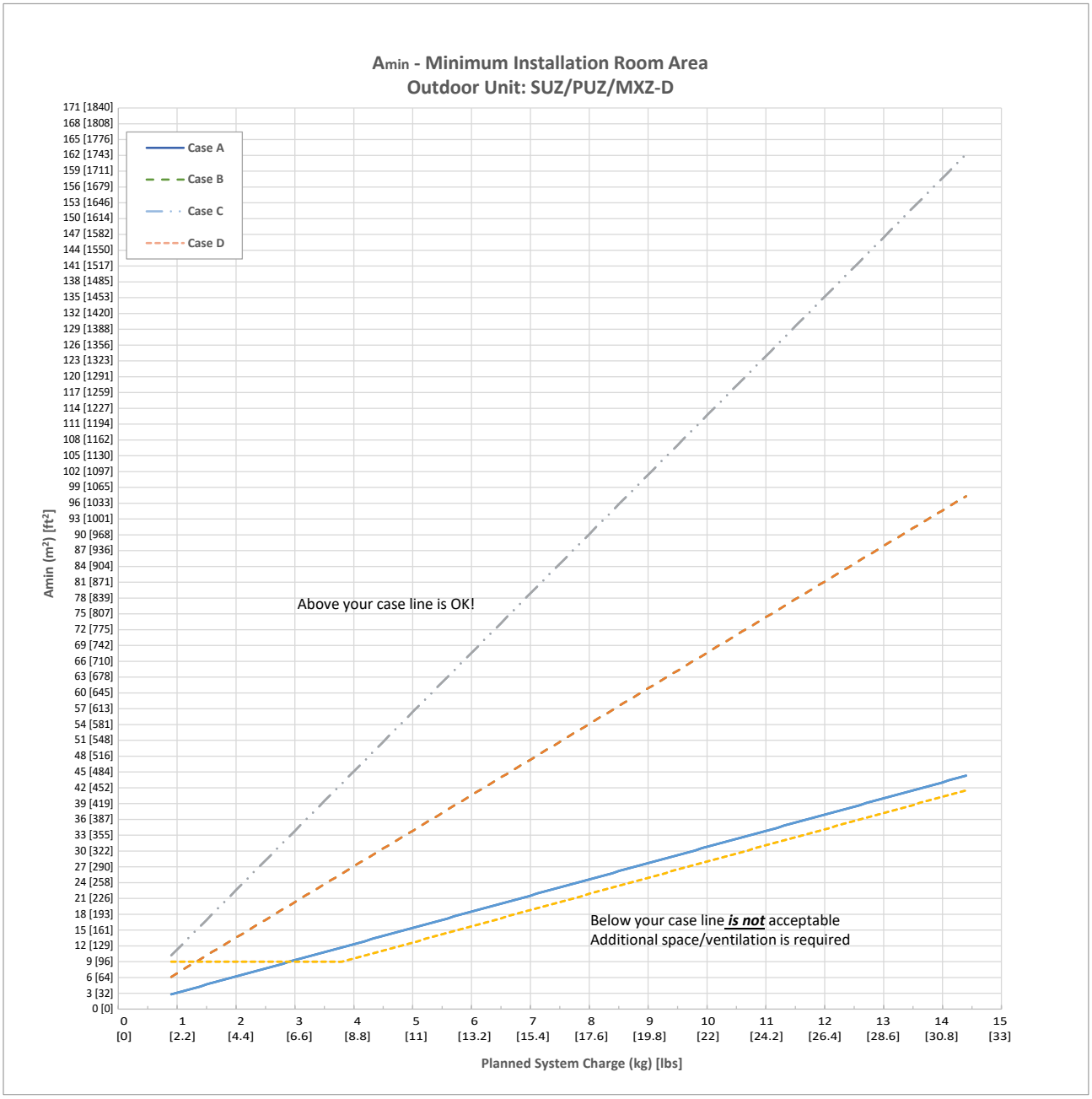

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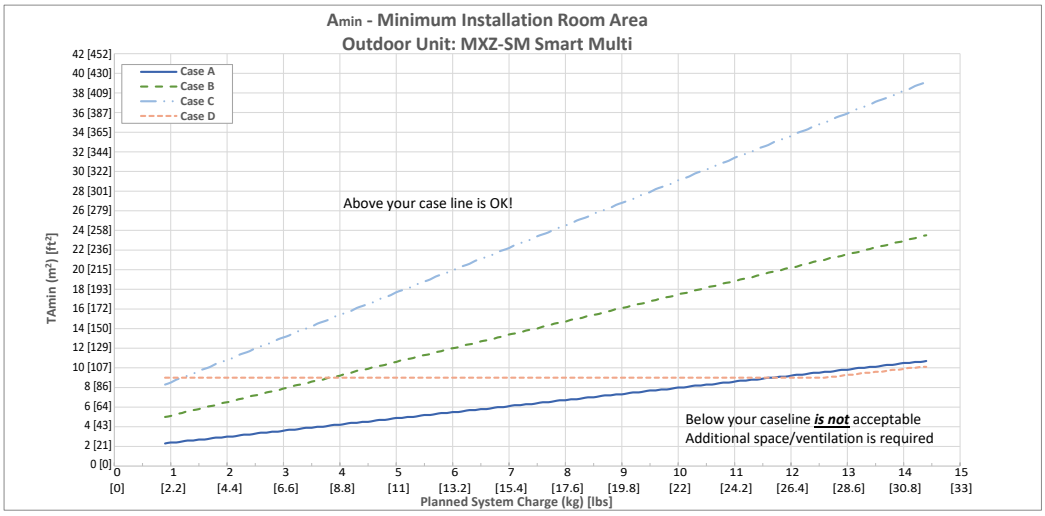

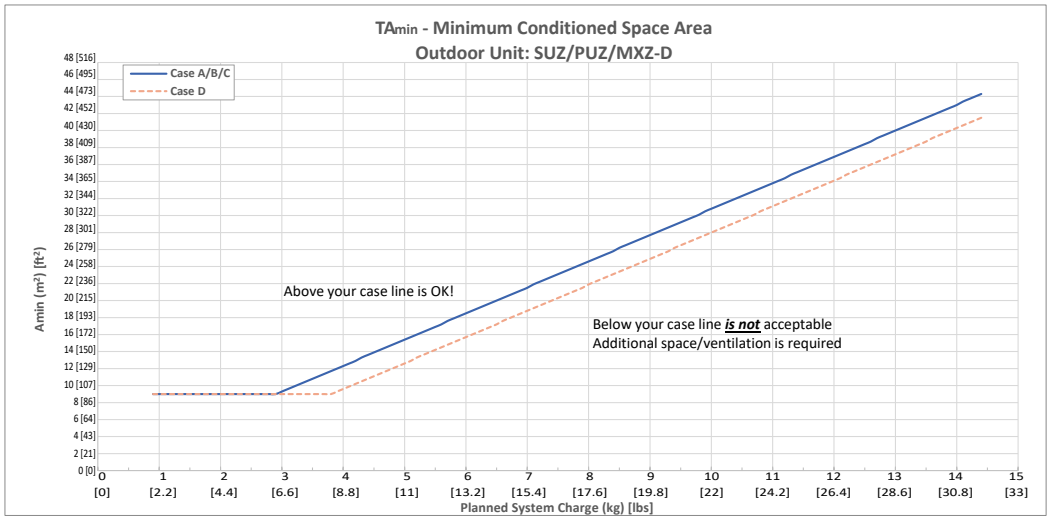

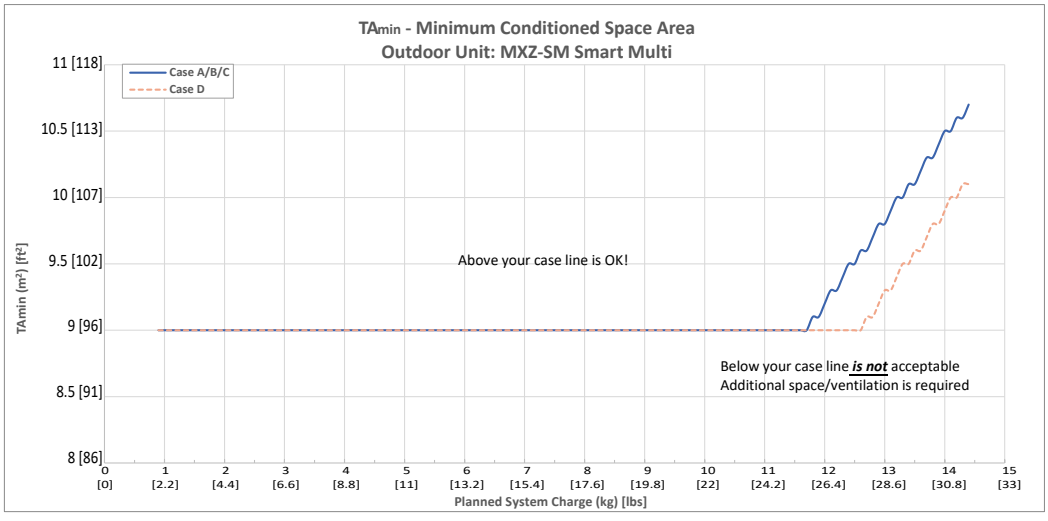

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2.5. Handling and service of R454B system

FLAMMABLE REFRIGERANT WARNING

- Follow all national and local regulations and policies regarding refrigerant removal, evacuation, and recovery processes.
- Follow all safety precautions and procedures found in the installation and service manuals.
- Flammable refrigerant systems may only be purged with oxygen-free nitrogen.
  – Never use compressed air or oxygen for purging flammable refrigerant systems.
- Do not place vacuum pump air outlet near potential ignition sources.
- Verify proper ventilation available.

2.5.1. Removal and evacuation of refrigerant R454B

FLAMMABLE REFRIGERANT WARNING

- Verify vacuum pump outlet is secured away from potential ignition sources.
- Verify proper ventilation is available.

1. Safely remove refrigerant following local and national regulations.
2. Evacuate
3. Purge the circuit with inert gas.
4. Evacuate
5. Continuously flush or purge with inert gas when using a flame to solder or de-solder.
6. Open the circuit
7. Recover the refrigerant charge into the correct recovery cylinders if venting is not allowed by local and national codes.

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2.5.2. Purging the system with R454B

NOTE

This process might need to be repeated several times.

1. Break the system vacuum with oxygen-free nitrogen.
2. Continue to fill until the working pressure is achieved.
3. Vent to atmosphere.
4. Evacuate the system.
5. Repeat steps until no refrigerant remains in the system, then fill a final time with oxygen-free nitrogen.
6. When purge is complete, vent the system down to atmospheric pressure to enable work to take place.

2.5.3. Charging R454B system

In addition to conventional charging procedures and safety precautions described in the installation and service manuals, read and follow the following precautions:

FLAMMABLE REFRIGERANT WARNING

- Do not allow contamination of different refrigerants to occur when using charging equipment.
- Keep hoses or lines as short as possible to minimize the amount of refrigerant contained in them.
- Keep all cylinders in an appropriate position according to the instructions.
- Ensure that the refrigerating system is properly grounded prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- DO NOT OVERFILL the refrigerant system.
- Pressure test the system prior to re-charging with appropriate purging gas.
- Leak test the system at completion of charge, prior to commissioning, and before leaving the worksite.

2.5.4. Recovery of R454B

FLAMMABLE REFRIGERANT WARNING

- Do not mix refrigerants in recovery units and especially not in cylinders.
- Never heat the compressor body with an open flame or any other ignition sources to accelerate the process.

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Verify the following prior to recovering refrigerant from the system:

- Verify that only the proper cylinders required for flammable refrigerant recovery are used and that they are properly labeled.
  - If in doubt, contact manufacturer for consultation.
- Verify the correct number of cylinders needed for total system charge are available.
- Verify cylinders are in good working order with necessary pressure relief and shut-off valves.
- Verify recovery cylinders are empty, properly evacuated, and cooled before recovery.
- Verify calibrated weighing scales are available and in good working order.
- Verify hoses are complete with leak-free disconnect coupling and in good condition.
- Ensure all recovered refrigerant is processed in accordance with local legislation, in proper recovery cylinder, and with appropriate transfer note arranged.
- If compressors or compressor oils are to be removed, verify they are evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant.
- Verify oil drained from the system is carried out safely.

2.6. Description and testing of leak mitigation functions

NOTE

The refrigerant leak detection system can be tested to verify that leak mitigation actions are functional. These actions serve to slow the leak rate and to disperse any concentrated refrigerant in the ducting.

For systems paired with an MXZ-SM Smart Multi outdoor unit, the unit has a safety-shutoff-valve installed that will close upon a leak detection and the compressor will run for several minutes to collect the refrigerant in the accumulator, then shut off.

The indoor unit fan motor activates to provide circulation airflow.

This process puts stress on system components, so testing should occur only when required, such as during system commissioning, or when advised by Mitsubishi Electric US, Inc. service personnel, or when required by local codes and regulations.

For systems paired with any other outdoor unit (SUZ/PUZ/MXZ *not Smart Multi), leak mitigation actions include automatic cutoff of the outdoor unit compressor and activating the fan motor of the indoor unit for circulation airflow.

2.6.1. Testing procedure

1. Confirm that the system is powered on and in normal operation.
2. Unplug the refrigerant leak sensor cable from the indoor unit control board at the plug connector labeled CNSA.
3. The mitigation actions will be triggered and will continue until the unit is powered off.
4. Power off the system.
5. Reconnect the refrigerant leak sensor cable.
6. Restore power and return the system to normal operation.

FLAMMABLE REFRIGERANT WARNING

The fan will automatically start when refrigerant leak is detected by refrigerant leak sensor. Keep a safe distance from the fan to avoid injury.

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2.7. Decommissioning of R454B system

NOTE

LABELING: All equipment that is decommissioned and emptied of refrigerant must have a label stating FLAMMABLE REFRIGERANT with the date and signature affixed to the equipment.

Prior to decommissioning, verify the following safety checks:

- Follow all safety precautions and procedures.
- Take oil and refrigerant samples in case analysis is required prior to re-use of recovered refrigerant.
- Verify proper power is available necessary to fully execute procedure.
- Ensure the recovery process is supervised at all times by a trained professional.
- Verify mechanical handling equipment is available, if required, for handling refrigerant cylinders.
- Ensure all personal protective equipment is available and being used correctly.
- Verify recovery equipment and cylinders conform to the appropriate standards.

Follow the steps listed in this procedure to properly decommission the system:

1. Isolate system electrically.
2. Pump down refrigerant system, if possible.
3. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
4. Verify cylinder is situated on the scales before recovery takes place.
5. Start the recovery machine and operate in accordance with instructions.
   - Do not overfill cylinders (no more than 80 % volume liquid charge).
   - Do not exceed the maximum working pressure of the cylinder, even temporarily.
6. Once cylinders are properly filled and the process complete:
   - Promptly remove the cylinders and the equipment from site.
   - Verify all isolation valves on the equipment are closed.

NOTE

Do not re-use recovered refrigerant in another refrigerant system unless it has been cleaned in accordance with procedure and regulation.

2.8. Disposal of R454B

Recover the refrigerant and recycle it.

If recycling is not possible then it should be incinerated by a licensed facility.

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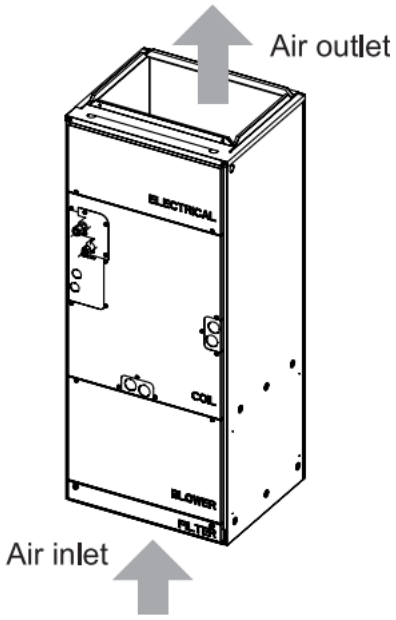
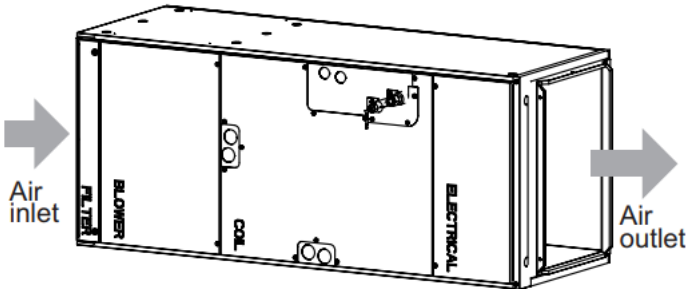
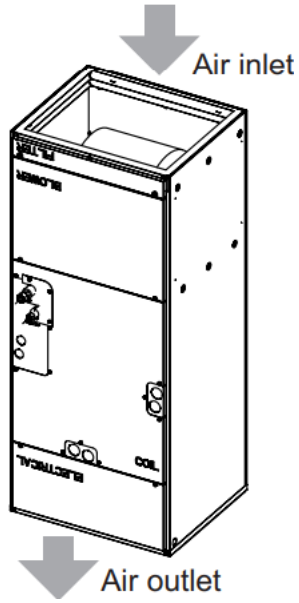
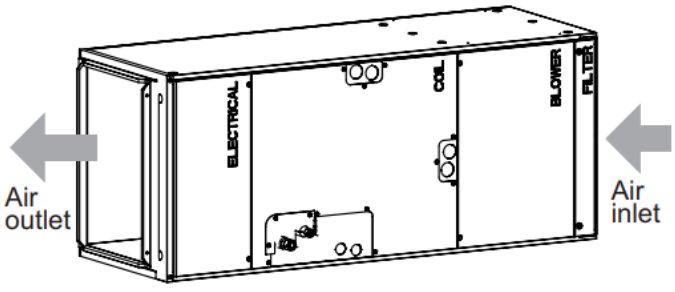
3. Part Names and Functions

Table 1. Indoor unit

Vertical	Horizontal Right
	
Downflow	**Horizontal left**
	

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4. Specifications

Model code			12	18
Power source			208/230V, 1-phase, 60Hz	
Cooling / Heating capacity		Btu/h	12,000 / 13,500	18,000 / 20,000
		kW	3.5 / 4.0	5.3 / 5.9
Tonnage			1	1.5
Dimensions	Height	mm [in]	1275 [50-1/4]	
	Width		432 [17]	
	Depth		548 [21-5/8]	
Net weight		kg [lb]	51 [113]	
Fan	Airflow rate (low-mid-high)	CFM	280 - 340 - 400	515 - 625 - 735
	Minimum circulation airflow[a.]		400	735
	External static pressure	in. WG [Pa]	0.30 - 0.50 - 0.80 [75 - 125 - 200]	

[a.] Specified in UL60335-2-40

Model code			24	30
Power source			208/230V, 1-phase, 60Hz	
Cooling / Heating capacity		Btu/h	24,000 / 27,500	30,000 / 32,000
		kW	7.0 / 7.9	8.8 / 9.4
Tonnage			2	2.5
Dimensions	Height	mm [in]	1378 [54-1/4]	
	Width		534 [21]	
	Depth		548 [21-5/8]	
Net weight		kg [lb]	64 [141]	
Fan	Airflow rate (low-mid-high)	CFM	613 - 744 - 875	
	Minimum circulation airflow[a.]		875	
	External static pressure	in. WG [Pa]	0.30 - 0.50 - 0.80 [75 - 125 - 200]	

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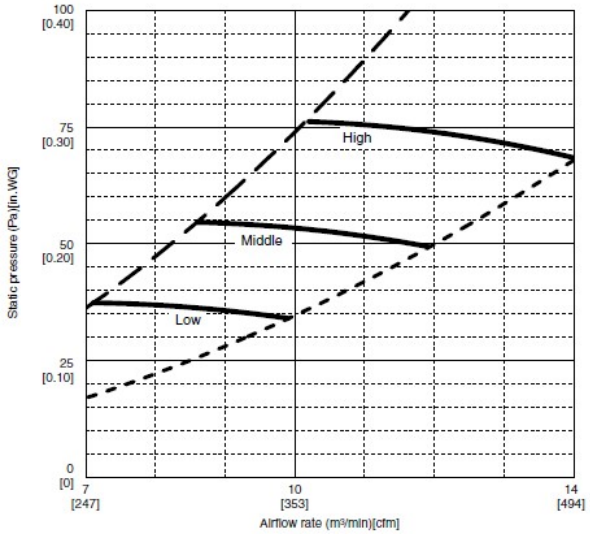
Model code			36	42	48
Power source			208/230V, 1-phase, 60Hz		
Cooling / Heating capacity		Btu/h	34,000 / 38,000	42,000 / 48,000	48,000 / 51,000
		kW	10.0 / 11.1	12.3 / 14.1	14.1 / 14.9
Tonnage			3	3.5	4
Dimensions	Height	mm [in]	1511 [59-1/2]		
	Width		635 [25]		
	Depth		548 [21-5/8]		
Net weight		kg [lb]	78 [172]		
Fan	Airflow rate (low-mid-high)	CFM	788 - 956 - 1125	1040 - 1262 - 1485	
	Minimum circulation airflow[a.]		1125	1485	
	External static pressure	in. WG [Pa]	0.30 - 0.50 - 0.80 [75 - 125 - 200]		

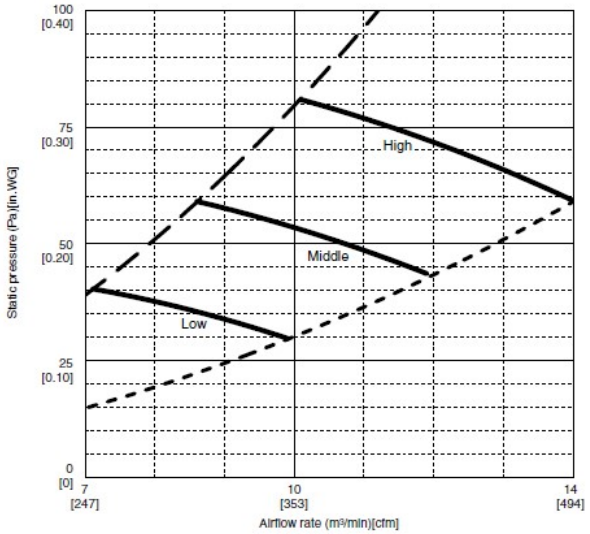
5. Fan Performance and Corrected Airflow

Table 2. Model code 12

Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 75Pa, 0.30 [in. WG], Power source: 208/230 V, 60Hz





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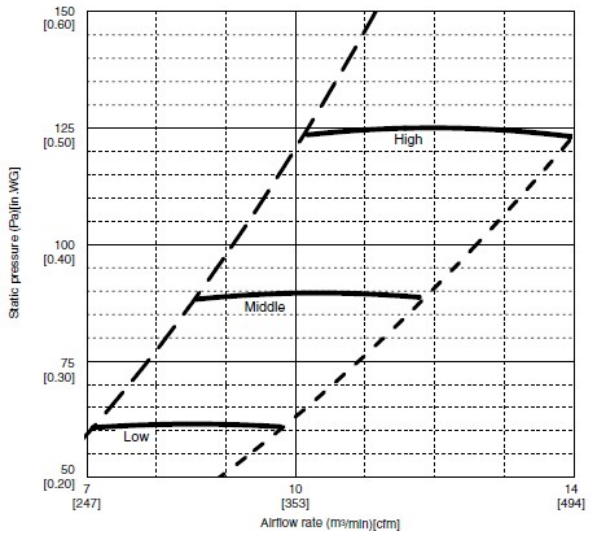
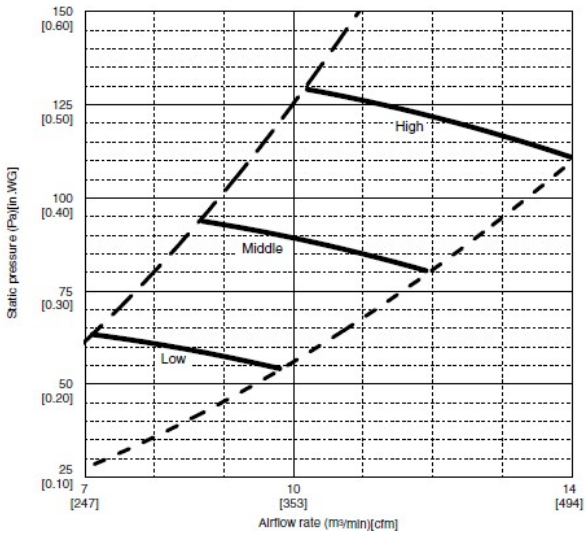
Vertical, Horizontal right, Horizontal left **Downflow**

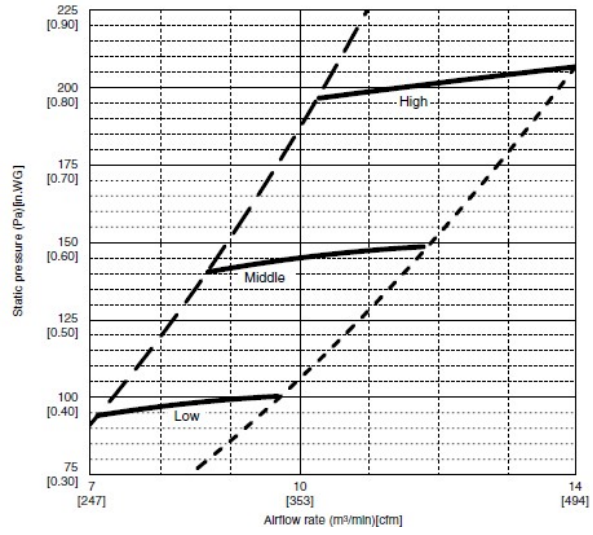
External static pressure: 125Pa, 0.50 [in. WG], Power source: 208/230 V, 60Hz





Vertical, Horizontal right, Horizontal left **Downflow**

External static pressure: 200Pa, 0.80 [in. WG], Power source: 208/230 V, 60Hz



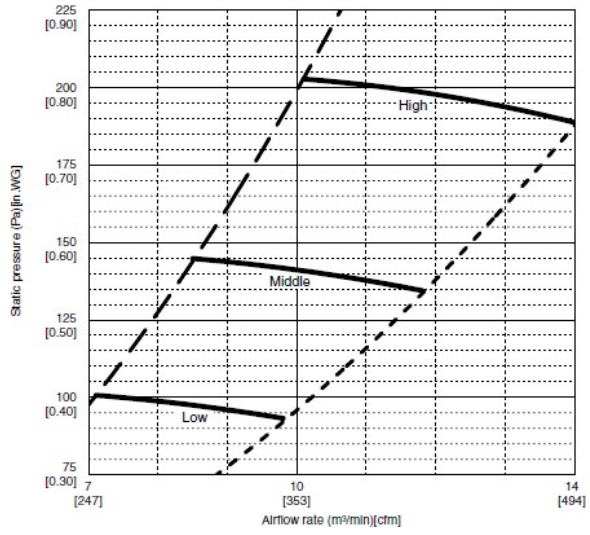


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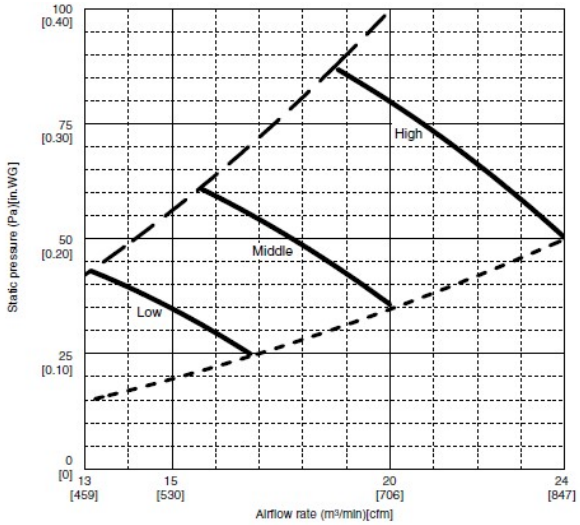
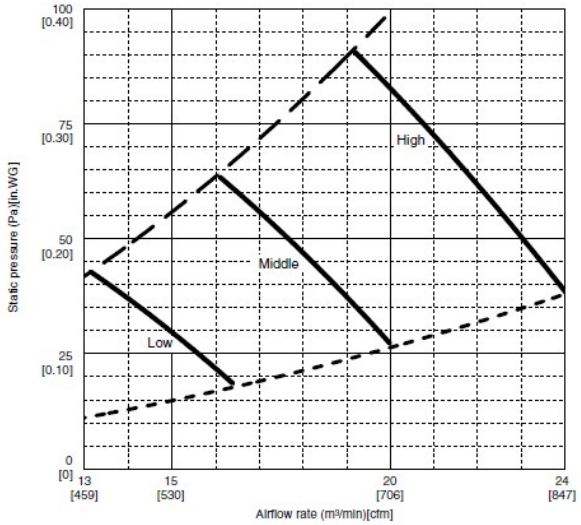
Table 3. Model code 18

Vertical, Horizontal right, Horizontal left	Downflow

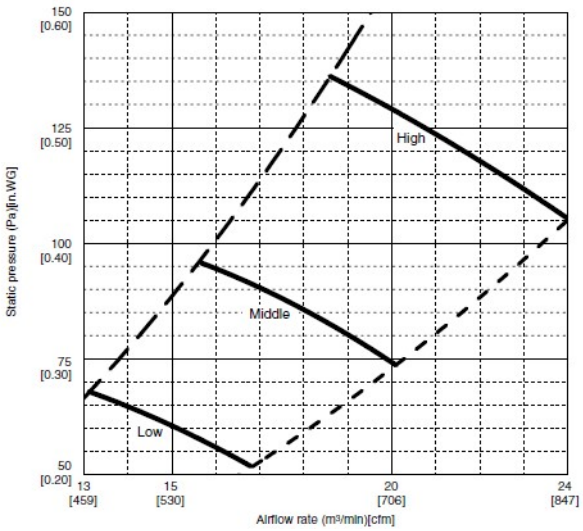
External static pressure: 75Pa, 0.30 [in. WG], Power source: 208/230 V, 60Hz

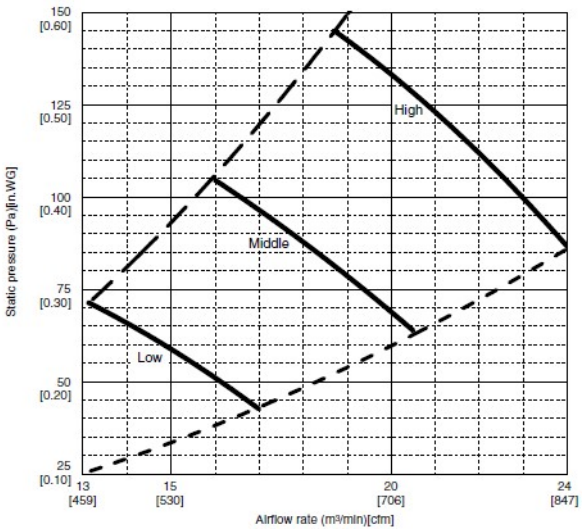




Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 125Pa, 0.50 [in. WG], Power source: 208/230 V, 60Hz





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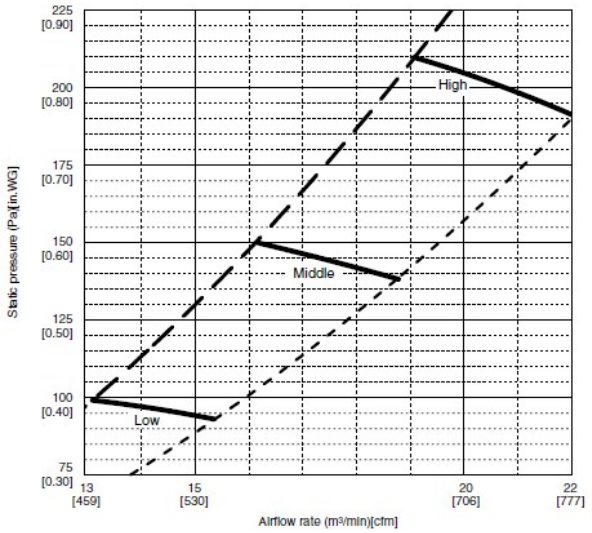
Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 200Pa, 0.80 [in. WG], Power source: 208/230 V, 60Hz



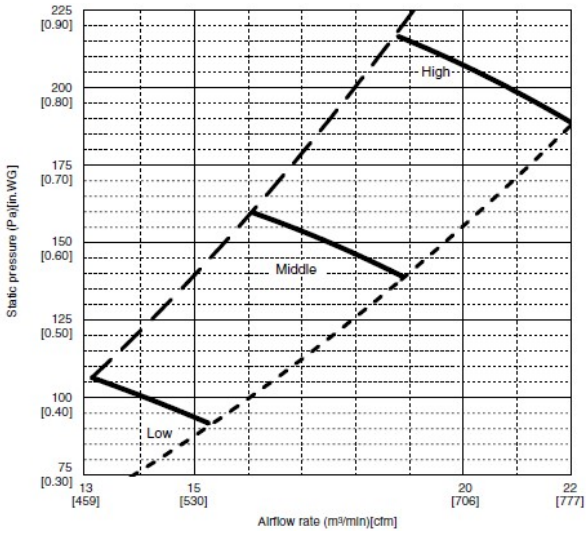
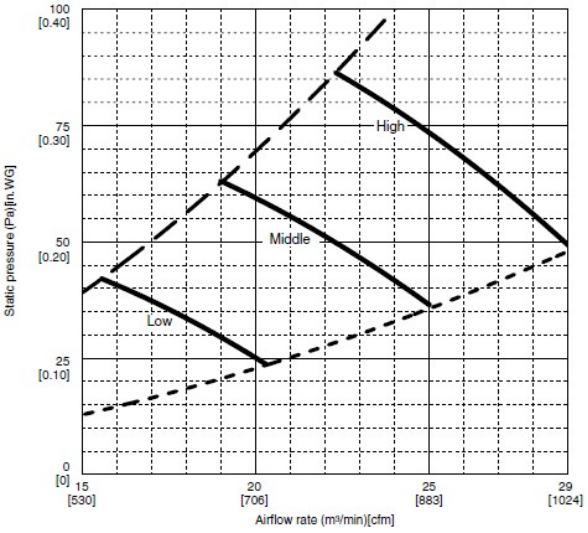
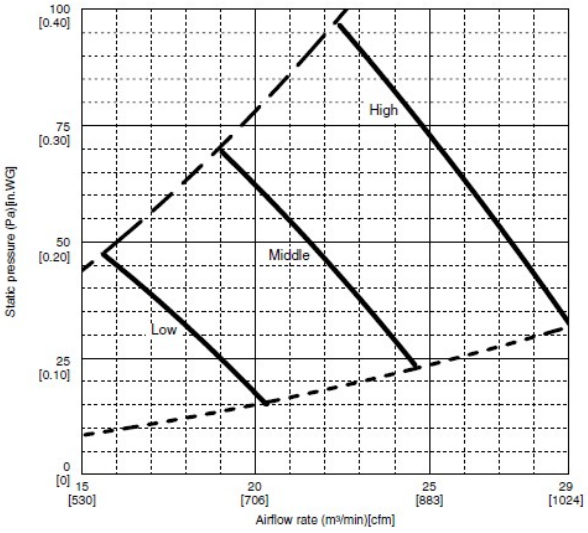


Table 4. Model code 24

Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 75Pa, 0.30 [in. WG], Power source: 208/230 V, 60Hz





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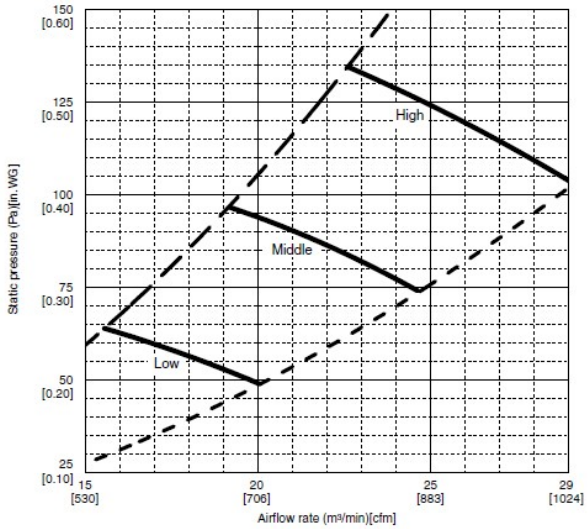
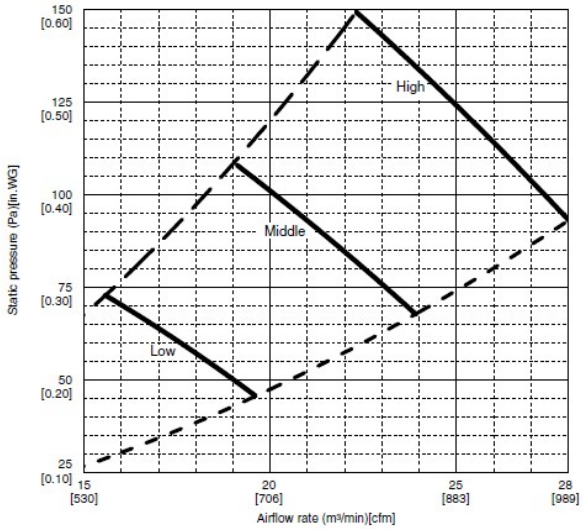
Vertical, Horizontal right, Horizontal left **Downflow**

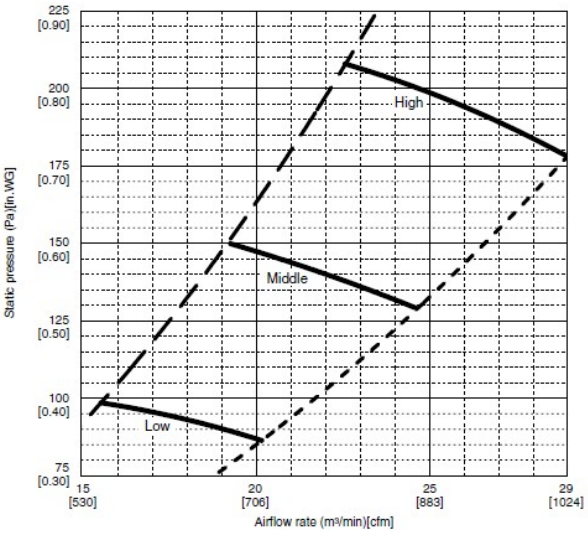
External static pressure: 125Pa, 0.50 [in. WG], Power source: 208/230 V, 60Hz





Vertical, Horizontal right, Horizontal left **Downflow**

External static pressure: 200Pa, 0.80 [in. WG], Power source: 208/230 V, 60Hz



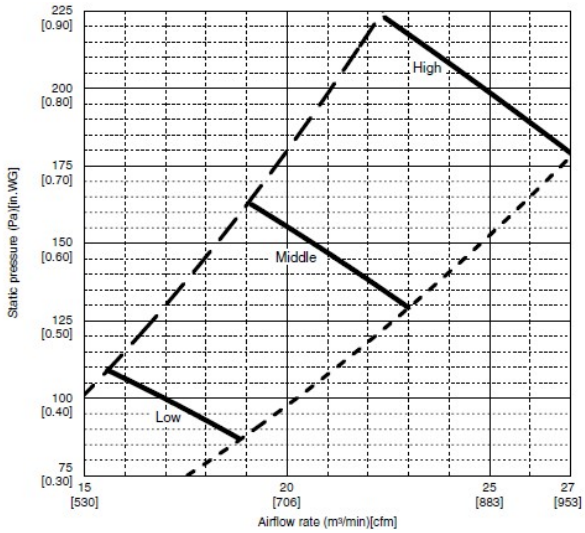


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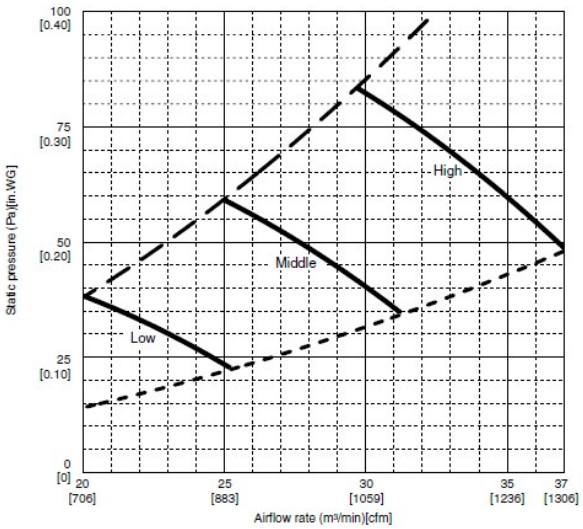
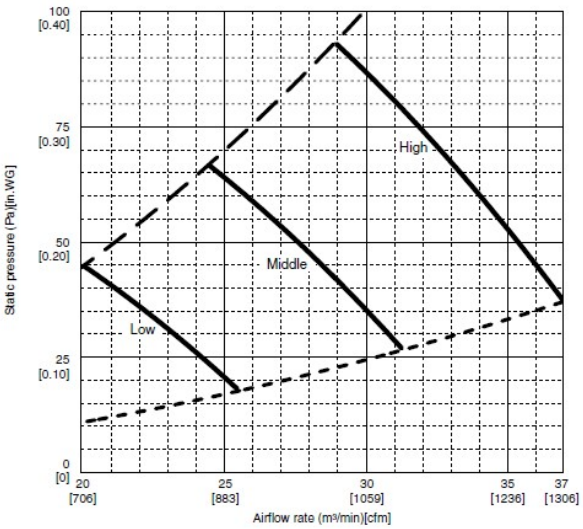
Table 5. Model code 30

Vertical, Horizontal right, Horizontal left	Downflow

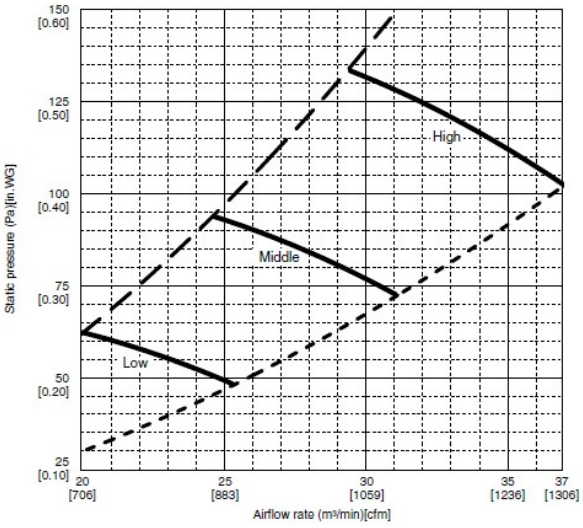
External static pressure: 75Pa, 0.30 [in. WG], Power source: 208/230 V, 60Hz

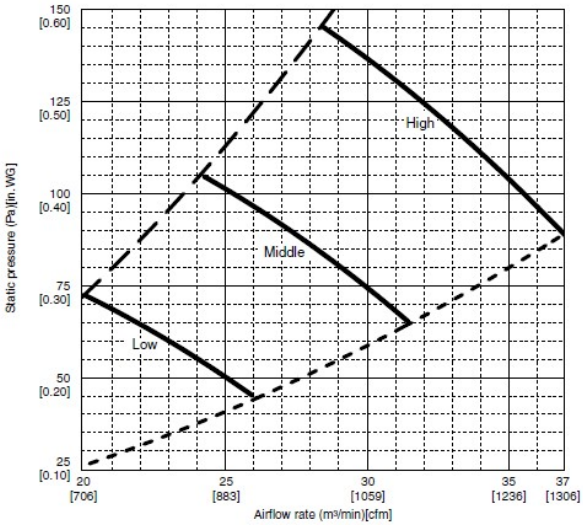




Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 125Pa, 0.50 [in. WG], Power source: 208/230 V, 60Hz





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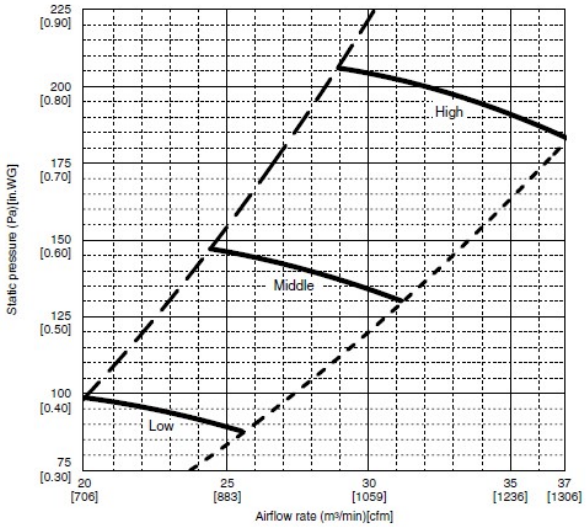
Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 200Pa, 0.80 [in. WG], Power source: 208/230 V, 60Hz



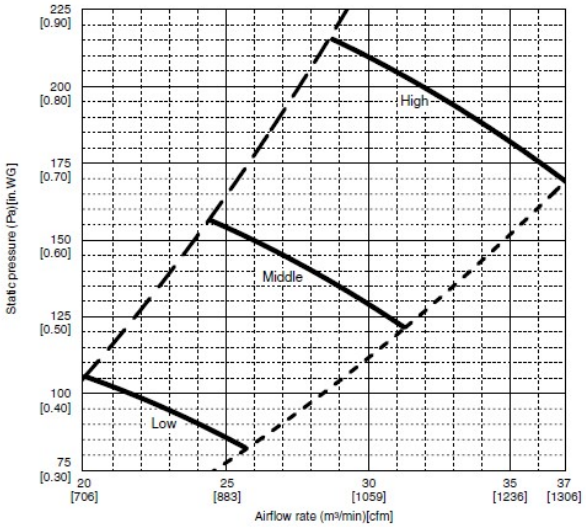
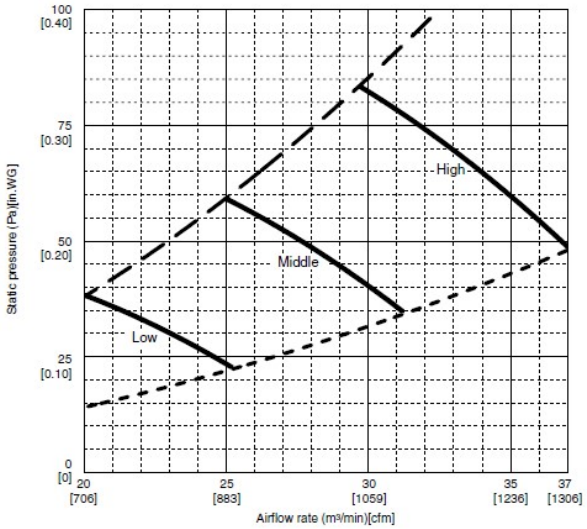
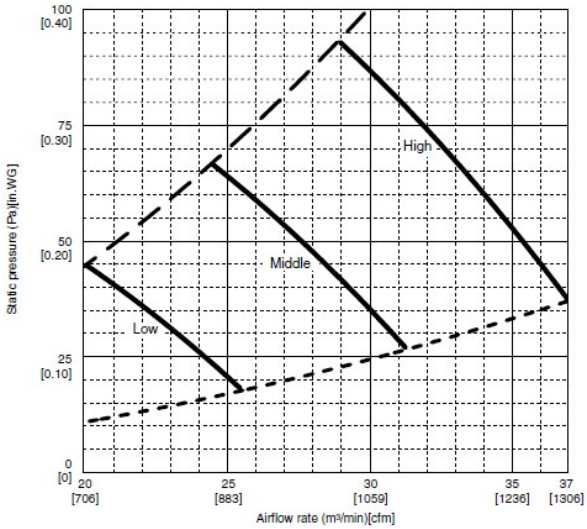


Table 6. Model code 36

Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 75Pa, 0.30 [in. WG], Power source: 208/230 V, 60Hz





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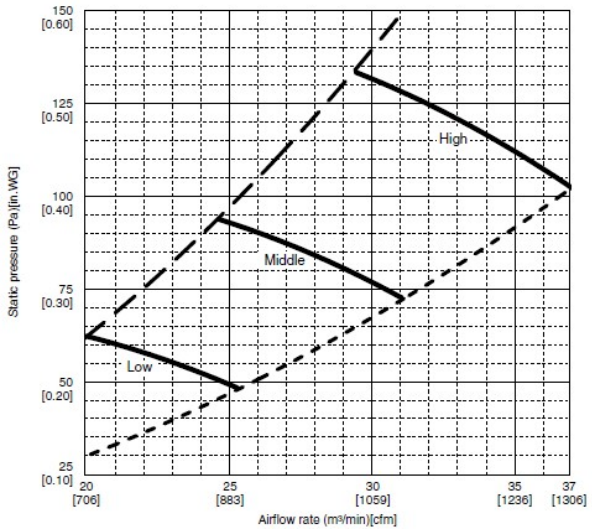
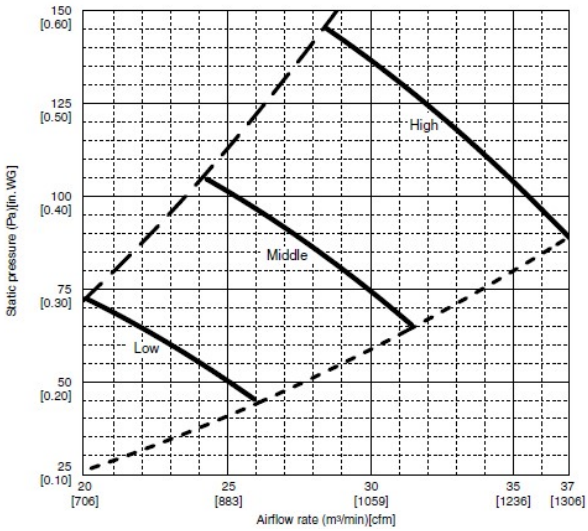
Vertical, Horizontal right, Horizontal left **Downflow**

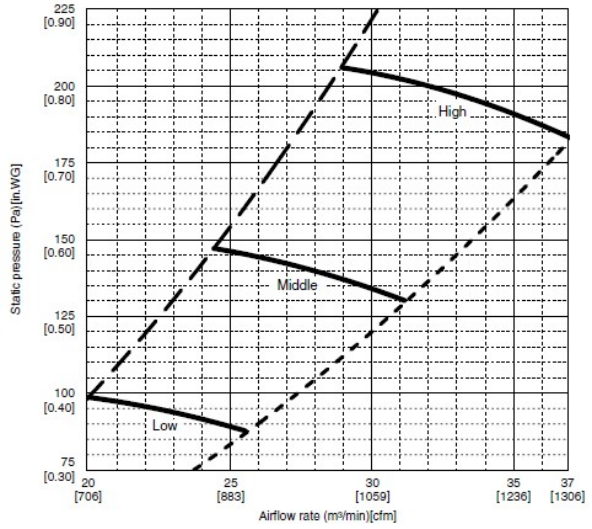
External static pressure: 125Pa, 0.50 [in. WG], Power source: 208/230 V, 60Hz





Vertical, Horizontal right, Horizontal left **Downflow**

External static pressure: 200Pa, 0.80 [in. WG], Power source: 208/230 V, 60Hz



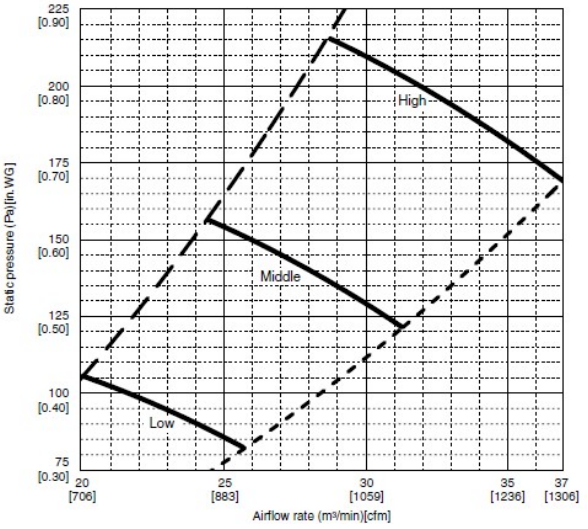


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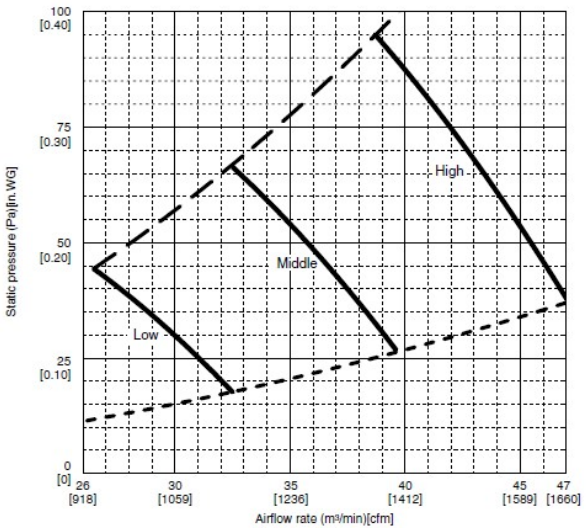
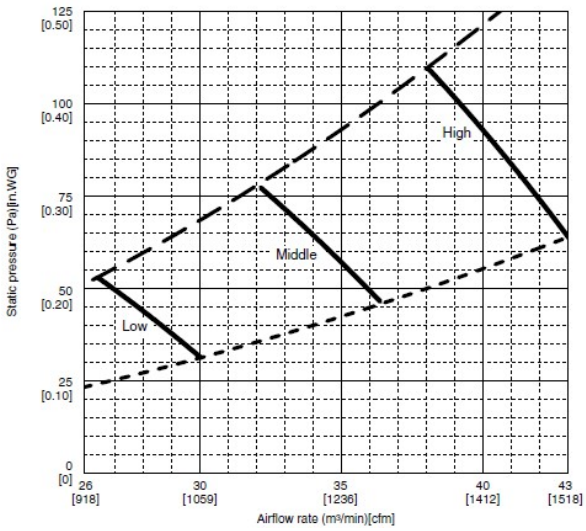
Table 7. Model code 42 & 48

Vertical, Horizontal right, Horizontal left	Downflow

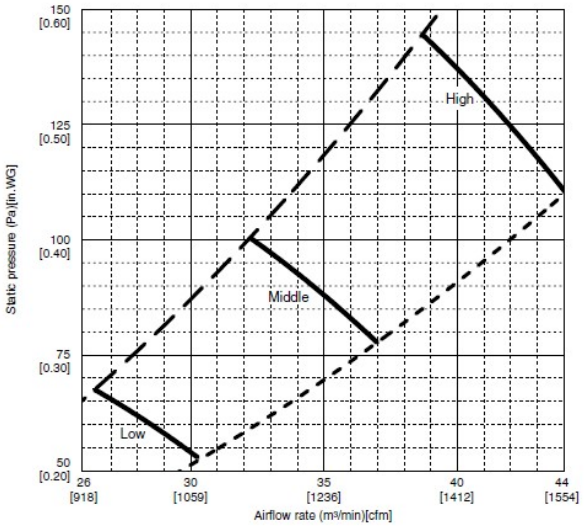
External static pressure: 75Pa, 0.30 [in. WG], Power source: 208/230 V, 60Hz

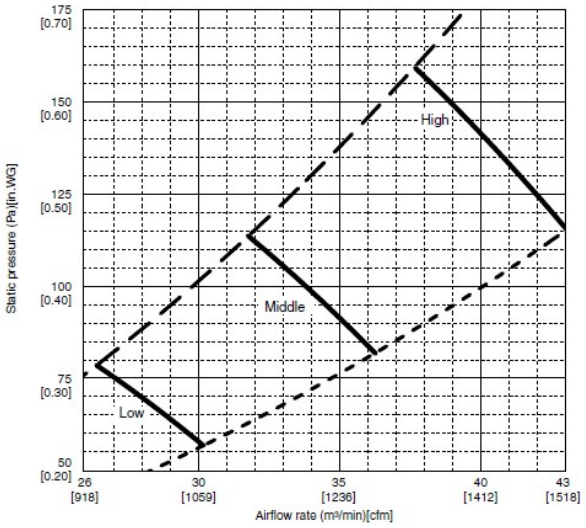




Vertical, Horizontal right, Horizontal left	Downflow

External static pressure: 125Pa, 0.50 [in. WG], Power source: 208/230 V, 60Hz





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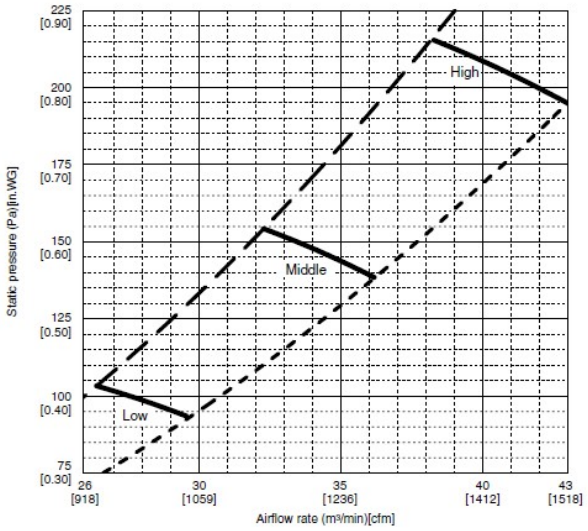
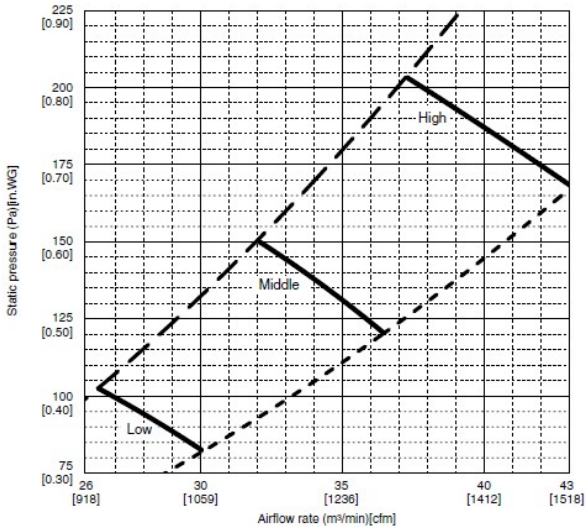
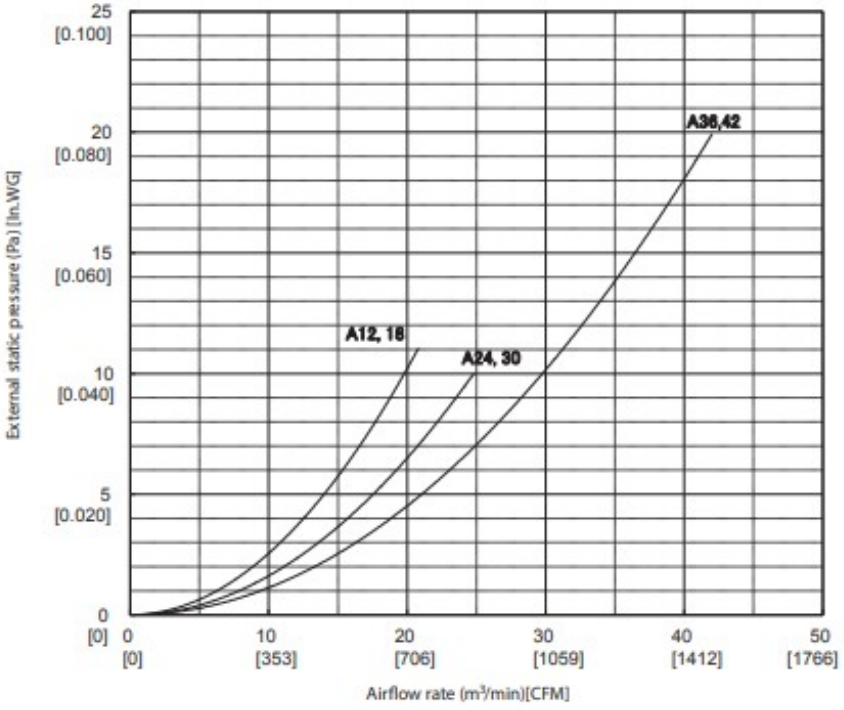
Vertical, Horizontal right, Horizontal left **Downflow**

External static pressure: 200Pa, 0.80 [in. WG], Power source: 208/230 V, 60Hz





Air filter



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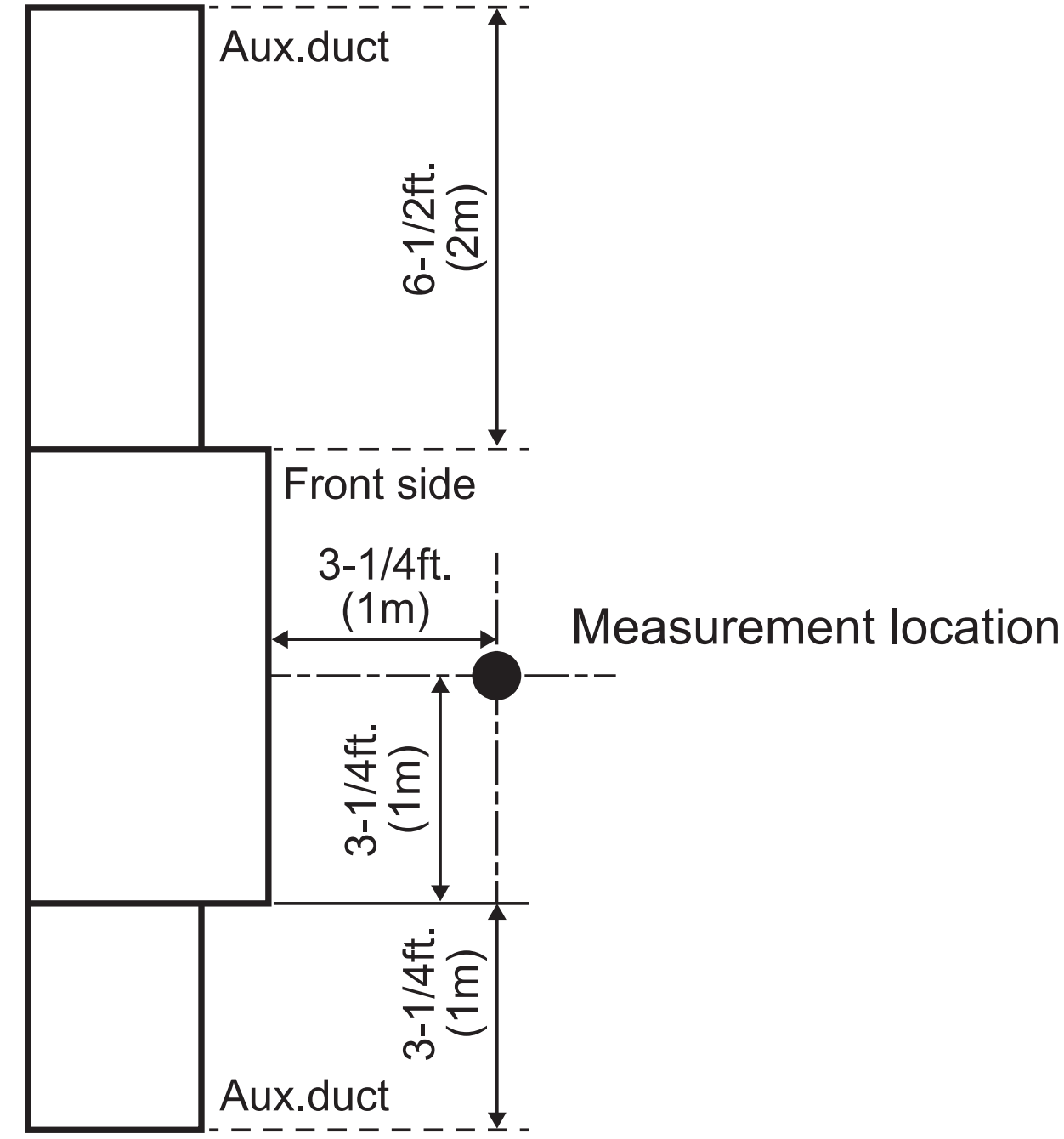
6. Sound Pressure Levels

6.1. Sound pressure level

Multi-Position



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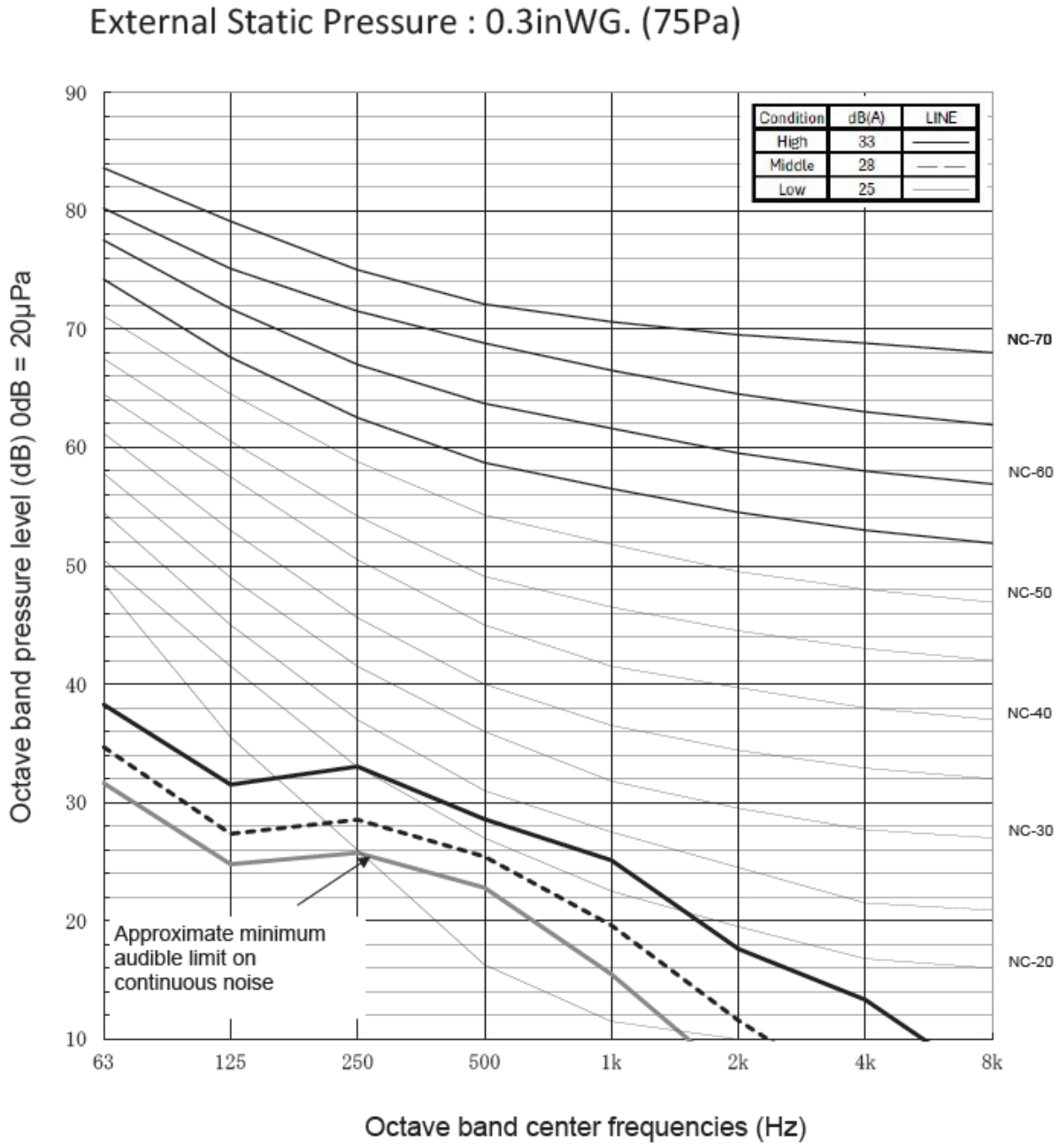
6.2. NC Curves

Table 8. Model code 12, External static pressure 0.30, 0.50, 0.80 in WG (75, 125, 200 Pa).



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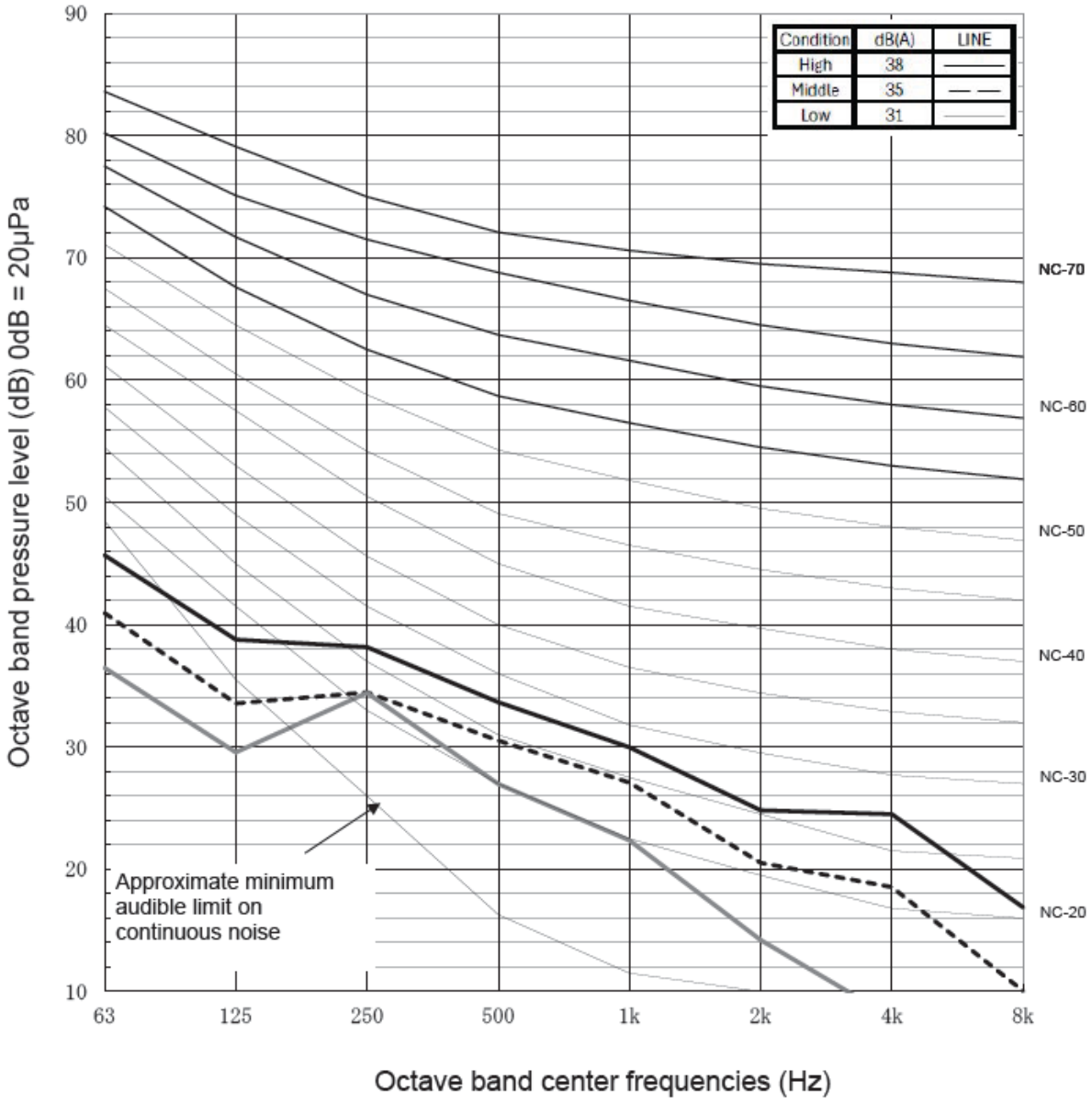
External Static Pressure : 0.5inWG. (125Pa)



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External Static Pressure : 0.8inWG. (200Pa)

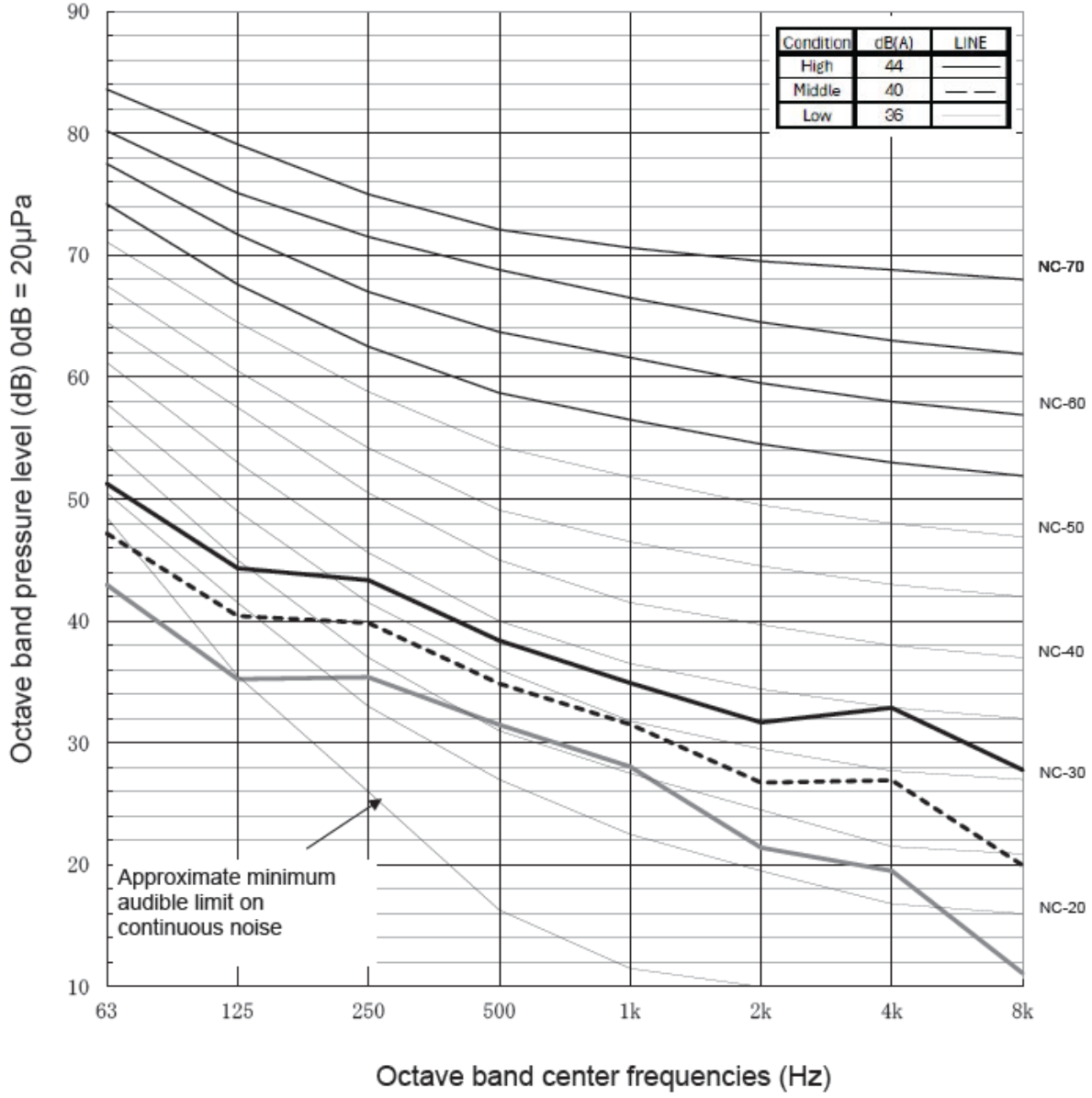

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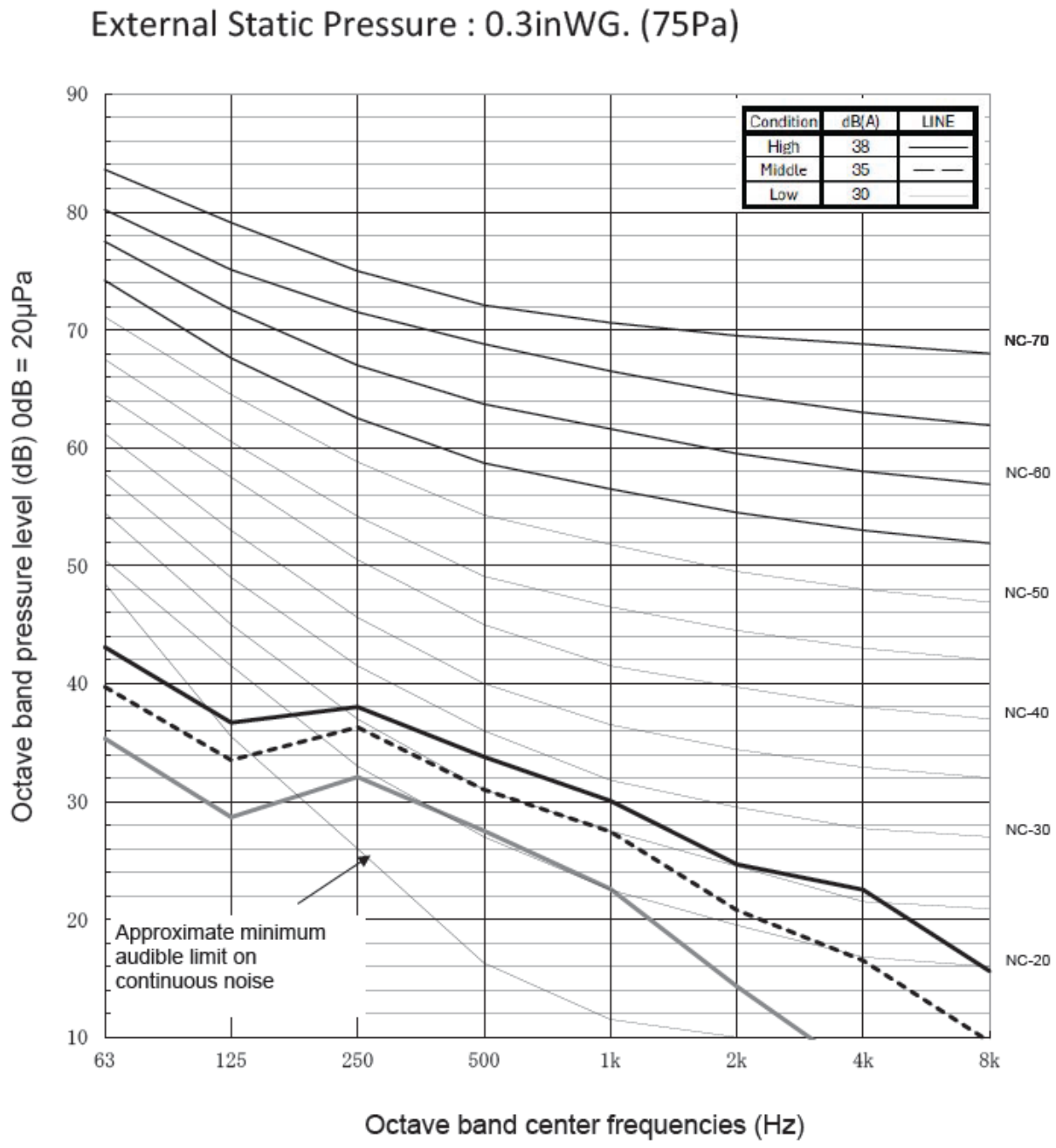
Table 9. Model code 18, External static pressure 0.30, 0.50, 0.80 in WG (75, 125, 200 Pa).



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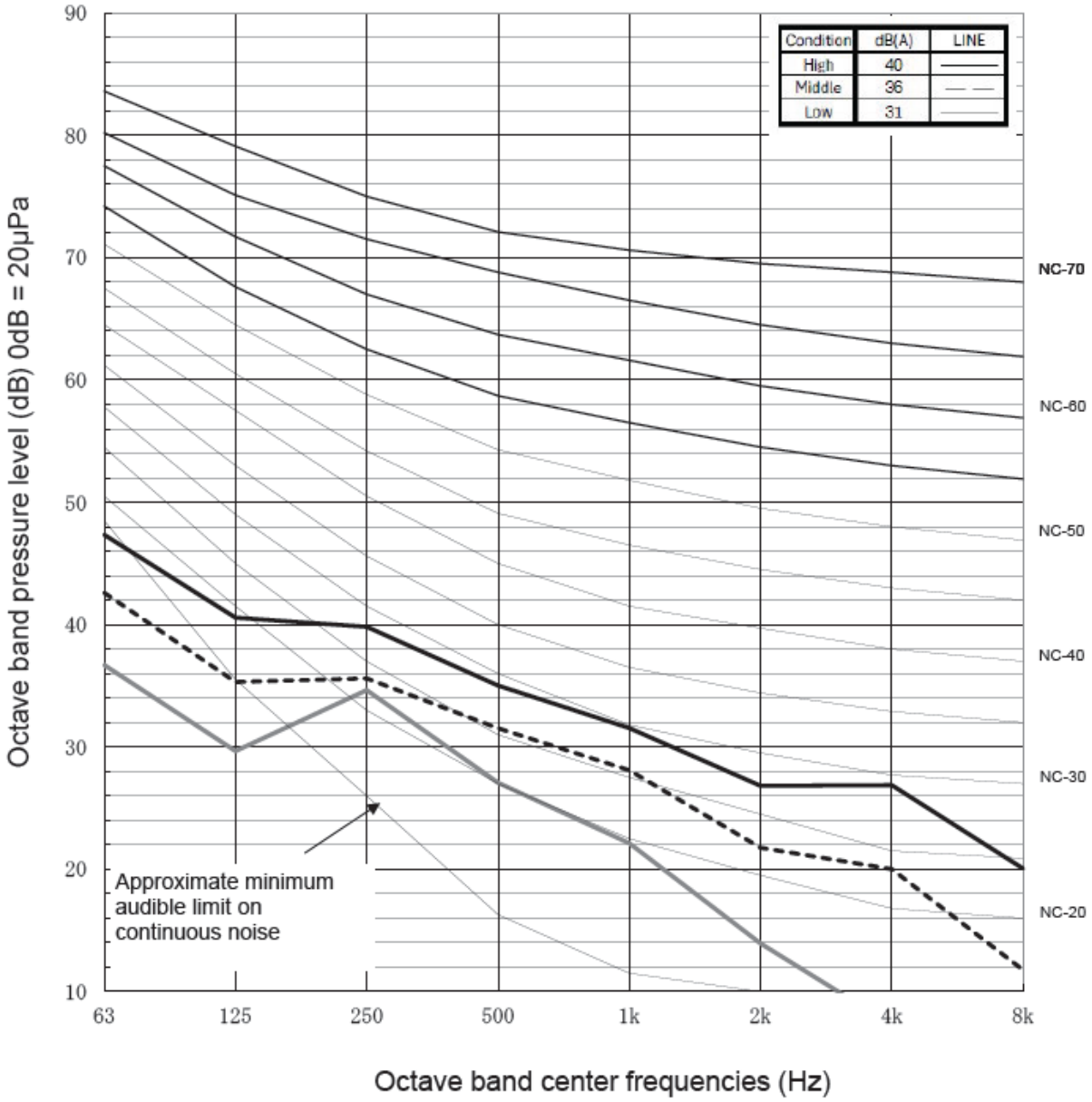
External Static Pressure : 0.5inWG. (125Pa)



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External Static Pressure : 0.8inWG. (200Pa)

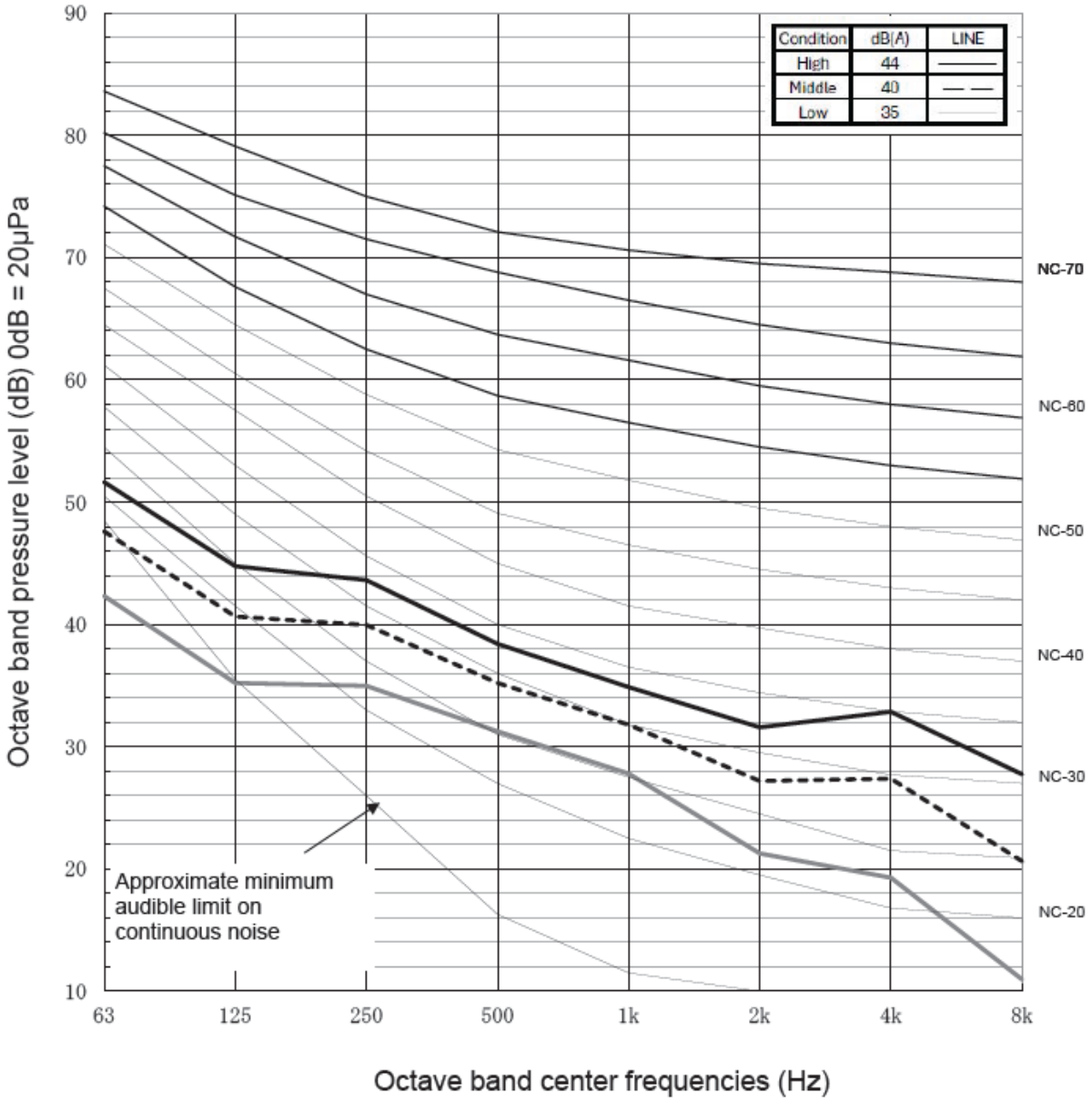

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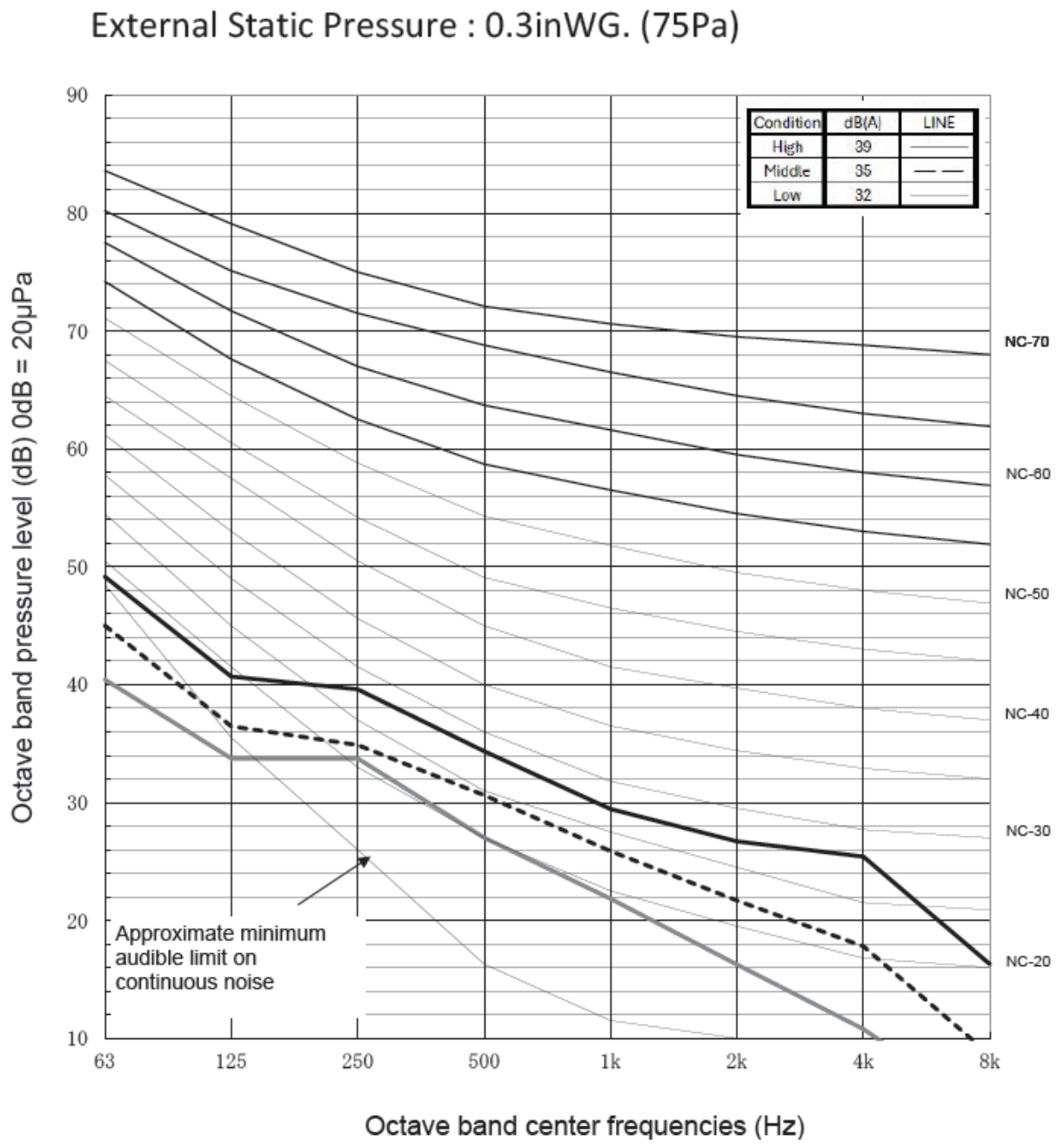
Table 10. Model code 24, External static pressure 0.30, 0.50, 0.80 in WG (75, 125, 200 Pa).



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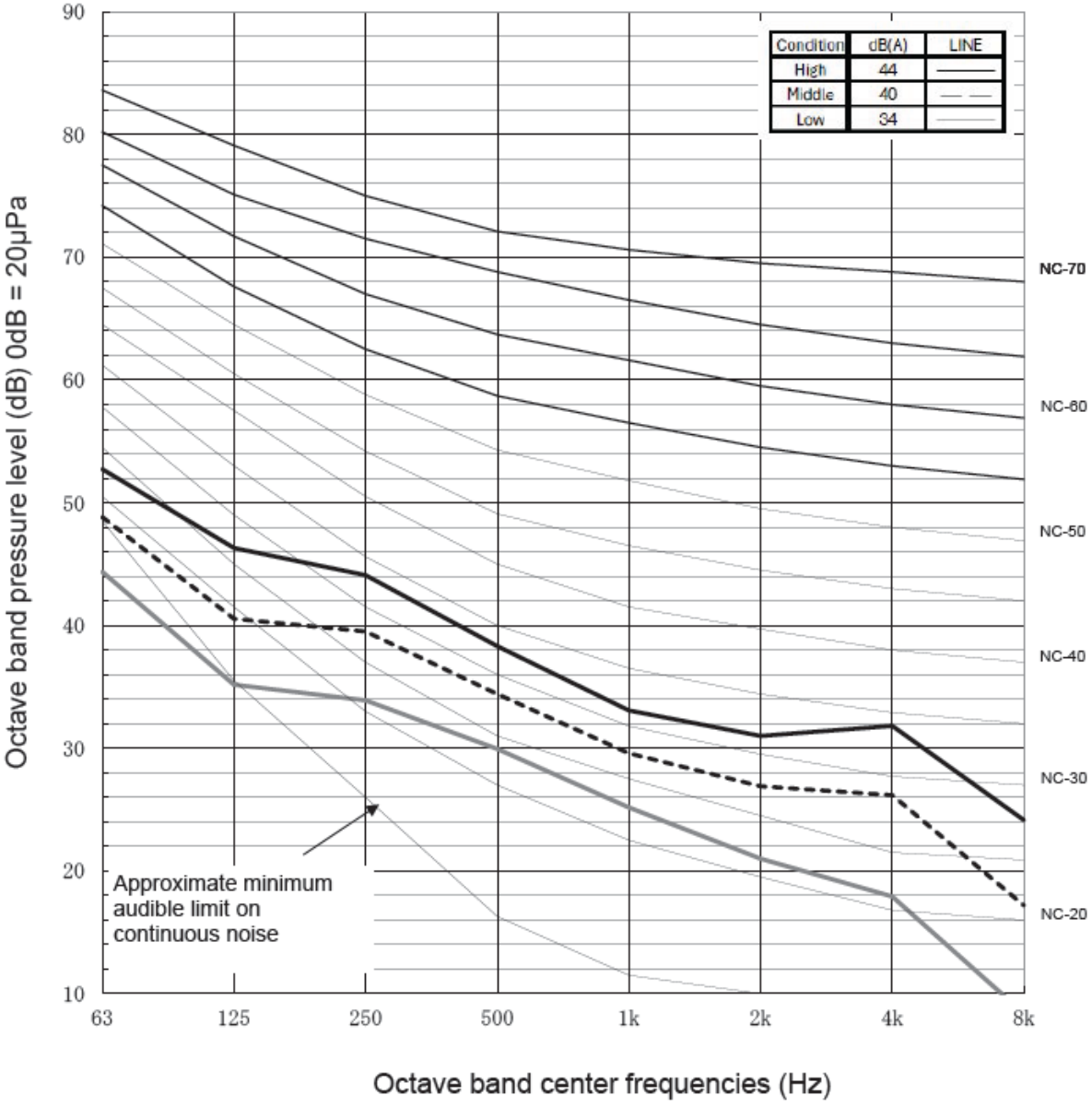
External Static Pressure : 0.5inWG. (125Pa)



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External Static Pressure : 0.8inWG. (200Pa)

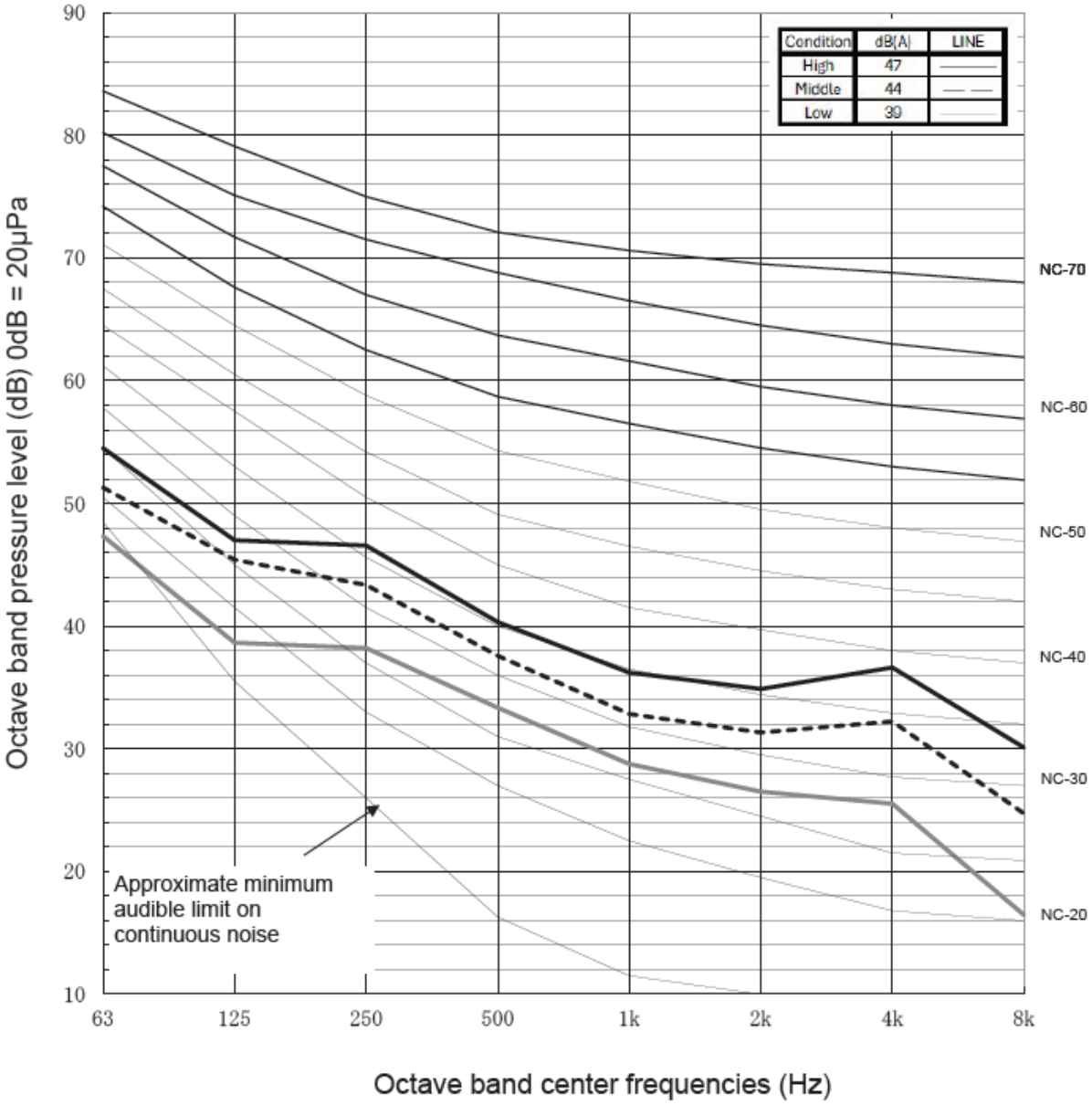

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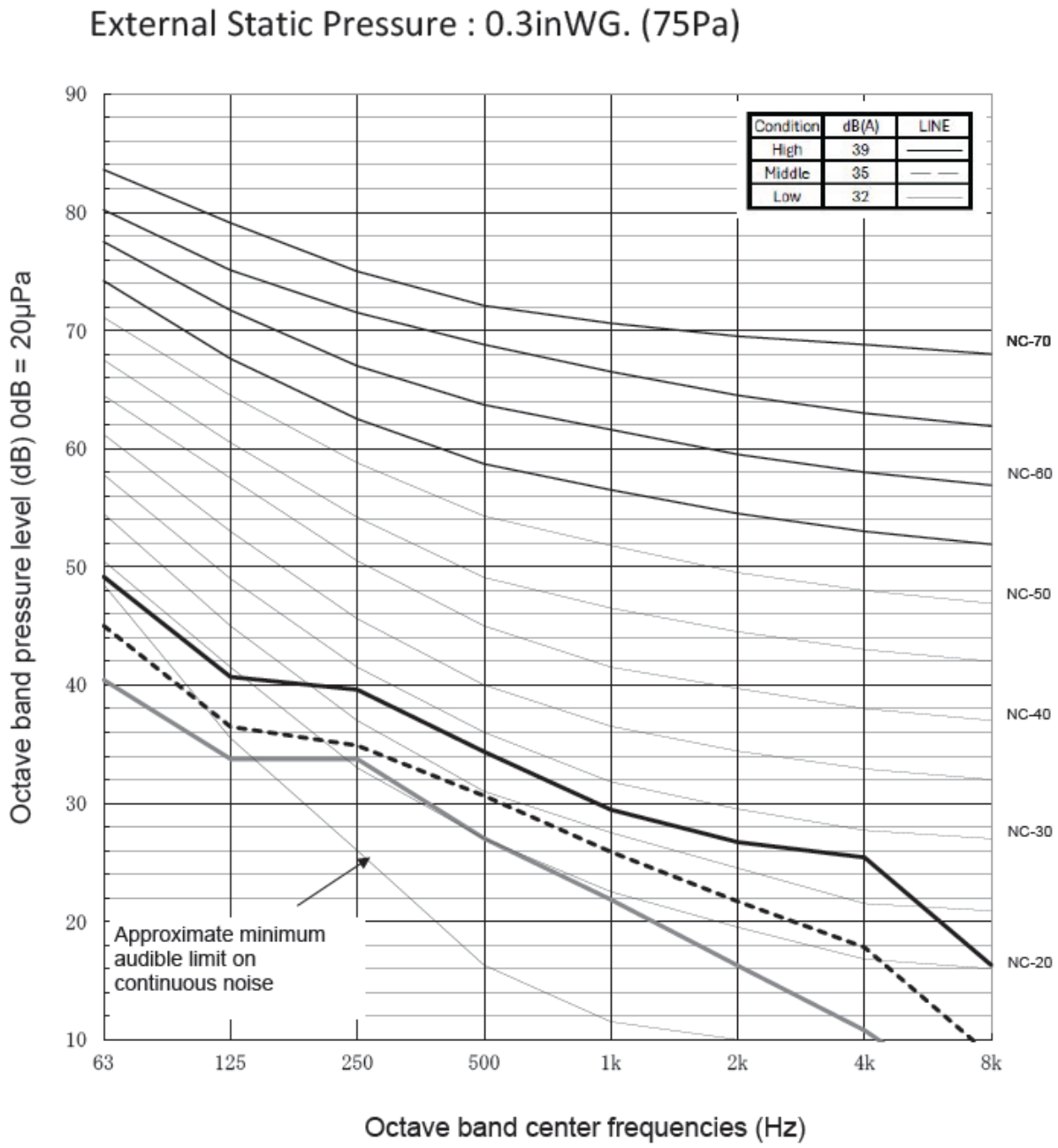
Table 11. Model code 30, External static pressure 0.30, 0.50, 0.80 in WG (75, 125, 200 Pa).



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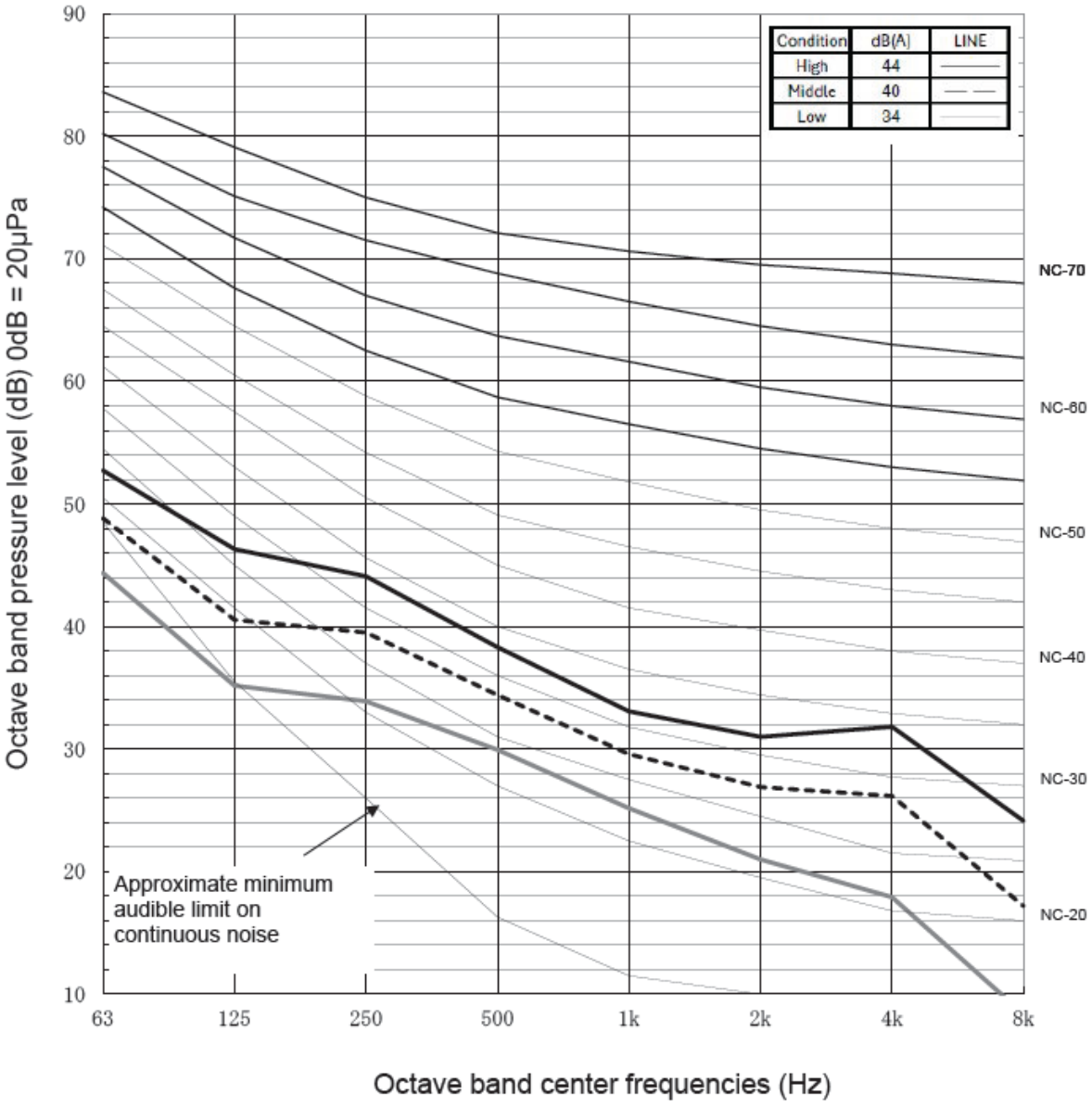
External Static Pressure : 0.5inWG. (125Pa)



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External Static Pressure : 0.8inWG. (200Pa)

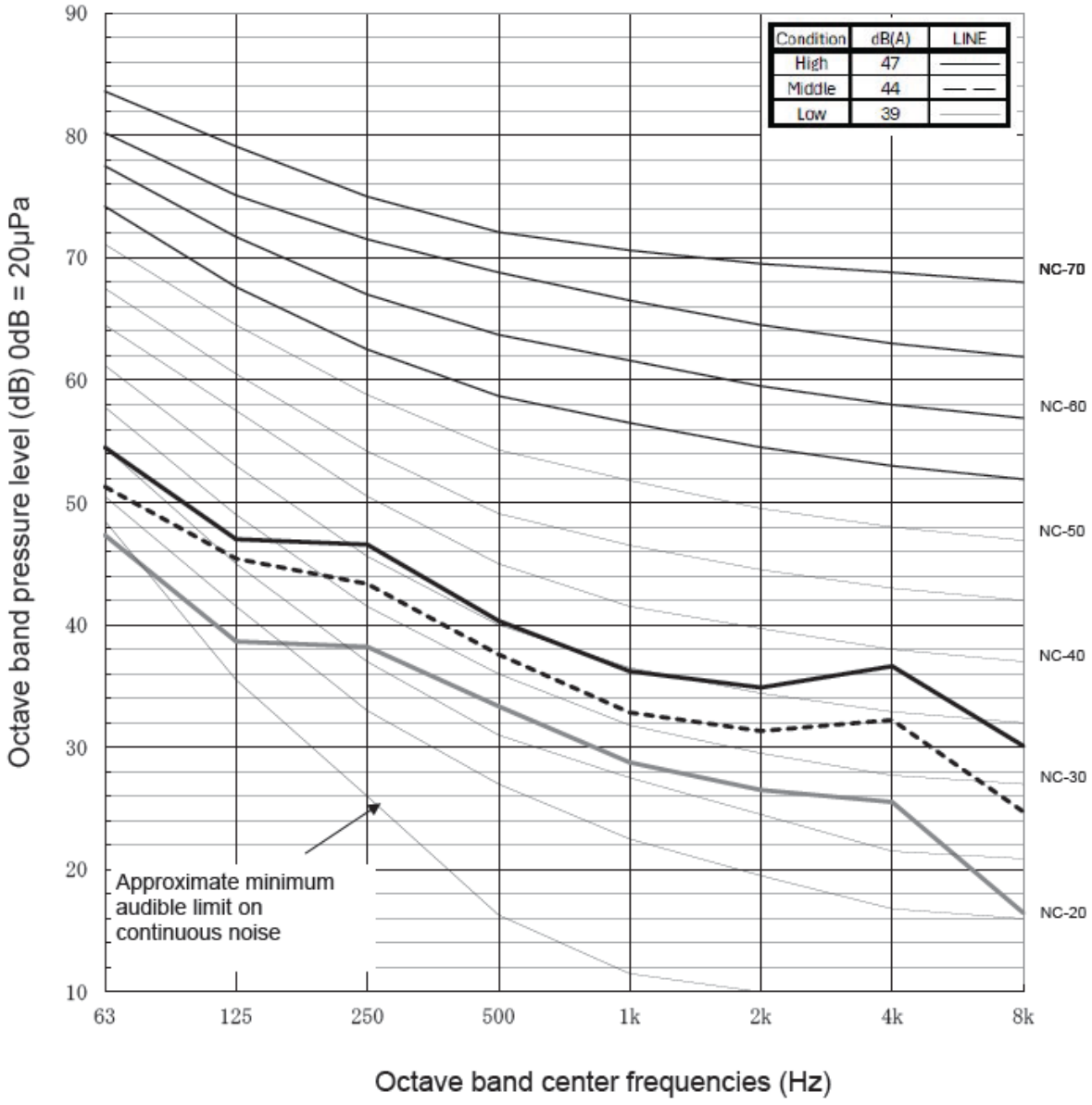

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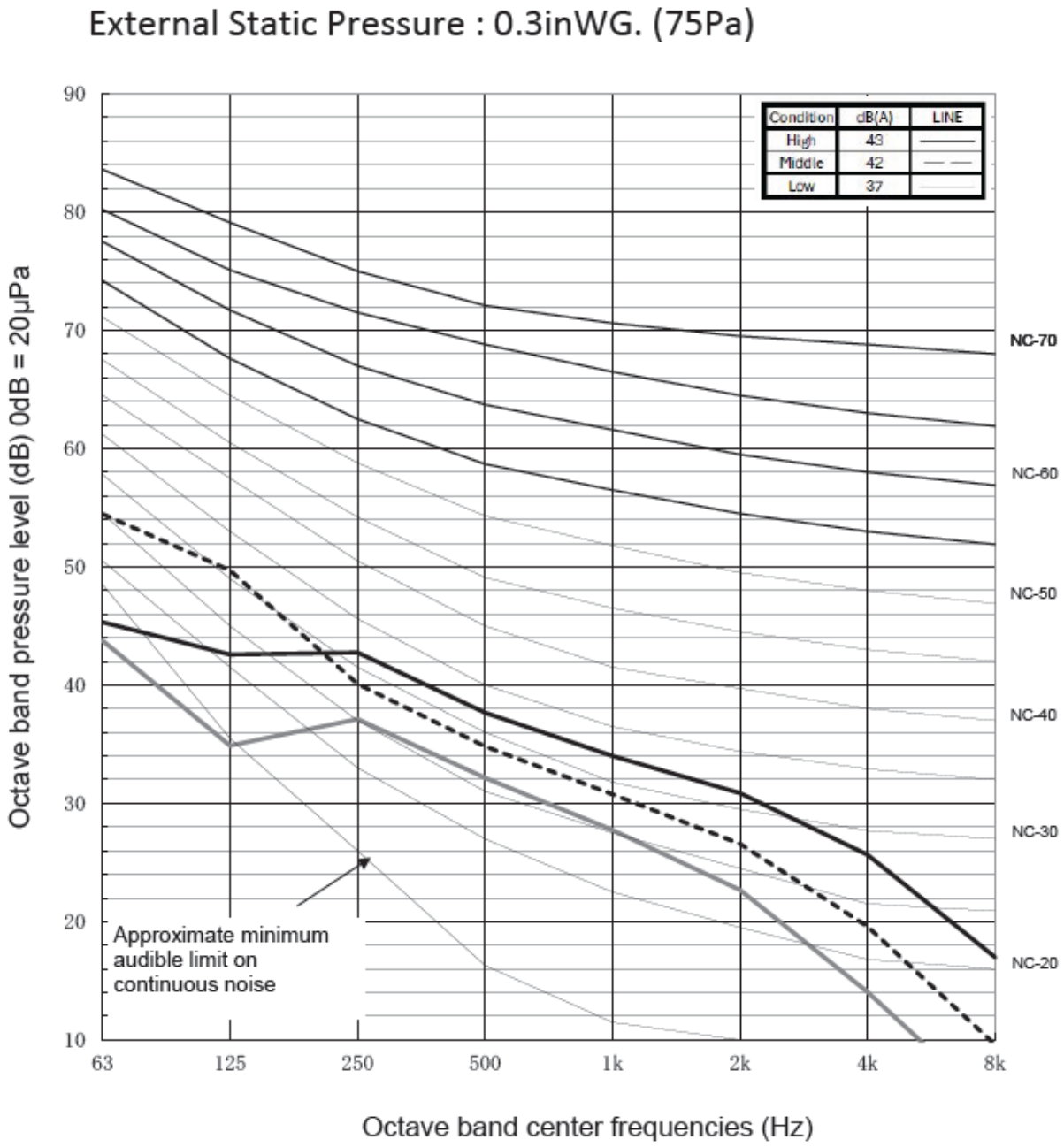
Table 12. Model code 36, External static pressure 0.30, 0.50, 0.80 in WG (75, 125, 200 Pa).



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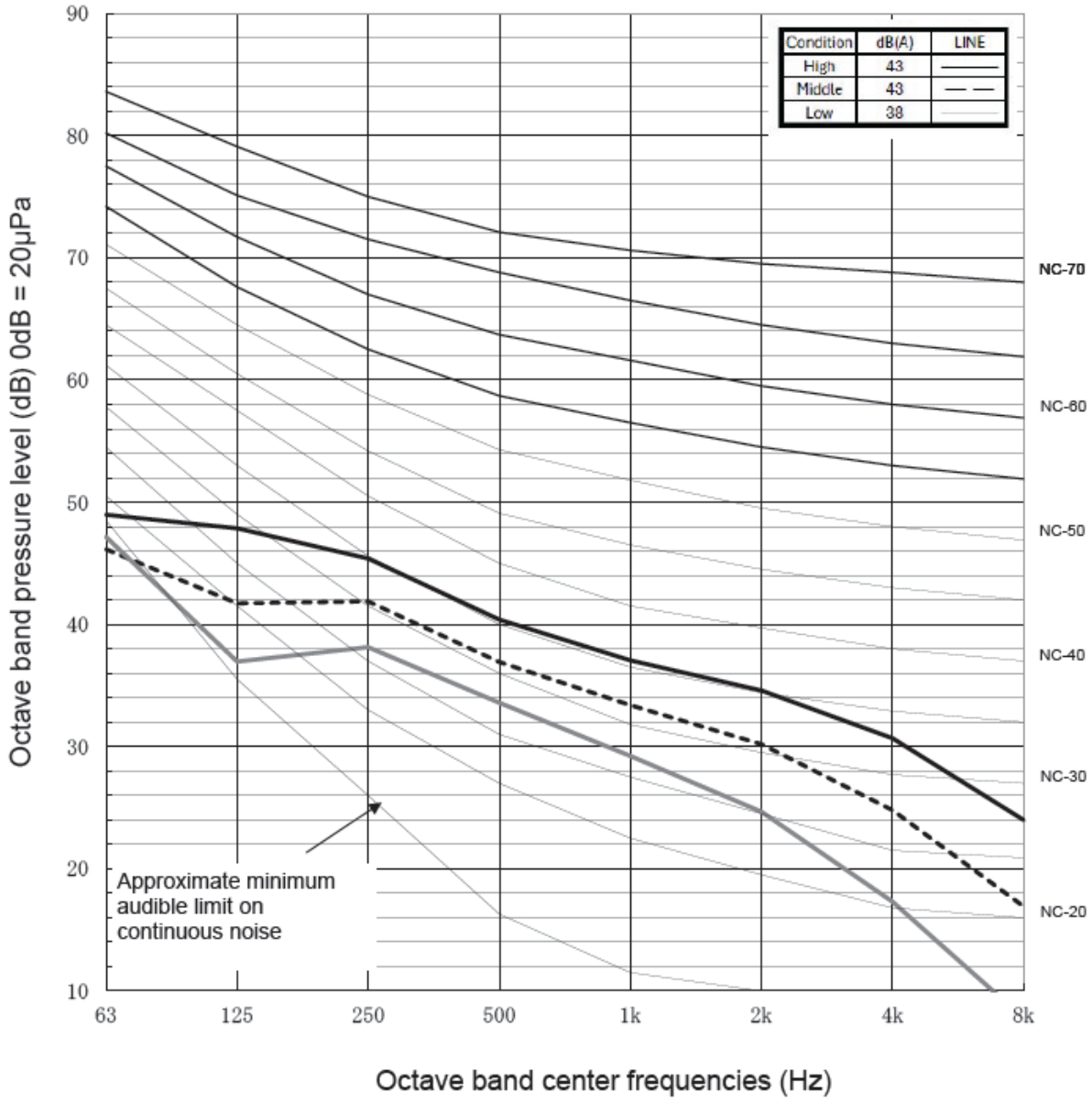
External Static Pressure : 0.5inWG. (125Pa)



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External Static Pressure : 0.8inWG. (75Pa)

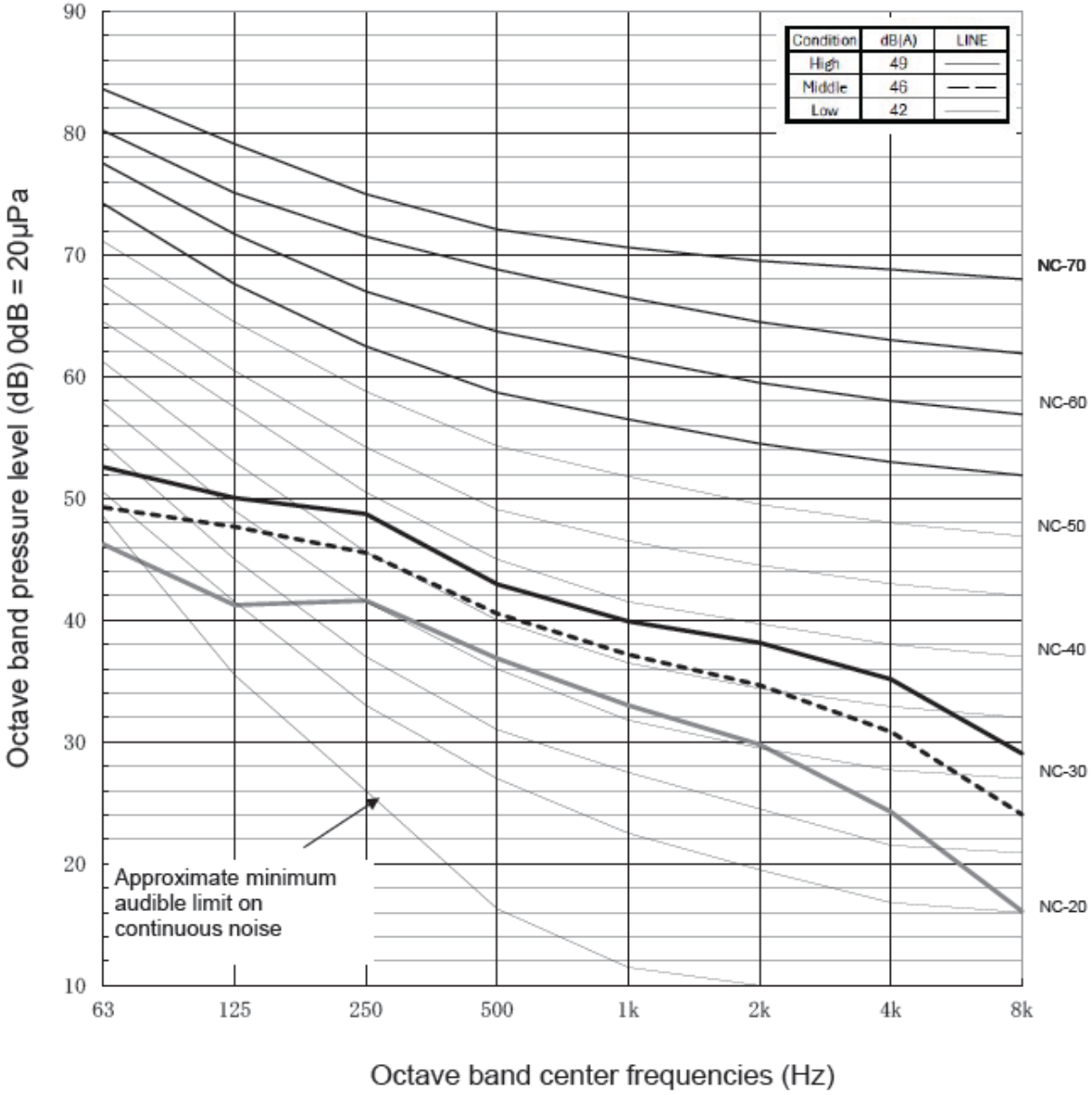

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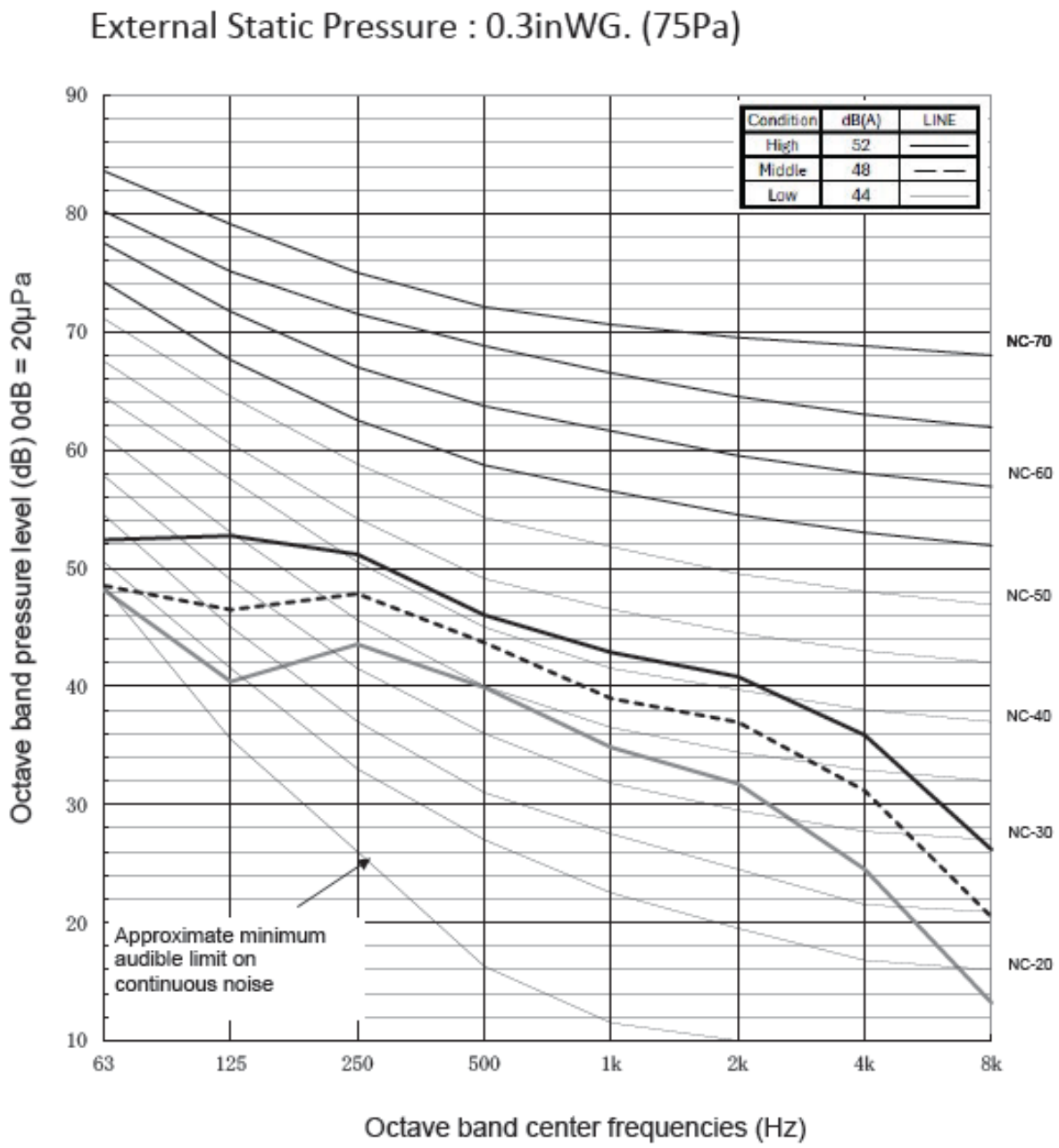
Table 13. Model code 42 & 48, External static pressure 0.30, 0.50, 0.80 in WG (75, 125, 200 Pa).



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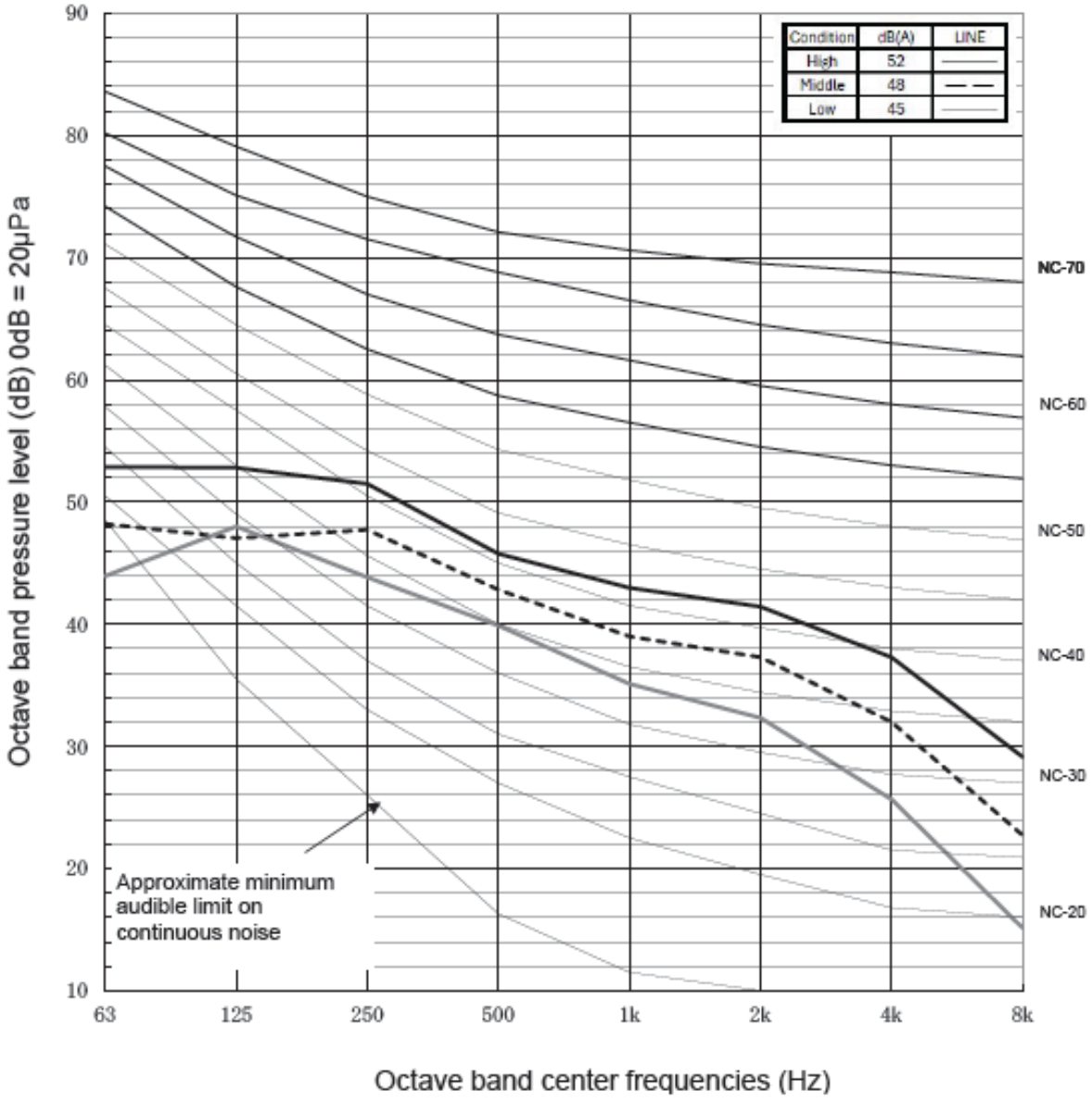
External Static Pressure : 0.5inWG. (125Pa)



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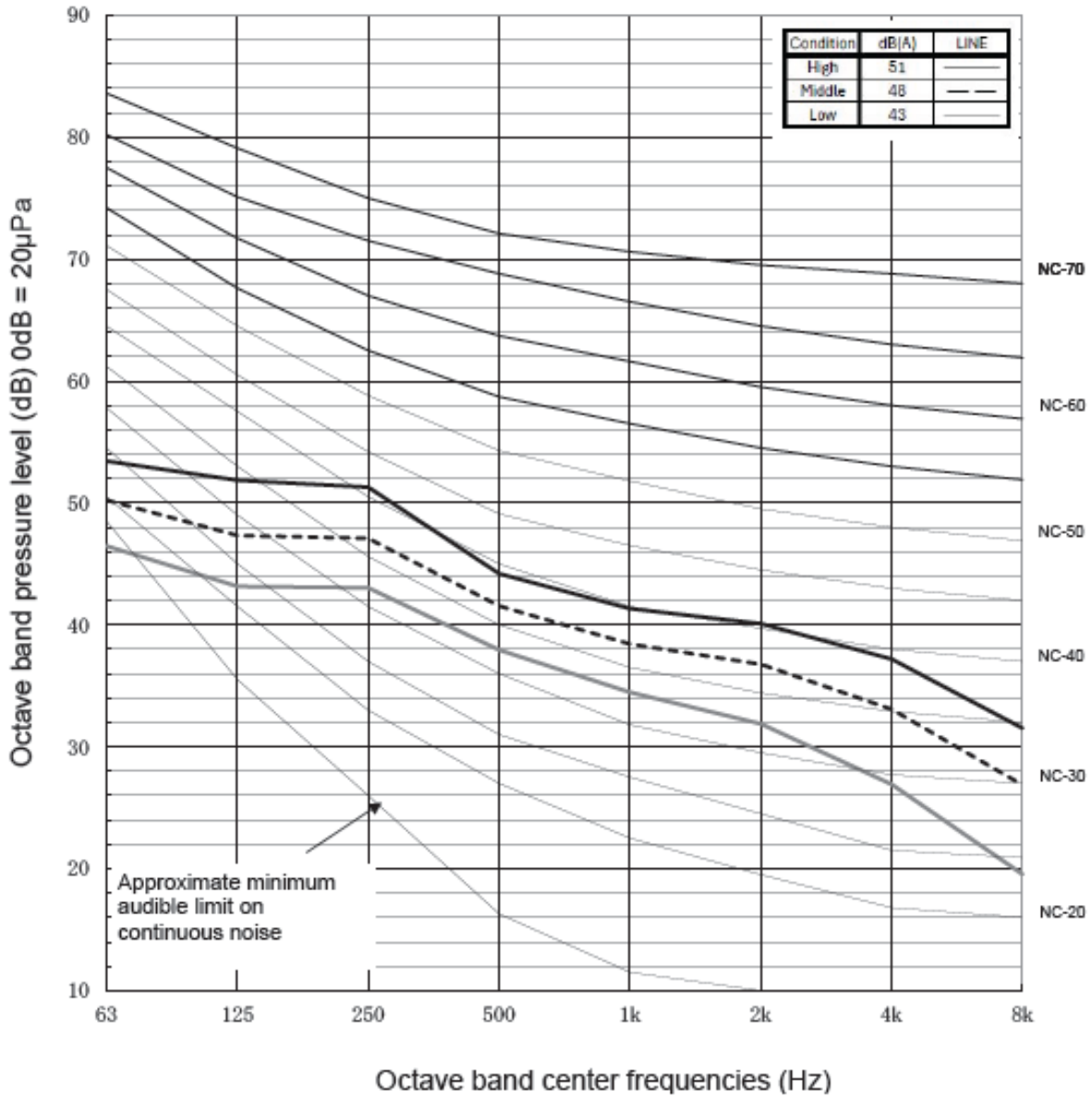
External Static Pressure : 0.8inWG. (200Pa)



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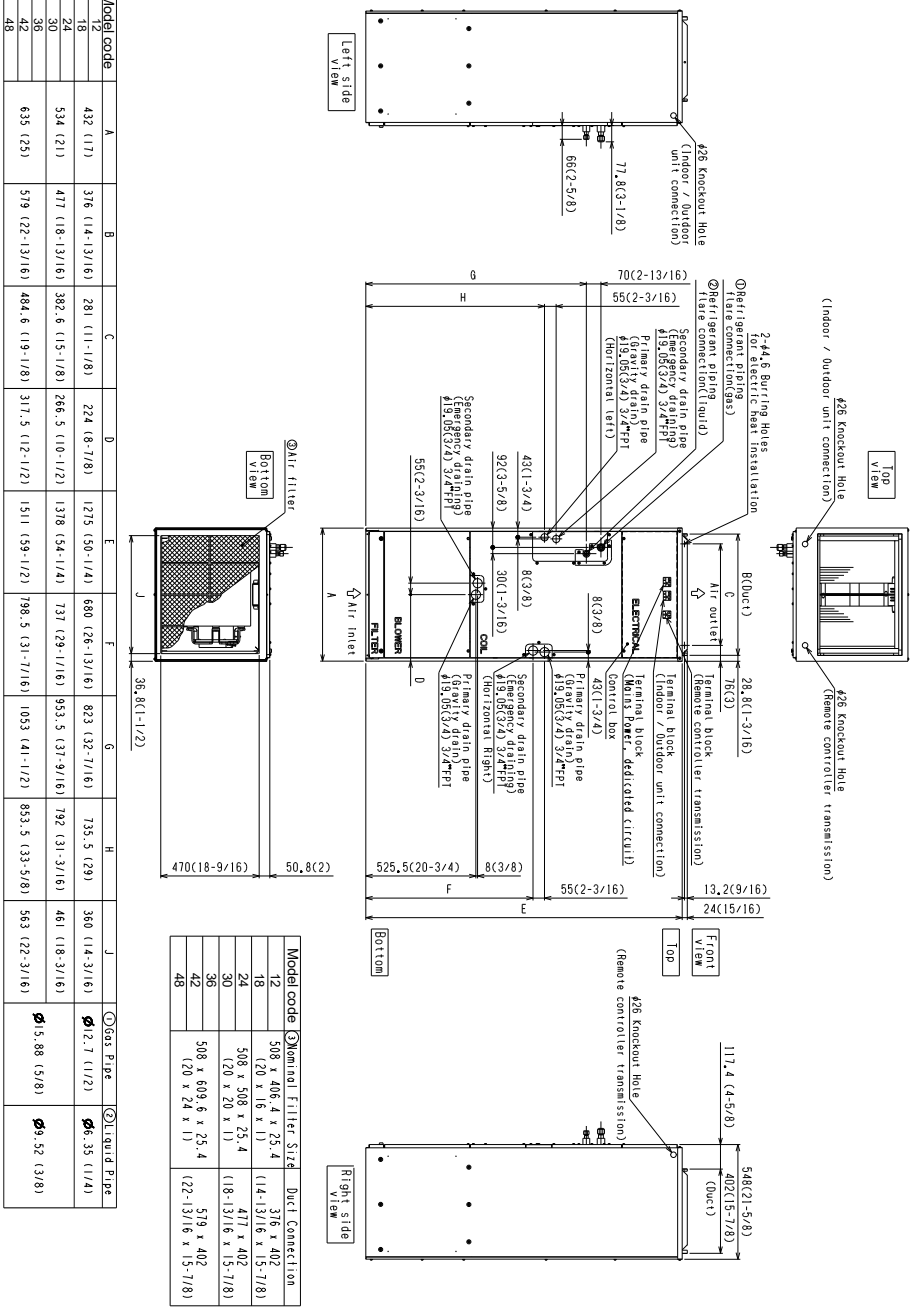
7. Dimensions

Provide enough clearance in front of unit for service and maintenance. Electrical entrance for PVA located on both left and right side of the cabinet. See the right or left side view for knockout locations.



Model code	③Nominal Filter Size	Duct Connection
12	508 x 406.4 x 25.4 (20 x 16 x 1)	376 x 402 (14-13/16 x 15-7/8)
18		
24	508 x 508 x 25.4 (20 x 20 x 1)	477 x 402 (18-13/16 x 15-7/8)
30		
36	508 x 609.6 x 25.4 (20 x 24 x 1)	579 x 402 (22-13/16 x 15-7/8)
42		
48		

Units: mm (in.)

Model code	A	B	C	D	E	F	G	H	J	①Gas Pipe	②Liquid Pipe
12	432 (17)	376 (14-13/16)	281 (11-1/8)	224 (8-7/8)	1275 (50-1/4)	680 (26-13/16)	823 (32-7/16)	735.5 (29)	360 (14-3/16)	Ø12.7 (1/2)	Ø6.35 (1/4)
18											
24	534 (21)	477 (18-13/16)	382.6 (15-1/8)	266.5 (10-1/2)	1378 (54-1/4)	737 (29-1/16)	953.5 (37-9/16)	792 (31-3/16)	461 (18-3/16)		
30											
36											
42	635 (25)	579 (22-13/16)	484.6 (19-1/8)	317.5 (12-1/2)	1511 (59-1/2)	798.5 (31-7/16)	1053 (41-1/2)	853.5 (33-5/8)	563 (22-3/16)	Ø15.88 (5/8)	Ø9.52 (3/8)
48											

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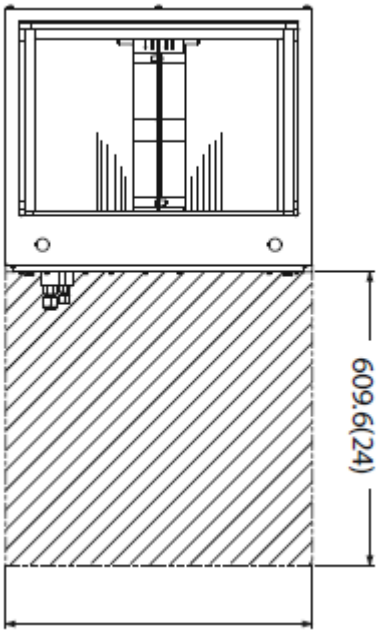
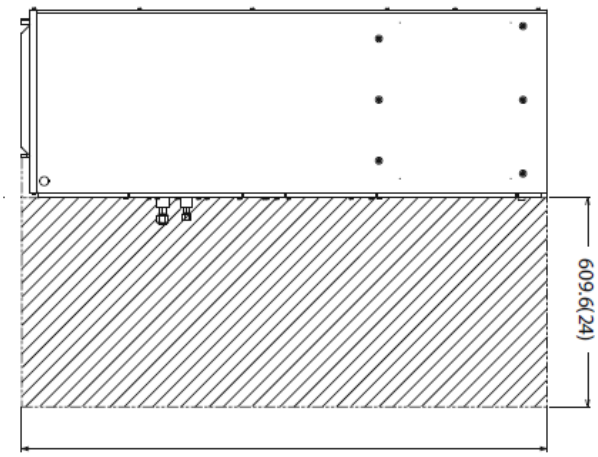
7.1. Outlines

Table 14. Clearance area

Vertical	Horizontal
	
width of unit	**length of unit**

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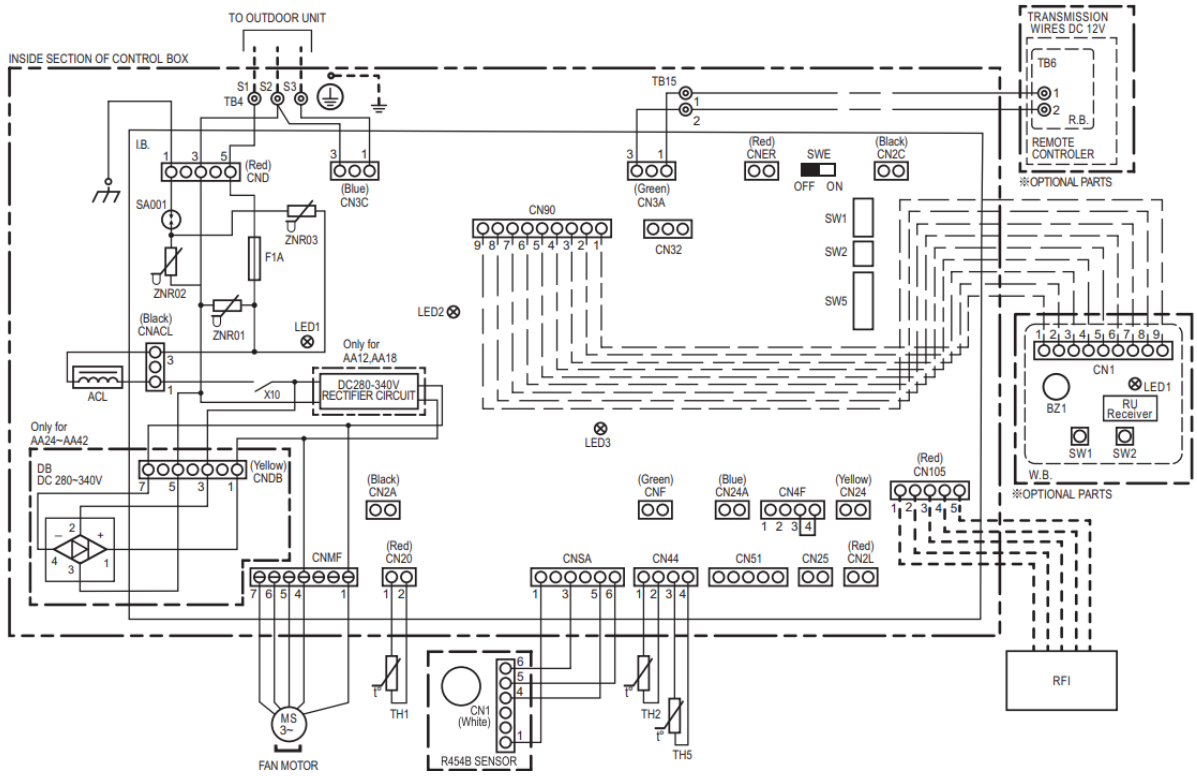
8. Wiring Diagram

PVA-AA12, 18, 24, 20, 36, 42NL



MODEL CODE	SWITCH
12	
18	
24	
30	
36	
42	

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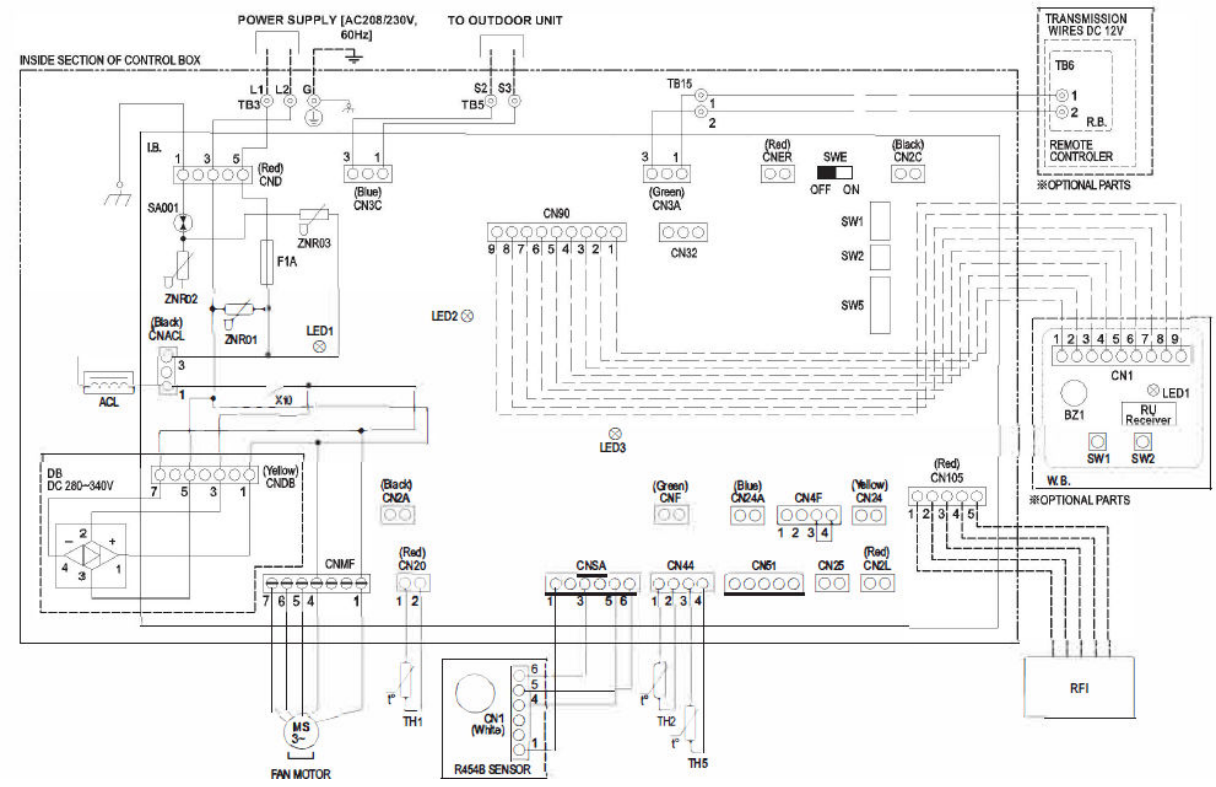
PVA-AA48NL



MODEL CODE	SWITCH
48	SW1 ON 1 2 3 4 5 6 / SW2 ON 1 2 3 4 5 6 / SW5 ON 1 2 3 4 5 6 7 8

SYMBOL EXPLANATION

SYMBOL	NAME
I.B.	INDOOR CONTROLLER BOARD
CN24	CONNECTOR (HEATER CONTROL 1ST)
CN24A	CONNECTOR (HEATER CONTROL 2ND)
CN25	CONNECTOR (HUMIDITY OUTPUT)
CN2A	CONNECTOR (0-10V ANALOG INPUT)
CN2C	CONNECTOR (ERV OUTPUT)
CN2L	CONNECTOR (LOSSNAY)
CN32	CONNECTOR (REMOTE SWITCH)
CN51	CONNECTOR (CENTRALLY CONTROL)
CN90	CONNECTOR (WIRELESS)
CN105	CONNECTOR (RADIO FREQUENCY)
CNER	CONNECTOR (ERV INPUT)
CNF	CONNECTOR (HUMIDITY INPUT)
CNDB	CONNECTOR (DIODE BRIDGE)
LED1	LED(POWER SUPPLY)
LED2	LED(REMOTE CONTROLLER SUPPLY)
LED3	LED(TRANSMISSION INDOOR-OUTDOOR)
RFI	RADIO FREQUENCY INTERFACE FOR RF THERMOSTAT

SYMBOL	NAME
I.B.	INDOOR CONTROLLER BOARD
SW1	SWITCH (FOR MODEL SELECTION)
SW2	SWITCH (FOR CAPACITY CODE)
SW5	SWITCH (FOR MODE SELECTION)
SWE	CONNECTOR (EMERGENCY OPERATION)
F1A	FUSE AC250V 6.3A
ZNR01, 02, 03	VARISTOR
SA001	ARRESTOR
X10	AUX. RELAY
TH1	INTAKE AIR TEMP. THERMISTOR
TH2	PIPE TEMP. THERMISTOR/LIQUID
TH5	COND./EVA.TEMP. THERMISTOR
ACL	AC REACTOR (POWER FACTOR IMPROVEMENT)
DB	DIODE BRIDGE
TB3	TERMINAL BLOCK (POWER SUPPLY)
TB5	TERMINAL BLOCK (INDOOR/OUTDOOR CONNECTING LINE)
TB15	TERMINAL BLOCK (REMOTE CONTROLLER TRANSMISSION LINE)

SYMBOL	NAME
OPTIONAL PARTS	
W.B.	IR WIRELESS REMOTE CONTROLLER BOARD
RU	RECEIVING UNIT
BZ1	BUZZER
LED1	LED(RUN INDICATOR)
SW1	SWITCH(HEATING ON/OFF)
SW2	SWITCH(COOLING ON/OFF)
R.B.	WIRED REMOTE CONTROLLER BOARD
TB6	TERMINAL BLOCK (REMOTE CONTROLLER TRANSMISSION LINE)

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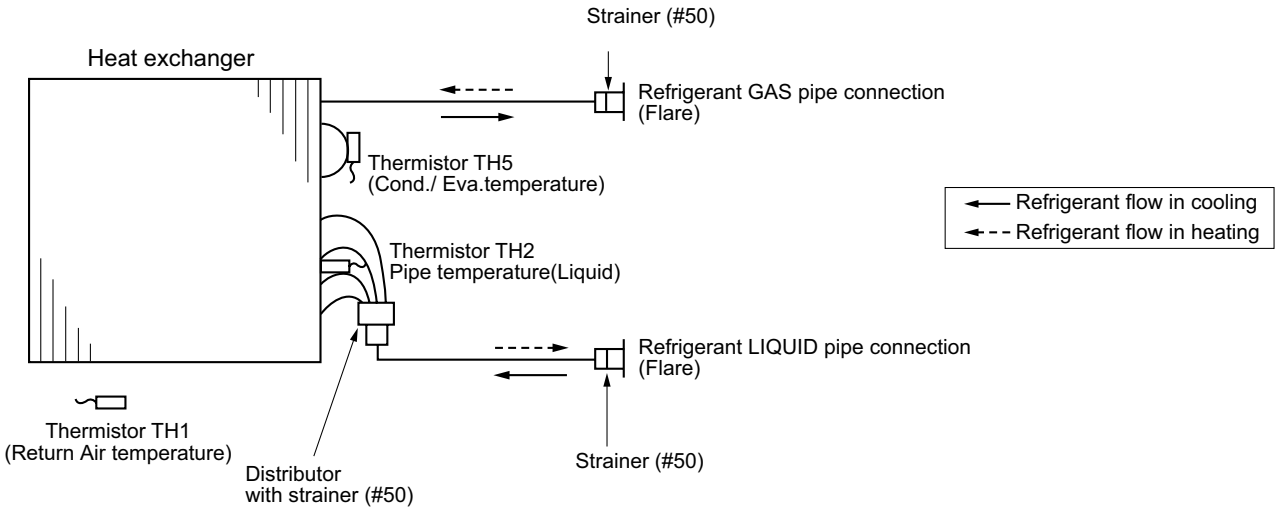
NOTE

1. Since the outdoor side electric wiring may change be sure to check the outdoor unit electric wiring for servicing.
2. Indoor and outdoor connecting wires are made with polarities, make wiring matching terminal numbers (S1, S2, S3).
3. Symbols used in wiring diagram above are as follows:

	Connector
	Terminal
	(**HEAVY DOTTED LINE**): Field wiring
	(Thin dotted line): Optional parts

4. Use copper supply wire.

9. Refrigerant System Diagram



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10. Heater Control

10.1. Control specifications and function setting

- **Table 15. Function table: shows the mode setting for the field-installed heater.**

Mode (function) no.		Mode	Heater Operation in Error	Heater Operation in defrost	Fan Control when Heater ON [1]
11	23				
1	1	No Heater Present[2]			
2	1	Heater Available Disable Heater during Defrost and Error	OFF	OFF	High
2	2	Heater Available Enable heater and fan during Defrost and Error [3]	ON	ON	High

[1]While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller.

[2]Factory setting

[3]The heater will not operate if the following errors are active. In these cases, the error must be corrected, and the system restarted in order to recover heater function:

– Remote controller communication error (E4, E5)
– M-NET communication error (A0-A8)
– Air intake sensor error (P1)

Installers are strongly advised never to physically uninstall a wired controller while the system is running. In addition to the safety concerns, this practice can also trigger a remote controller communication error.

IMPORTANT

If the system detects an error that could potentially create a safety hazard, **the heater will not operate.**

CAUTION

If a heater is installed in a duct, do no use Panel Heater Connector. By doing so, the fan will turn off when the heater is on, which may result in fire.

NOTE

When using the SPTB1 accessory, take special care when restarting power to the system to ensure that both the indoor unit and outdoor unit are powered up at the same time to avoid triggering a communication error.

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- **Table 16. Heater control table: shows how the field-installed heater is controlled.**

Key
- EH1: Electric heater
- EH2: Electric heater
- To: Set point temperature
- T_{RA}: Return air temperature
- X: Time delay (Selectable. Default is 24 min. Selectable to 14, 19, or 29 min)

Mode Change	Condition								
	(To -T_{RA}) > 2.7 ° F [1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5° C] i X min	EH1 ON for > 7 mi	AND	(To -T_{RA}) > 2.7 ° F [1.5 ° C]	AND	T_{RA} has not increased by 0.9 ° F [0.5° C] in 7 min	(To -T_{RA}) < 0.9 °F [0.5° C]
EH1 ON	○	AND	○						
EH2 ON				○	AND	○	AND	○	
EH1 OFF									○
EH2 OFF									○

- **Table 17. Time delay selection table: shows how the time delay is selected**

Request Code[1]	Action[2]
390	Monitor Time Delay Setting
391	Set Time Delay to 14 minutes
392	Set Time Delay to 19 minutes
393	Set Time Delay to 24 minutes[3]
394	Set Time Delay to 29 minutes

[1]Time delay can only be selected with MA controller. If use of a non-MA controller is desired, the time delay must first be selected with the MA controller. Then the non-MA controller can be attached and used.

[2]All delay times are approximate.

[3]The default time delay setting is 24 minutes.

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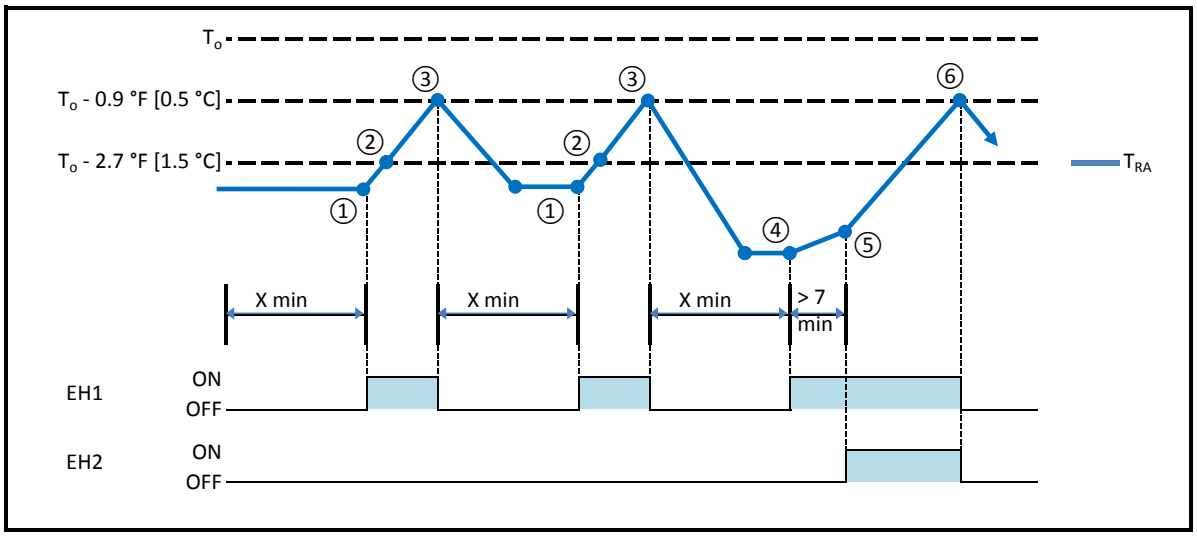
- **Table 18. Heater operation example: shows example of heater operation.**



Step	Condition			Result
①	(T_o -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5°C] in X min	EH1 ON
②	(T_o -T_{RA}) < 2.7 °F [1.5 °C]	AND	T_{RA} increasing faster than 0.9 °F [0.5°C] in 7 min	EH2 not ON
③	(T_o -T_{RA}) < 0.9 °F [0.5°C]			EH1 OFF
④	(T_o -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5°C] in X min	EH1 ON
⑤	(T_o -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} not increasing faster than 0.9 °F [0.5°C] in 7 min	EH2 ON
⑥	(T_o -T_{RA}) < 0.9 °F [0.5°C]			EH1 OFF EH2 OFF

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10.2. Fan control

By setting Mode No. 23 in the Function Table in section 9-1 and using CN4Y from the CN24RELAY-KIT-CM3 kit, the following patterns of fan control will become possible.

Table 19. Fan Control Patterns

CN4Y for FAN control (CN24RELAY-KIT-CM3)	Mode (function) No. 23	Heater operation in DEFROST and ERROR[1]	Fan mode in DEFROST and ERROR	Fan (all other modes)
Enabled	1[2]	OFF	STOP	Set (heater ON)
	2	ON	STOP	High (heater ON)[3]

[1]The heater will not operate if the following errors are active. In these cases, the error must be corrected, and the system restarted in order to recover heater function:

- Remote controller communication error (E4, E5)
- M-NET communication error (A0-A8)
- Air intake sensor error (P1)

Installers are strongly advised never to physically uninstall a wired controller while the system is running. In addition to the safety concerns, this practice can also trigger a remote controller communication error.

IMPORTANT

If the system detects an error that could potentially create a safety hazard, **the heater will not operate.**

CAUTION

If a heater is installed in a duct, do no use Panel Heater Connector. By doing so, the fan will turn off when the heater is on, which may result in fire.

NOTE

When using the SPTB1 accessory, take special care when restarting power to the system to ensure that both the indoor unit and outdoor unit are powered up at the same time to avoid triggering a communication error.

[2]Factory setting

[3]While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller.

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Table 20. Fan Speed Setting[1]

Mode	Setting		Mode No.	Setting
	Heating Thermo-OFF	DEFROST or ERROR		
Fan Control	Very Low	Very Low	25	1 [2]
	STOP	Remote Controller Setting	25	2
	Remote Controller Setting	Remote Controller Setting	25	3

[1]Refer to Installation Manual for function settings.

[2]Factory setting

10.3. CN24RELAY-KIT-CM3 (Optional Parts) installation

The following section describes installation of the External Heater Adapter that connects to PVA-A AA7 series indoor unit. This products is the special wiring parts to drive an electric heater with the air conditioner.

(1) Parts list

- Check that the following parts are included in the package.

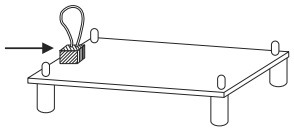
1. External output cable..... .. 2 in total
   Two types of cables with different connectors are included.
2. Panel heater connector..... ..... 3 in total
   White: 3
3. Relay

(2) Connection to the indoor unit

- Use the cables that fit the connectors on the indoor unit control board.

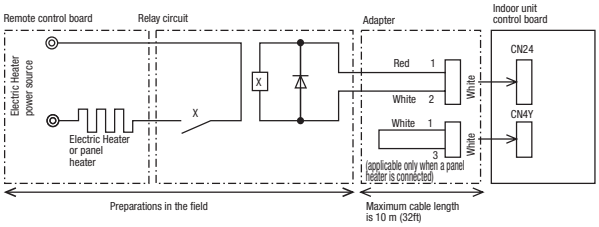
1. External output cable
   This cable is used to connect a relay circuit for an interlocked operation with either an electric or a panel heater.
   Select the heater output pattern (1st = CN24 or 2nd = CN24A) to use, and connect the cable to the connector on the indoor unit control board that corresponds to the selection.
2. Panel heater connector
   This connector is used to perform an interlocked operation with a panel heater. Depending on the indoor unit control board specification, connect the cable to CN2Y as appropriate.

CN2Y for FAN control (CN24RELAY-KIT-CM3)



3) Wiring

- A basic connection method is shown below.



- The length of the electrical wiring for the CN24RELAY-KIT-CM3 is 2 meters (6-1/2 ft.)
- To extend this length, use sheathed 2-core cable.
  Control cable type: CVV, CVS, CPEV or equivalent.
  Cable size: 0.5 mm^2 ~ 1.25 mm^2 (16 to 22 AWG)
  Don't extend the cable more than 10 meters (32ft)

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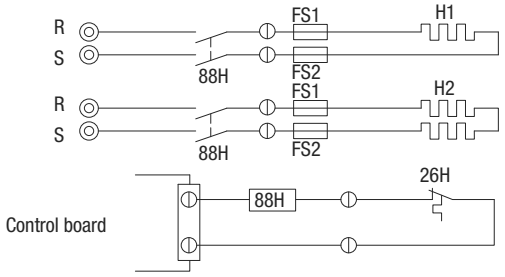
Table 21. Recommended circuit



CN24 or CN24a

1-phase power supply, 208V, 230V, 60Hz

KEY

– FS1, 2: Thermal fuse
– H1, H2: Heater
– 26H: Overheat protection thermostat
– 88H: Electromagnetic

(4) Wiring restrictions

- Keep the length of the cable connecting to the circuit board of the indoor unit shorter than 10 meters (32 ft).
- Longer than 10 meters (32 ft) could cause improper operation.
- Use a transit relay when extending wiring such as remote wiring.

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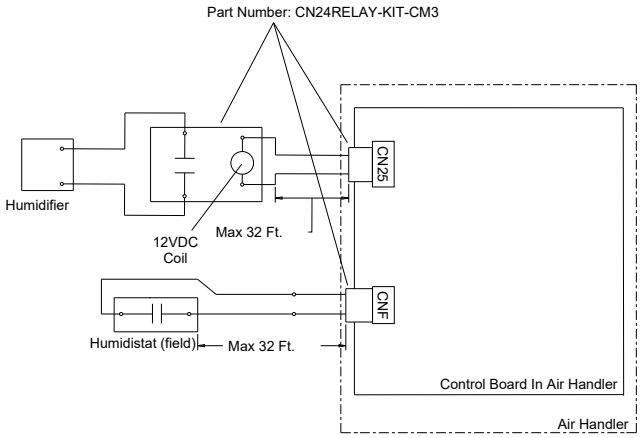
11. Humidifier



Humidifier Control (CN25 Output is ON)
Sequence of operation:

1. The humidistat closes CNF
2. The fan starts on high
3. CN25 provides 12VDC to turn on the Humidifier (do not exceed 1 Watt draw per relay)
4. When the Humidistat opens, the fan continues to run for 30 seconds to clear the ductwork of moist air
5. If defrost starts during humidifier operation, CN25 de-energizes

Humidistat:

- Non-Voltage a-contact input
- Contact rating voltage > = 15 VDC
- Contact Rating Current > = 0.1 A
- Minimum Applicable Load < = 1mA at DC

Mode (function) No.		Humidistat Output	Condition	CN25 Output	Fan Speed
13	**16**	**CNF Input**	**(No Defrost/No Error)**		
2	1[a.]	OFF	Heat operation & Thermo OFF	OFF	RC[b.] Setting
			Heat operation & Thermo ON		
		ON	Heat operation & Thermo OFF	OFF	RC Setting
			Heat operation & Thermo ON	ON	High
	2	OFF	Heat operation & Thermo OFF	OFF	RC Setting
			Heat operation & Thermo ON		
		ON	Heat operation & Thermo OFF	ON	High
			Heat operation & Thermo ON		
1[a.]	-	-	No humidifier operation	OFF	RC Setting
The fan continues to run for 30 seconds after the humidifier stops.					

CAUTION

If a heater is installed in a duct, do no use Panel Heater Connector. By doing so, the fan will turn off when the heater is on, which may result in fire.

NOTE

When using the SPTB1 accessory, take special care when restarting power to the system to ensure that both the indoor unit and outdoor unit are powered up at the same time to avoid triggering a communication error.

[a.] Factory setting

[b.] Remote controller

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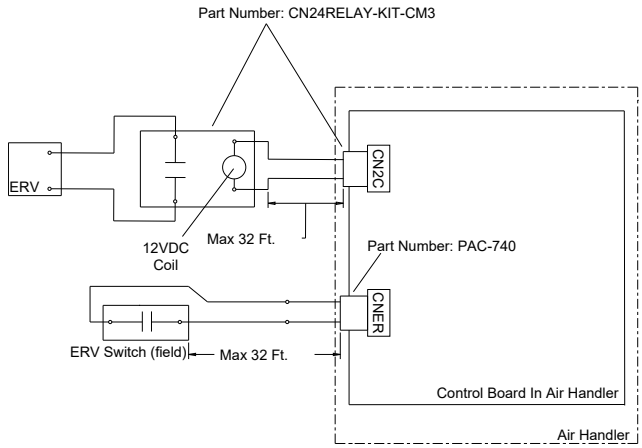
12. ERV (Energy Recovery Ventilation)



ERV Control

Sequence of operation:

1. The ERV demand switch closes CNER
2. 12 VDC is provided to CN2C to turn on ERV
3. If the unit goes into defrost, CN2C stops 12 VDC output

ERV Switch:

- Non-Voltage a-contact input
- Contact rating voltage >= 15 VDC
- Contact rating current >= 0.1 A
- Minimum applicable load <= 1mA at DC

ERV output / CNER input	Function Mode 26	Condition	Fan speed	CN2C output (=Fan output)
OFF	-	Cool/Heat/Fan operation	RC[a.] setting	ON
		Defrost	STOP	OFF
		STOP	STOP	OFF
ON	1[b.]	Cool/Heat/Fan operation	RC setting	ON
		Defrost	STOP	OFF
		STOP	STOP	OFF
	2	Cool/Heat/Fan operation	RC setting	ON
		Defrost	STOP	OFF
		STOP	RC setting [c.,d.]	ON

[a.] Remote controller

[b.] Factory setting

[c.] If ERV control is effective when STOP, IDU doesn't report fan status or PB error (Fan motor error).

[d.] When fan speed setting by RC is "Auto", Fan speed is fixed to "HIGH".

13. Troubleshooting

13.1. Cautions on troubleshooting

⚠ CAUTION

(1) Before troubleshooting, check the following:

1. Check the power supply voltage.
2. Check the indoor/outdoor connecting wire for miswiring.

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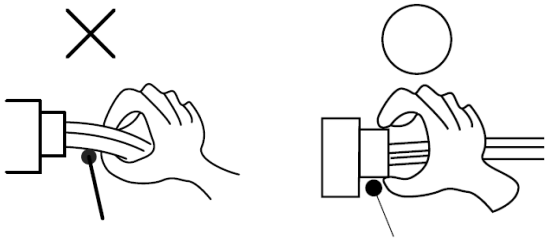
⚠ CAUTION

(2) Take care of the following during servicing.

1. Before servicing the air conditioner, be sure to turn off the remote controller first to stop the main unit, and then turn off the breaker.
2. When removing the indoor controller board, hold the edge of the board with care NOT to apply stress on the components.
3. When connecting or disconnecting the connectors, hold the housing of the connector. DO NOT pull the lead wires.



Lead wires Housing point

13.2. Self-check

Refer to the installation manual that comes with each remote controller for details.

Remote controller	[Output pattern A] Errors detected by indoor unit
Check code on the LCD	Symptom
P1	Intake sensor error
P2 / P9	Pipe (liquid or 2-phase pipe) sensor error
E6 / E7	Indoor / outdoor unit communication error
P4	Float switch connector open error
P5	Drain pump error
P6	Freezing / overheating safeguard operation
EE	Communication error between indoor and outdoor units
P8	Pipe temperature error
E4, E5	Remote controller signal communication error
PB	Fan motor error
Fb	Indoor unit control system error (memory error, etc.)
FL	Refrigerant leak detected
FH	Refrigerant leak sensor error[a.]
PL	Refrigerant circuit abnormal
E0, E3	(NO sound) Remote controller transmission error
E1, E2	(NO sound) Remote controller control board error

[a.] The refrigerant leak sensor is not properly connected OR replacement of refrigerant leak sensor is required due to end of life or failure. See the sub-section *Service note: servicing and replacing the refrigerant leak sensor* found in chapter *Mount positions* for basic information about the refrigerant leak sensor location and replacement. A complete procedure can be found in the Indoor Unit service manual.

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Remote controller	[Output pattern B] Errors detected by unit other than indoor unit (outdoor unit, etc.)
Check code on the LCD	**Symptom**
E9	Indoor/outdoor unit communication error (transmitting error) (outdoor unit)
UP	Compressor overcurrent interruption
U3 / U4	Open/short of outdoor unit thermistors
UF	Compressor overcurrent interruption (when compressor locked)
U2	Abnormal high discharging temperature / 49C worked / insufficient refrigerant
U1 / Ud	Abnormal high pressure (63H worked) / overheating safeguard operation
U5	Abnormal temperature of heat sink
U8	Outdoor unit fan protection stop
U6	Compressor overcurrent interruption / abnormal of power module
U7	Abnormality of super heat due to low discharge temperature
U9 / UH	Abnormality such as overvoltage, voltage shortage, abnormal and synchronous signal to main circuit / current sensor error
FL	Refrigerant leakage or Refrigerant leak sensor error caused by other rooms
Others	Other errors (refer to the technical manual for the outdoor unit)

If the unit cannot be operated properly after the above test run has been performed, use this table to remove the cause:

Symptom			**Cause**
Remote controller		**LED 1, 2 (PCB in outdoor unit)**	
PLEASE WAIT	For about 2 minutes following power-on	After LED 1, 2 are lit → LED 2 is turned off Only LED 1 is lit (correct operation)	• For about 2 minutes after power-on, operation of the remote controller is not possible due to system start-up. (correct operation)
PLEASE WAIT → Error code	After about 2 minutes has expired following power-on	Only LED 1 is lit → LED 1, 2 blink.	• Connector for the outdoor unit's protection device is not connected. • Reverse or open phase wiring for the outdoor unit's power terminal block (L1, L2, L3)
Display messages do not appear even when operation switch is turned ON (operation lamp does not light up).		Only LED 1 is lit → LED 1, 2 blinks twice LED 2 blinks once	• Incorrect wiring between indoor and outdoor units (incorrect polarity of S1, S2, S3) • Remote controller wire short
Operation is not possible for about 30 seconds after cancellation of function selection. (correct operation)			

Description of LED 1, 2, and 3 on the indoor controller	
LED 1: power for microcomputer	Indicates whether control power is supplied. Make sure that this LED is always lit.
LED 2: power for remote controller	Indicates whether power is supplied to the remote controller. This LED lights only in the case of the indoor unit which is connected to the outdoor unit refrigerant address "0".
LED 3: communication between indoor and outdoor units	Indicates state of communication between the indoor and outdoor units. Make sure that this LED is always blinking.

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13.2.1. Auto restart function

Indoor unit control board

This model is equipped with the AUTO RESTART FUNCTION.

When the indoor unit is controlled with the remote controller, the operation mode, set temperature, and the fan speed are memorized by the indoor unit control board.

The AUTO RESTART FUNCTION will restart the unit within a time delay of 5 to 10 minutes after power is restored.

Set the AUTO RESTART FUNCTION using the remote controller. (Mode no. 01)

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13.2.2. Function table

Mode	Settings	Mode (function) No.	Setting no.	Default setting
Power failure auto restart	Not available	01	1	1
	Available		2	
Indoor temperature detect	Indoor unit operating average	02	1	1
	Indoor unit's internal sensor		2	
	Remote controller's internal sensor		3	
LOSSNAY connectivity	Not supported	03	1	1
	Supported (indoor unit **is not** equipped with outdoor air intake)		2	
	Supported (indoor unit **is** equipped with outdoor air intake)		3	
Power voltage	240V (230V)	04	1	1
	220V (208V)		2	
Filter sign	100 Hr	07	1	3
	2500 Hr		2	
	No filter sign indicator		3	
External static pressure	See section 14.4 of the installation manual	08	1	2
			2	
			3	
		10	1	1
			2	
Heater control	Heater not present	11	1	1
	Heater present[a.]		2	
Humidifier	Humidifier not present	13	1	1
	Humidifier present		2	
Humidifier control	Heat mode & Thermo ON	16	1	1
	Heat mode		2	
Defrost on/off cycle settings [b.]	Standard	17	1	1
	High for humid winter climates		2	
Heater control **defrost and error**	Disable heater during defrost and error	23	1	1
	Enable heater and fan during defrost and error [c.]		2	
Fan speed thermo off (**heating**)	Extra low	25	1	1
	Stop		2	
	RC Setting		3	
Fan speed thermo off (**cooling**)	RC setting	27	1	1
	Stop		2	

[a.] While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller.

[b.] Only operational with PUZ

[c.] The heater will not operate if the following errors are active. In these cases, the error must be corrected, and the system restarted in order to recover heater function:

- Remote controller communication error (E4, E5)
- M-NET communication error (A0-A8)
- Air intake sensor error (P1)

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Installers are strongly advised never to physically uninstall a wired controller while the system is running. In addition to the safety concerns, this practice can also trigger a remote controller communication error.

IMPORTANT

If the system detects an error that could potentially create a safety hazard, the heater will not operate.

CAUTION

If a heater is installed in a duct, do not use Panel Heater Connector. By doing so, the fan will turn off when the heater is on, which may result in fire.

NOTE

When using the SPTB1 accessory, take special care when restarting power to the system to ensure that both the indoor unit and outdoor unit are powered up at the same time to avoid triggering a communication error.

13.3. Self-diagnosis action table

Error Code	Abnormal point and detection method	Cause	Countermeasure
P1	**Room temperature thermistor (TH1)** 1. The unit is in three-minute resume prevention mode if short/open of thermistor is detected. Abnormal if the unit does not reset normally after three minutes. (The unit returns to normal operation, if it has normally reset.) 2. Constantly detected during cooling, drying and heating operation Short: 90 ˚C [194 ˚F] or more Open: -40 ˚C [-40 ˚F] or less	1. Defective thermistor characteristics 2. Contact failure of connector (CN20) on the indoor controller board (Insert failure) 3. Breaking of wire or contact failure of thermistor wiring 4. Defective indoor controller board	1–3. Check resistance value of thermistor. 0 ˚C [32 ˚F].....15.0kΩ 10 ˚C [50 ˚F].....9.6kΩ 20 ˚C [68 ˚F].....6.3kΩ 30 ˚C [86 ˚F].....4.3kΩ 40 ˚C [104 ˚F]...3.0kΩ If you put force on (draw or bend) the lead wire with measuring resistance value of thermistor breaking of wire or contact failure can be detected. 2. Check contact failure of connector (CN20) on the indoor controller board. Refer to 12-5. Turn the power on again and check restart after inserting connector again. 4. Check room temperature display on remote controller. Replace indoor controller board if there is abnormal difference with actual room temperature. Turn the power off, and on again to operate after check.

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Error Code	Abnormal point and detection method	Cause	Countermeasure
P2	**Pipe temperature thermistor/Liquid (TH2)** 1. The unit is in three-minute resume prevention mode if short/open of thermistor is detected. Abnormal if the unit does not reset normally after three minutes. (The unit returns to normal operation, if it has normally reset.) 2. Constantly detected during cooling, drying, and heating (except defrosting) operation. Short: 90 ˚C [194 ˚F] or more Open: -40 ˚C [-40 ˚F] or less	1. Defective thermistor characteristics 2. Contact failure of connector (CN44) on the indoor controller board (Insert failure) 3. Breaking of wire or contact failure of thermistor wiring 4. Defective refrigerant circuit is causing thermistor temperature of 90 ˚C [194 ˚F] or more or -40 ˚C [-40 ˚F] or less. 5 Defective indoor controller board	1–3. Check resistance value of thermistor. For characteristics, refer to (P1) above. 2. Check contact failure of connector (CN44) on the indoor controller board. Refer to 12-5. Turn the power on again and check restart after inserting connector again. 4. Check pipe <liquid> temperature with remote controller in test run mode. If pipe<liquid> temperature is extremely low (in cooling mode) or high (in heating mode), refrigerant circuit may have defective. 5. Check pipe <liquid> temperature with remote controller in test run mode. If there is extreme difference with actual pipe <liquid> temperature, replace indoor controller board. Turn the power off, and on again to operate after check.
P4 (5701)	Contact failure of drain float switch (CN4F) 1. Extract when the connector of drain float switch is disconnected. (3 and 4 of connector CN4F is not short-circuited.) 2. Constantly detected during operation.	1. Contact failure of connector (Insert failure) 2. Defective indoor controller board	1. Check contact failure of float switch connector. Turn the power on again and check after inserting connector again. 2. Operate with connector (CN4F) short-circuited. Refer to 12-5. Replace indoor controller board if abnormality reappears.

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Error Code	Abnormal point and detection method	Cause	Countermeasure
P6	**Freezing/overheating protection is working** 1. Freezing protection (Cooling mode) The unit is in six-minute resume prevention mode if pipe <liquid or condenser/evaporator> temperature stays under -15 ˚C [5 ˚F] for three minutes after the compressor started. Abnormal if it stays under -15 ˚C [5 ˚F] for three minutes again within 16 minutes after six-minute resume prevention mode. 2. Overheating protection (Heating mode) The units is in six-minute resume prevention mode if pipe <Liquid or condenser / evaporator>temperature is detected as over 70 ˚C [158 ˚F] after the compressor started. Abnormal if the temperature of over 70 ˚C [158 ˚F] is detected again within 30 minutes after six-minute resume prevention mode.	(Cooling or drying mode) 1. Clogged filter (reduced airflow) 2. Short cycle of air path 3. Low-load (low temperature) operation beyond the tolerance range 4. 4 Defective indoor fan motor • Fan motor is defective. • Indoor controller board is defective. 5. Defective outdoor fan control 6. Overcharge of refrigerant 7. Defective refrigerant circuit (clogs) (Heating mode) 1. Clogged filter (reduced airflow) 2. Short cycle of air path 3. Over-load (high temperature) operation beyond the tolerance range 4. Defective indoor fan motor • Fan motor is defective. • Indoor controller board is defective. 5. Defective outdoor fan control 6. Overcharge of refrigerant 7. 7 Defective refrigerant circuit (clogs) 8. Bypass circuit of outdoor unit is defective	(Cooling or drying mode) 1. Check clogging of the filter 2. Remove shields 4. Refer to 12-8. DC Fan motor (FAN MOTOR/ INDOOR CONTROLLER BOARD) 5. Check outdoor fan motor 6~7. Check operating condition of refrigerant circuit. (Heating mode) 1. Check clogs of the filter 2. Remove shields 4. Refer to 12-8. DC Fan motor (FAN MOTOR/ INDOOR CONTROLLER BOARD) 5. Check outdoor fan motor 6~8. Check operating condition of refrigerant circuit

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Error Code	Abnormal point and detection method	Cause	Countermeasure
P8	Pipe temperature <Cooling mode> Detected as abnormal when the pipe temperature is not in the cooling range 3 minutes after compressor start and 6 minutes after the liquid or condenser/ evaporator pipe is out of cooling range. **NOTE** 1) It takes at least 9 minutes. to detect. 2) Abnormality P8 is not detected in drying mode. Cooling range : -3 ˚C (-5.4 ˚F)] (TH-TH1) TH: Lower temperature between: liquid pipe temperature (TH2) and condenser/ evaporator temperature (TH5) TH1: Intake temperature <Heating mode> When 10 seconds have passed after the compressor starts operation and the hot adjustment mode has finished, the unit is detected as abnormal when condenser/ evaporator pipe temperature is not in heating range within 20 minutes. **NOTE** 3) It takes at least 27 minutes to detect abnormality. 4) It excludes the period of defrosting (Detection restarts when defrosting mode is over) Heating range : 3˚C(5.4˚F) [(TH5-TH1)	1. Slight temperature difference between indoor room temperature and pipe <liquid or condenser / evaporator> temperature thermistor • Shortage of refrigerant • Disconnected holder of pipe <liquid or condenser / evaporator> thermistor • Defective refrigerant circuit 2. Converse connection of extension pipe (on plural units connection) 3. Converse wiring of indoor/ outdoor unit connecting wire (on plural units connection) 4. Defective detection of indoor room temperature and pipe <condenser / evaporator> temperature thermistor 5. Stop valve is not opened completely	1~4. Check pipe <liquid or condenser / evaporator> temperature with room temperature display on remote controller and outdoor controller circuit board. Conduct temperature check with outdoor controller circuit board after connecting 'A-Control Service Tool (PAC-SK52ST)'. 2~3. Check converse connection of extension pipe or converse wiring of indoor/outdoor unit connecting wire.
P9	Abnormality of pipe temperature thermistor / Condenser-Evaporator (TH5) 1. The unit is in three-minute resume protection mode if short/open of thermistor is detected. Abnormal if the unit does not get back to normal within three minutes. (The unit returns to normal operation, if it has normally reset.) 2. Constantly detected during cooling, drying, and heating operation (except defrosting) Short: 90 ˚C [194 ˚F] or more Open: -40 ˚C [-40 ˚F] or less	1. Defective thermistor characteristics 2. Contact failure of connector (CN44) on the indoor controller board (Insert failure) 3. Breaking of wire or contact failure of thermistor wiring 4. Temperature of thermistor is 90 ˚C [194 ˚F] or more or -40 ˚C [-40 ˚F] or less caused by defective refrigerant circuit 5. Defective indoor controller board	1–3. Check resistance value of thermistor. For characteristics, refer to (P1) above. 2. Check contact failure of connector (CN44) on the indoor controller board. Refer to 12-5. Turn the power on and check restart after inserting connector again. 4. Operate in test run mode and check pipe <condenser / evaporator>temperature. If pipe <condenser / evaporator> temperature is extremely low (in cooling mode) or high (in heating mode), refrigerant circuit may have defect. 5. When no problems are found in 1–4 above, replace the indoor unit control board.

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Error Code	Abnormal point and detection method	Cause	Countermeasure
E0 or E4	**Remote controller transmission error(E0)/signal receiving error(E4)** 1. Abnormal if main or sub remote controller can not receive normally any transmission from indoor unit of refrigerant address “0” for three minutes. (Error code : E0) 2. Abnormal if sub remote controller could not receive for any signal for two minutes. (Error code: E0) 1. Abnormal if indoor controller board can not receive normally any data from remote controller board or from other indoor controller board for three minutes. (Error code: E4) 2. Indoor controller board cannot receive any signal from remote controller for two minutes. (Error code: E4)	1. Contact failure at transmission wire of remote controller 2. All remote controllers are set as “sub” remote controller. In this case, E0 is displayed on remote controller, and E4 is displayed at LED (LED 1, LED 2) on the outdoor controller circuit board. 3. Mis-wiring of remote controller 4. Defective transmitting receiving circuit of remote controller 5. Defective transmitting receiving circuit of indoor controller board of refrigerant address “0” 6. Noise has entered into the transmission wire of remote controller	1. Check disconnection or looseness of indoor unit or transmission wire of remote controller. 2. Set one of the remote controllers “main”. If there is no problem with the action above. 3. Check wiring of remote controller. • Total wiring length: max 500m (Do not use cable 5 3 or more) • The number of connecting indoor units: max 16 units • The number of connecting remote controller: max 2 units When it is not the above-mentioned problem of 1~3 4. Diagnose remote controllers. a) When “RC OK” is displayed, Remote controllers have no problem. Turn the power off, and on again to check. If abnormality generates again, replace indoor controller board. b) When “RC NG” is displayed, Replace remote controller. c) When “RC E3” is displayed, d) When “ERC 00-06” is displayed, **[** c),d)→Noise may be causing abnormality. **]** ∗ If the unit is not normal after replacing indoor controller board in group control, indoor controller board of address “0” may be abnormal.
E3 or E5	**Remote controller transmission error(E3)/signal receiving error(E5)** 1. Abnormal if remote controller could not find blank of transmission path for six seconds and could not transmit. (Error code: E3) 2. Remote controller receives transmitted data at the same time, compares the data, and when detecting it, judges different data to be abnormal 30 continuous times. (Error code: E3) 1. Abnormal if indoor controller board could not find blank of transmission path. (Error code: E5) 2. Indoor controller board receives transmitted data at the same time, compares the data,and when detecting it, judges different data to be abnormal 30 continuous times. (Error code: E5)	1. Two remote controller are set as “main.” (In case of 2 remote controllers) 2. Remote controller is connected with two indoor units or more 3. Repetition of refrigerant address 4. Defective transmitting receiving circuit of remote controller 5. Defective transmitting receiving circuit of indoor controller board 6. Noise has entered into transmission wire of remote controller.	1. Set a remote controller to main, and the other to sub 2. Remote controller is connected with only one indoor unit 3. The address changes to a separate setting 4~6. Diagnose remote controller a) When “RC OK”is displayed, remote controllers have no problem. Turn the power off,and on again to check. When becoming abnormal again, replace indoor controller board. b) When “RC NG”is displayed, replace remote controller. c) When “RC E3”or “ERC 00-66”is displayed, noise may be causing abnormality.

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Error Code	Abnormal point and detection method	Cause	Countermeasure
E6	Indoor/outdoor unit communication error (Signal receiving error) 1. Abnormal if indoor controller board cannot receive any signal normally for six minutes after turning the power on. 2. Abnormal if indoor controller board cannot receive any signal normally for three minutes. 3. Consider the unit as abnormal under the following condition: When two or more indoor units are connected to an outdoor unit, indoor controller board cannot receive a signal for three minutes from outdoor controller circuit board, a signal which allows outdoor controller circuit board to transmit signals.	1. Contact failure, short circuit or, mis-wiring (converse wiring) of indoor/outdoor unit connecting wire 2. Defective transmitting receiving circuit of indoor controller board 3. Defective transmitting receiving circuit of indoor controller board 4. Noise has entered into indoor/ outdoor unit connecting wire	∗ Check LED display on the outdoor control circuit board. (Connect A-control service tool, PAC-SK52ST.) Refer to EA-EC item if LED displays EA-EC. 1. Check disconnection or looseness of indoor/ outdoor unit connecting wire of indoor unit or outdoor unit. Check all the units in case of twin triple indoor unit system. 2~4. Turn the power off, and on again to check. If abnormality generates again, replace indoor controller board or outdoor controller circuit board. ∗ Other indoor controller board may have defect in case of twin triple indoor unit system.
E7	**Indoor/outdoor unit communication error (Transmitting error)** Abnormal if “1” receiving is detected 30 times continuously though indoor controller board has transmitted “0”.	1. Defective transmitting receiving circuit of indoor controller board 2. Noise has entered into power supply 3. Noise has entered into outdoor control wire	1~3. Turn the power off, and on again to check. If abnormality generates again, replace indoor controller board.
Fb	**Indoor controller board** Abnormal if data cannot be read normally from the nonvolatile memory of the indoor controller board.	1. Defective indoor controller board	1. Replace indoor controller board.
FH	**Refrigerant leak sensor error** Abnormal if refrigerant sensor cannot detect errors normally.	1. The refrigerant leak sensor mounted on the indoor unit does not work. 2. The refrigerant leak sensor is not connected properly or the wire is broken.	1. While the error is being displayed, the indoor unit fan continues operating. 2. Ventilate the room well, make sure that there is no ignition source and then turn off the power • Check the connection of parts such as connectors and turn the power on again. • If the error does not clear, replace the Refrigerant leak sensor.

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Error Code	Abnormal point and detection method	Cause	Countermeasure
FL	**Refrigerant leakage** Abnormal if refrigerant leakage detected by a refrigerant leak sensor.	1. The refrigerant leaks from the piping or the heat exchanger in the indoor unit. 2. The following items are used around the indoor unit. • Spray (LP gas including FREON, and whose main ingredient is propane and butane. • Aerosol insecticide (including ethanol). • Air spray painting (including dichloromethane). • Charcoal (charcoal fire). • Chemicals (such as ethanol). 3. Refrigerant leaks from piping or heat exchangers, or sensor errors in indoor units in other rooms.	1. While the error is being displayed, the indoor unit fan continues operating. 2. Ventilate the room well, make sure that there is no ignition source and then turn off the power • Check the indoor unit to detect the part where the refrigerant is leaking from. • Repair the part where refrigerant leaks. • Turn on the power again. • If the error does not clear, replace the Refrigerant leak sensor.
E1 or E2	**Remote controller control board** 1. Abnormal if data cannot be read normally from the nonvolatile memory of the remote controller control board. (Error code: E1) 2. Abnormal if the clock function of remote controller cannot be operated normally. (Error code: E2)	1. Defective remote controller	1. Replace indoor controller board.
PB	**Fan motor error** Abnormal if a) or b) is detected during fan motor operation. a) When the number of rotations is detected to be below the lower limit for 30 seconds. b) When the number of rotations is detected to be above the upper limit for 30 seconds.	1. Motor or fan cannot rotate because of foreign object, etc. 2. Motor wire disconnection or connector disconnection or looseness 3. Motor failure	1. Remove the foreign object causing the problem. 2. Check disconnection of the motor wiring or connector disconnection. 3. Replace the failed motor.

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13.4. Troubleshooting by inferior phenomena

Phenomena	Cause	Countermeasure
(1) LED 2 on indoor controller board is off.	**When LED 1 on indoor controller board is also off.** 1. Power supply of rated voltage is not supplied to outdoor unit 2. Defective outdoor controller circuit board 3. Power supply of 208~230V is not supplied to indoor unit 4. Defective indoor controller board	1. **Check the voltage of outdoor power supply terminal block (L, N) or (L3, N).** • When AC 208~230V is not detected. Check the power wiring to outdoor unit and the breaker. • When AC 208~230V is detected. – Check 2 (below) 2. **Check the voltage between outdoor terminal block S1 and S2.** • When AC 208~230V is not detected. Check the fuse on outdoor controller circuit board. Check the wiring connection. • When AC 208~230V is detected. – Check 3 (below) 3. **Check the voltage between indoor terminal block S1 and S2.** • When AC 208~230V is not detected. Check indoor/outdoor unit connecting wire for miswiring. • When AC 208~230V is detected. – Check 4 (below) 4. **Check the fuse on indoor controller board.** • Check the wiring connection. • If no problem are found, indoor controller board is defective.
(2) LED 2 on indoor controller board is blinking.	1. **When LED 1 on indoor controller board is also blinking. Connection failure of indoor/outdoor unit connecting wire.** 2. **When LED 1 is lit.** 1. Miswiring of remote controller wires Under twin triple indoor unit system, 2 or more indoor units are wired together. 2. Refrigerant address for outdoor unit is wrong or not set. Under grouping control system, there are some units whose refrigerant address is 0. 3. Short-cut of remote controller wires 4. Defective remote controller	**Check indoor/outdoor unit connecting wire for connection failure.** 1. Check the connection of remote controller wires in case of twin triple indoor unit system. When 2 or more indoor units are wired in one refrigerant system, connect remote controller wires to one of those units. 2. Check the setting of refrigerant address in case of grouping control system. If there are some units whose refrigerant addresses are 0 in one group, set one of the units to 0 using SW1 (3-6) on outdoor controller circuit board. 3~4. Remove remote controller wires and check LED 2 on indoor controller board. • When LED 2 is blinking, check the short-cut of remote controller wires. • When LED 2 is lit, connect remote controller wires again and: if LED 2 is blinking, remote controller is defective; if LED 2 is lit, connection failure of remote controller terminal block etc. has returned to normal.

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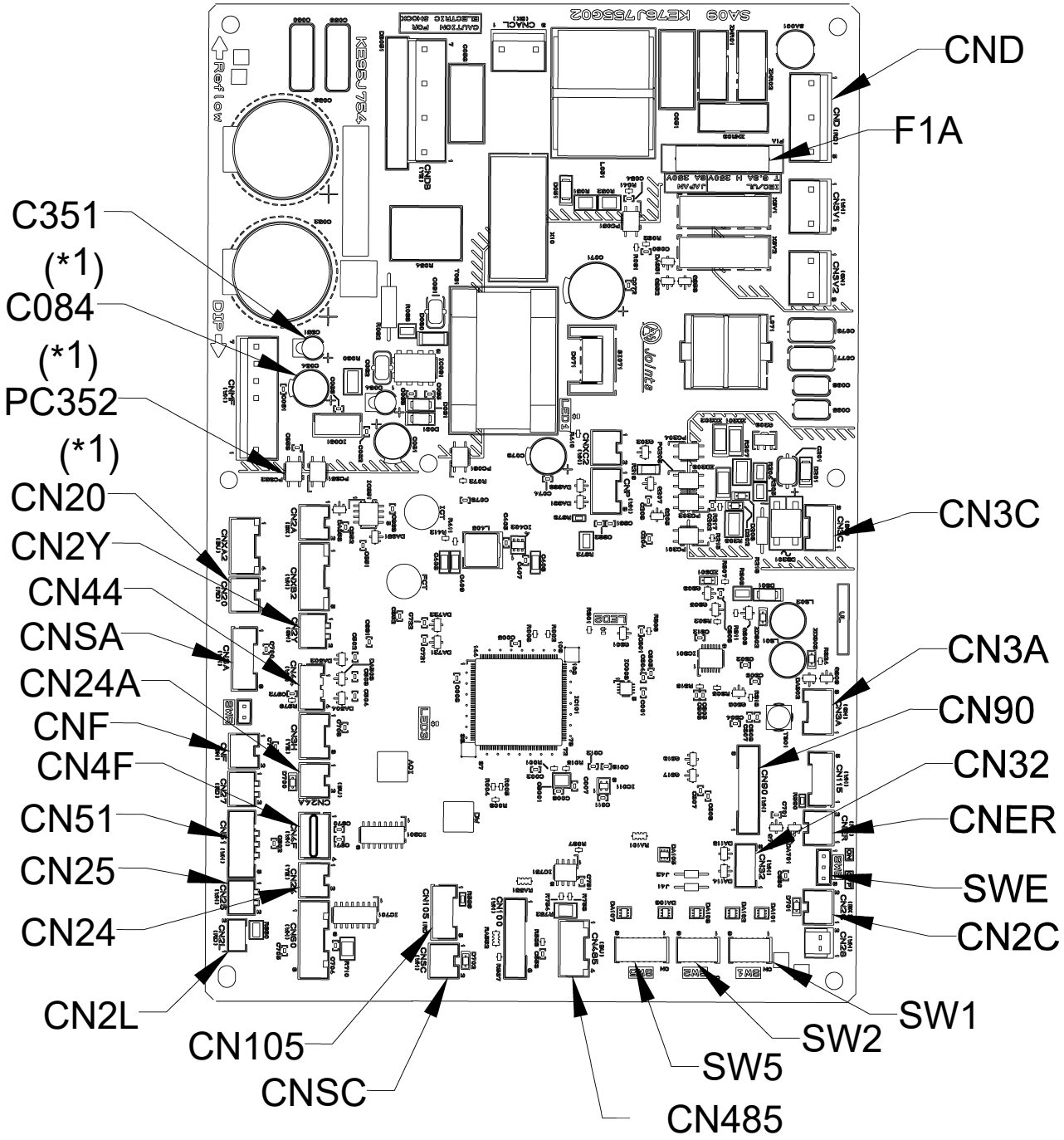
13.5. Test point diagram

Indoor controller board



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- (1*)
  - V_{FG}: Voltage on the (-) side of PC352 and C084
    - (same with the voltage between 7 (+) and 4 (-) of CNMF)
  - V_{CC}: Voltage between the C084 pins 15 VDC
    - (same with the voltage between 5 (+) and 4 (-) of CNMF)
  - V_{sp}: Voltage between the C351 pins
    - 0 VDC (with the fan stopped)
    - 1 - 6.5 VDC (with fan operating)
    - (same with the voltage between 6 (+) and 4 (-) of CNMF)
- CND: Power supply voltage (208-230VAC)
- CNMF: Fan motor output
  - 1 - 4: 310 - 340 VDC
  - 5 - 4: 15 VDC
  - 6 - 4: 0 - 6.5 VDC
  - 7 - 4: Stop 0 to 15 VDC, Run 7.5 VDC (0 - 15 pulse)
- CN32: Remote start/stop adapter
- CN22: For MA remote controller cable connection (10 - 13 VDC)
- CN105: Radio frequency interface
- CN51: Centralized control
- CN41: JAMA standard HA terminal A
- CN44: Thermistor (liquid/condenser/ evaporator temperature)
- CN4F: Float sensor
- CN20: Thermistor (inlet temperature)
- CN24: 1st heater control (12 VDC)
- CN24a: 2nd heater control
- CN2Y: For fan control
- CN3C: Indoor - outdoor transmission (0 - 24 VDC)
- CN90: Wireless remote controller
- CNSA: Refrigerant leak sensor
- CNER: ERV control
- CN2C: ERV input
- CN25: Humidity control
- CNF: Humidity input
- SWE: Emergency operation
- SW1: Model selection
- SW2: Capacity setting

13.6. Trouble criterion of main parts

<table>
<tr><th>Part name</th><th>Check method and criterion</th></tr>
<tr><td>Room temperature thermistor (TH1)</td><td rowspan="3">Measure the resistance with a tester.
(Part temperature 10C (50F) ~ 30C (86F))
<table><tr><td>Normal</td><td>Abnormal</td></tr><tr><td>4.3k~9.6k</td><td>Opened or short-circuited</td></tr></table></td></tr>
<tr><td>Pipe temperature thermistor / liquid (TH2)</td></tr>
<tr><td>Condenser / evaporator temperature thermistor (TH5)</td></tr>
</table>

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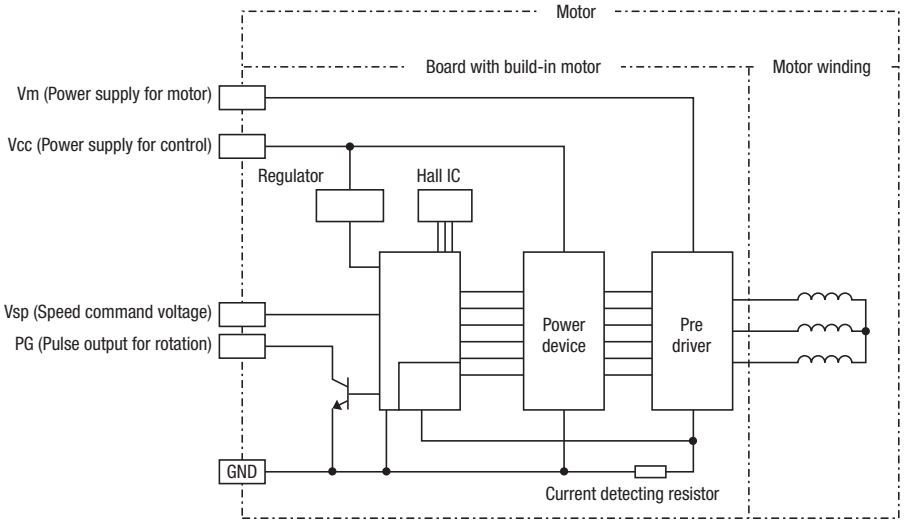
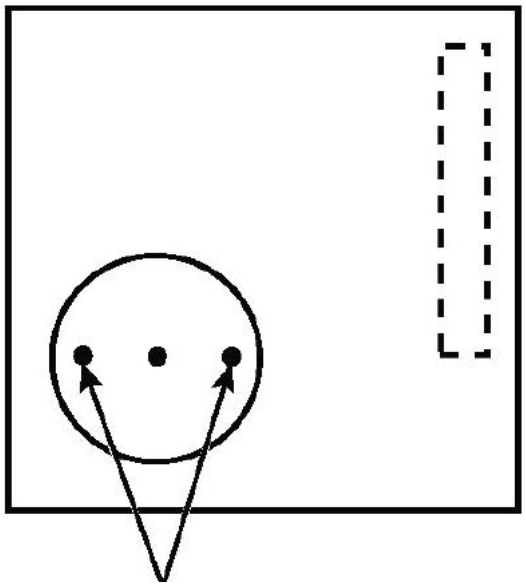
<table>
<tr><th>Part name</th><th>Check method and criterion</th></tr>
<tr><td>Wiring diagram</td><td> 
</td></tr>
<tr><td>Refrigerant leak sensor</td><td>Measure the resistance between the terminals with a multimeter.

<table><tr><th>Normal</th><th>Abnormal</th></tr><tr><td>Below 10</td><td>Open (10 or more)</td></tr></table>
After turning off the indoor unit breaker and leaving it for 5 minutes, measure the resistance value between the sensor terminals.

Back side of the sensor

 
Measure across both sides of the sensor pin</td></tr>
</table>

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13.7. Thermistor

<Thermistor Characteristic graph>

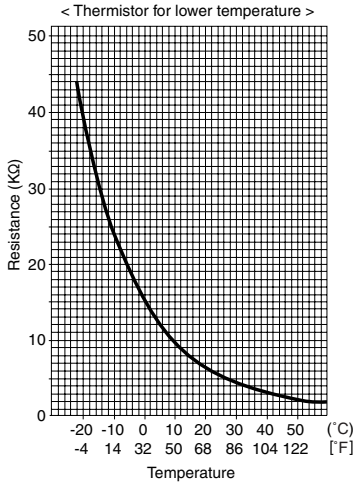
Thermistor for lower temperature

Room temperature thermistor (TH1)
Pipe temperature thermistor (TH2)
Condenser/evaporator temperature thermistor (TH5)

Thermistor R_0 = 15 kΩ ± 3%
Fixed number of B = 3480 kΩ ± 2%

$$Rt = 15\exp\{3480(\frac{1}{273+t} - \frac{1}{273})\}$$

0°C	(32°F)	15 kΩ
10°C	(50°F)	9.6 kΩ
20°C	(68°F)	6.3 kΩ
25°C	(77°F)	5.2 kΩ
30°C	(86°F)	4.3 kΩ
40°C	(104°F)	3.0 kΩ



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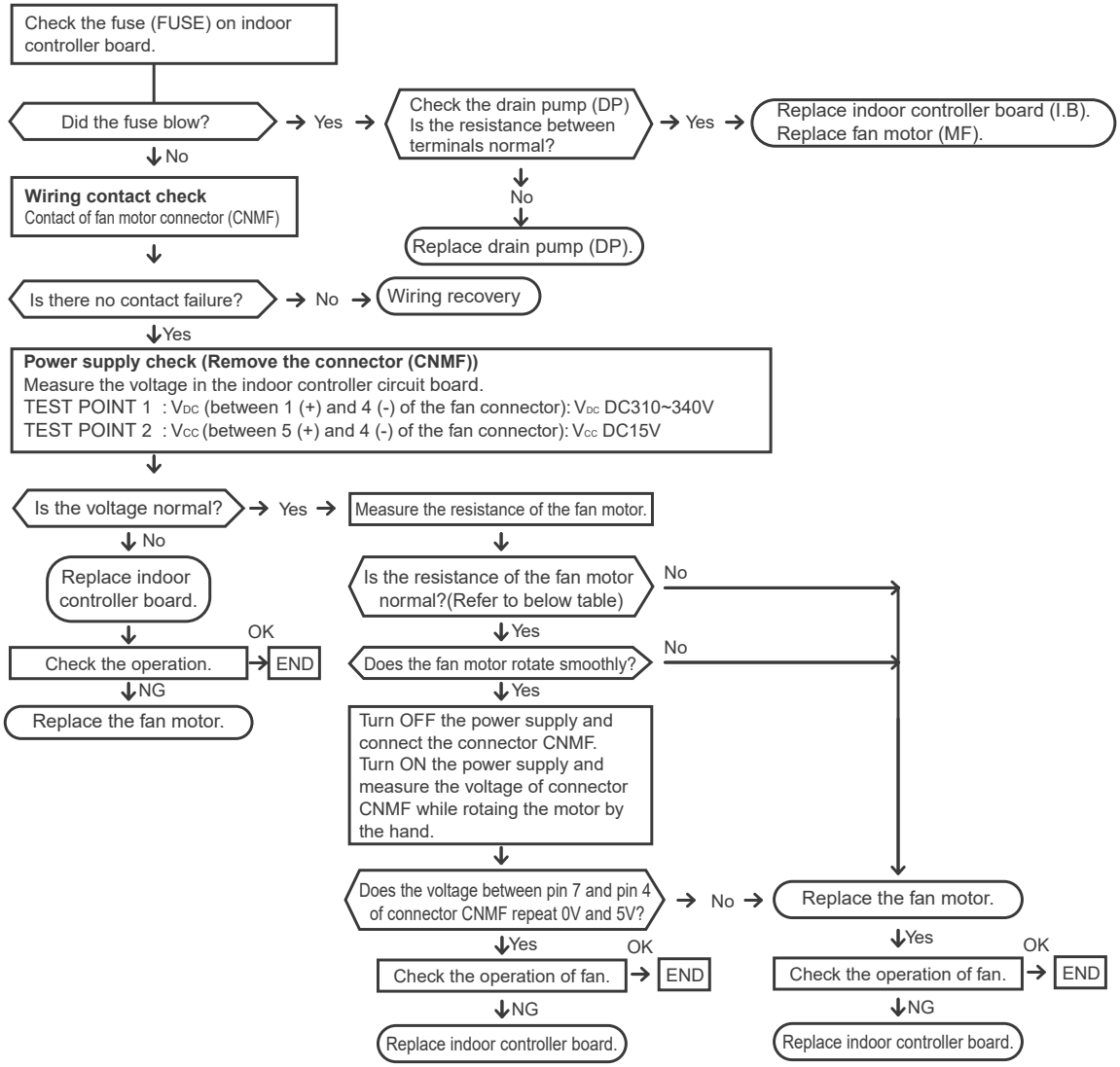
13.8. DC Fan motor (fan motor/indoor controller board)

Check method of DC fan motor (fan motor/indoor controller circuit board)

1 Notes
· High voltage is applied to the connecter (CNMF) for the fan motor. Give attention to the service.
· Do not pull out the connector (CNMF) for the motor with the power supply on.
(It causes trouble of the indoor controller circuit board and fan motor.)

2 Self check
Symptom : The indoor fan cannot turn around.



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13.8.1. DC Fan motor measuring points

Model code	12, 18, 24, 30	36, 42, 48
Measuring points	Resistance	
pin 1 - pin 4	O.L.	1MΩ
pin 3 - pin 4	50kΩ	47kΩ
pin 6 - pin 4	150kΩ	143kΩ
pin 7 - pin 4	O.L.	O.L.

NOTE

* To measure the resistance, connect the negative (-) end of the tester to pin 4.

13.9. Functions of DIP switch and jumper wire

Each function is controlled by the dip switch and the jumper wire on control p.c. board. SW1 and SW2 are equipped only for service parts.

Model setting and capacity setting are memorized in the nonvolatile memory of the control p.c. board of the unit.

Jumper wire	Functions	Setting by the dip switch and jumper wire	Remarks
SW1	Model settings	for service board 	

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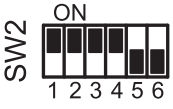
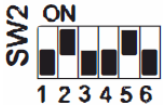
<table>
<tr><th>Jumper wire</th><th>Functions</th><th>Setting by the dip switch and jumper wire</th><th>Remarks</th></tr>
<tr><td>SW2</td><td>Capacity settings</td><td>
<table>
<tr><th>Model code</th><th>Service Board</th></tr>
<tr><td>12</td><td> 
</td></tr>
<tr><td>18</td><td> 
</td></tr>
<tr><td>24</td><td> 
</td></tr>
<tr><td>30</td><td> 
</td></tr>
<tr><td>36</td><td> 
</td></tr>
<tr><td>42</td><td> 
</td></tr>
<tr><td>48</td><td> 
</td></tr>
</table>
</td><td></td></tr>
<tr><td>J41
J42</td><td>Pair number setting with wireless remote controller</td><td>
<table>
<tr><th rowspan="2">Wireless remote controller setting</th><th colspan="2">Control PCB setting</th></tr>
<tr><th>J41</th><th>J42</th></tr>
<tr><td>0</td><td>○ [1]</td><td>○</td></tr>
<tr><td>1</td><td>× [2]</td><td>○</td></tr>
<tr><td>2</td><td>○</td><td>×</td></tr>
<tr><td>3 ~ 9</td><td>×</td><td>×</td></tr>
</table>
[1] ○ : Short
[2] × : Open
</td><td><Settings at time of factory shipment>
Wireless remote controller: 0
Control PCB: ○ (for both J41 and J42
Four pair number settings are supported.
The pair number settings of the wireless remote controller and indoor controller PCB (J41/J42) are given in the table on the left.
× in the table indicates the jumper line is disconnected.</td></tr>
</table>

[1] ○ : Short

[2] × : Open

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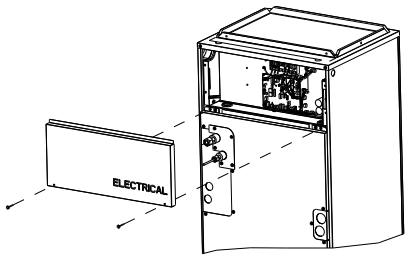
14. Disassembly Procedure

CAUTION

Exercise caution when removing heavy parts.

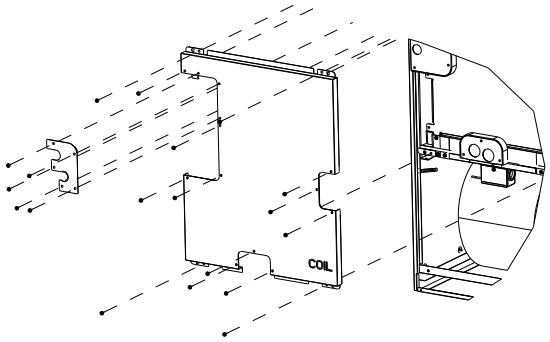
14.1. Control Box

1. Remove the electric panel (2 screws).

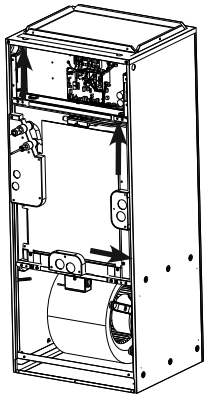


14.2. Coil Assembly

1. Remove the Electrical, Blower and Filter panel indicated in sections 1 and 2.
2. Remove the Coil panel by removing all of the screws securing it to the (3) smaller panels for refrigerant and drain lines.



3. Slide the smaller panels in the directions indicated and remove.



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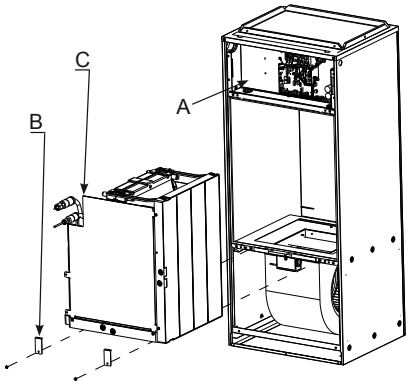
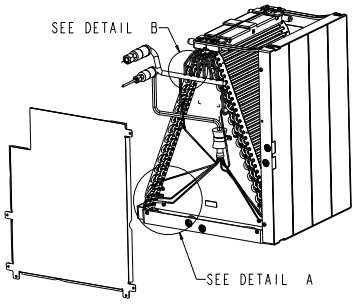
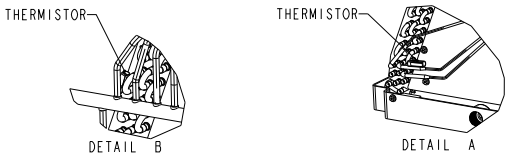
4a. Unplug the Thermistor (CN44) from the control board and route the harness from control box area out through the rubber grommet.
- Unplug the refrigerant leak sensor (CNSA) from the control board and route the harness from control box out through the rubber grommet.
4b. Remove the brackets which secure the coil assembly.
4c. Slide the coil assembly out of the air handler cabinet.

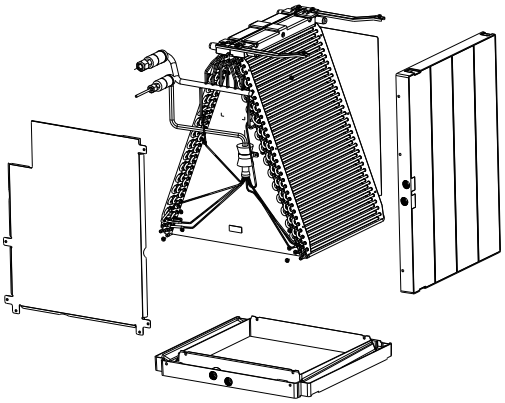


5. Remove the plate covering the coil assembly to access the thermistors.





6. Remove lower and side drain pan.



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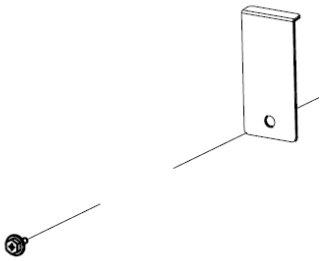
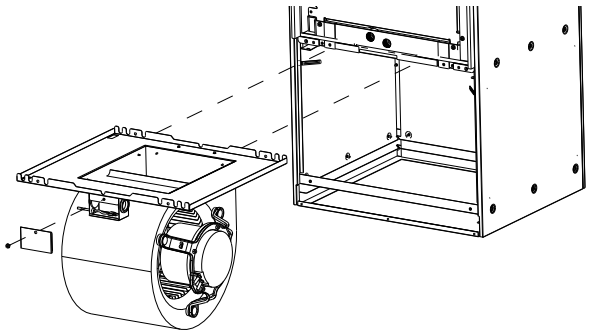
14.3. Blower/Fan Assembly

1. Remove the Blower and Filter panel (along with filter if installed) indicated in section 2.
2. Remove the (1 or 2) brackets that secure the coil assembly.

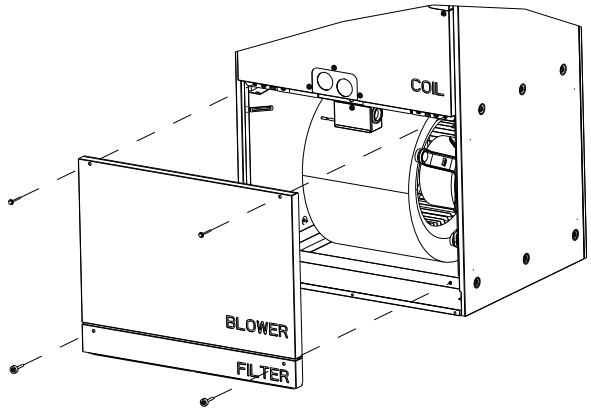


3. Remove the door that covers the small enclosure attached to the fan assembly (Fig.11). Unplug the motor and route the wire harness out of the enclosure.
4. Remove the (2) screws that secure the fan assembly and slide out.

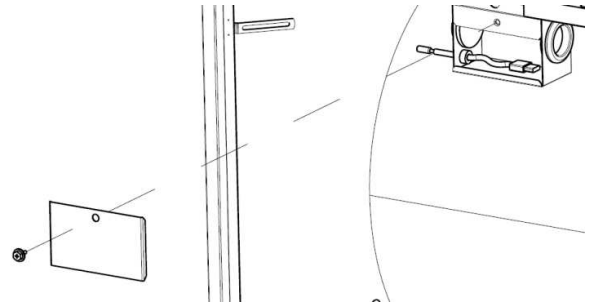


14.4. Thermistor (Return Air)

1. Remove the filter panel (2 thumbscrews).
2. Remove the blower panel (2 screws).



3. Remove the cover over the Return Air thermistor box and unplug the thermistor.
4. Pull out the thermistor holder and thermistor inside the box.



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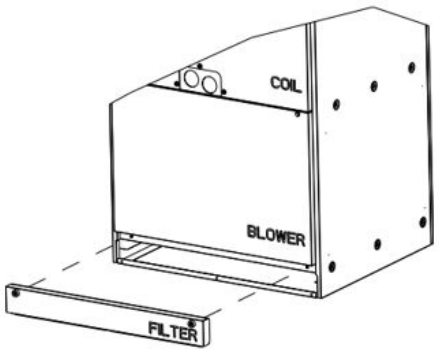
14.5. Refrigerant leak sensor

Table 22. Refrigerant leak sensor instructions

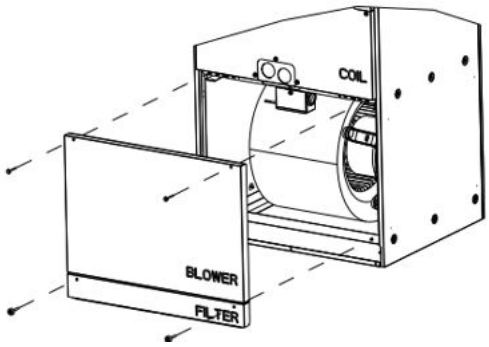
NOTE

The steps and figures on the preceding pages can be used to locate, service, and replace the refrigerant leak sensor.
For vertical installations, follow Step. 1 - 5.
For horizontal installations, follow Step. 1 - 4 and 6.

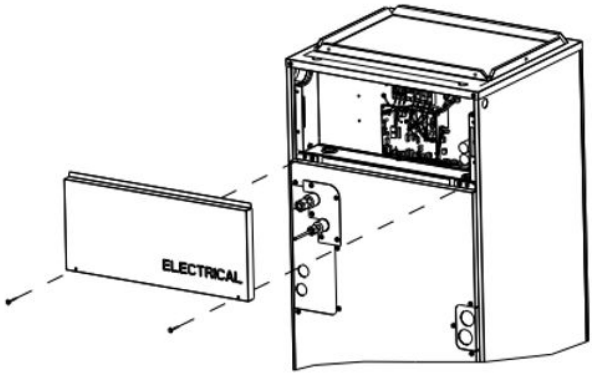
Step. 1 Remove the panel marked “FILTER”.



Step. 2 Remove the panel marked “BLOWER”.



Step. 3 Remove the panel marked “ELECTRICAL”.



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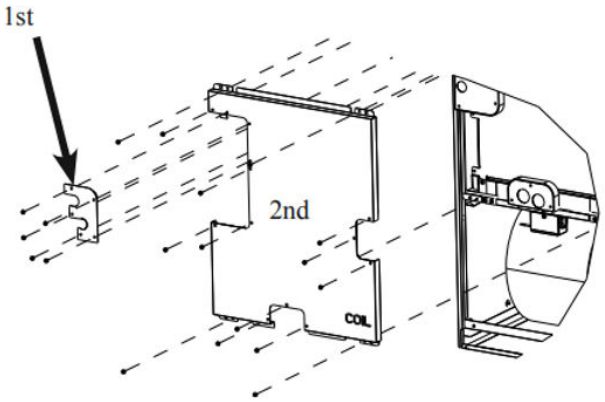
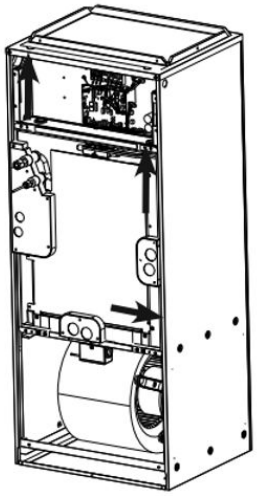
NOTE

The steps and figures on the preceding pages can be used to locate, service, and replace the refrigerant leak sensor.
For vertical installations, follow Step. 1 - 5.
For horizontal installations, follow Step. 1 - 4 and 6.



Step. 4a Remove the screws securing the (3) panels to the COIL panel shown in the image above. Remove the “1st” panel and “2nd” panel marked “COIL”.



Step. 4b Next, remove the smaller panels covering the drain holes and refrigerant lines by first sliding in the directions indicated here.

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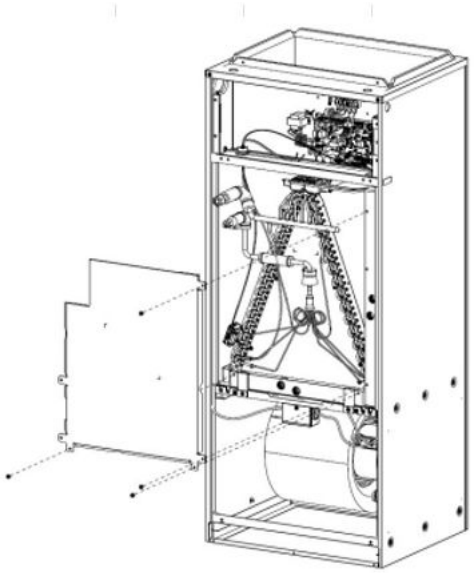
NOTE

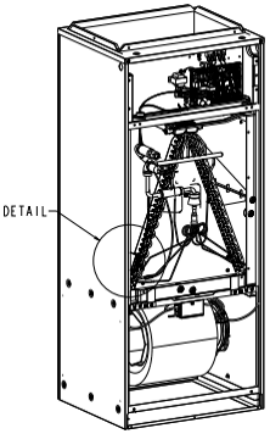
The steps and figures on the preceding pages can be used to locate, service, and replace the refrigerant leak sensor.
For vertical installations, follow Step. 1 - 5.
For horizontal installations, follow Step. 1 - 4 and 6.

Step. 4C Remove the screws (4) and front plate from the coil assembly.



VERTICAL INSTALLATION ONLY DETAILS

Step. 5 Locate the refrigerant leak sensor attached to the coil as shown. Separate the sensor housing from the vertical flow sensor bracket. Once the refrigerant leak sensor housing assembly is removed from the bracket, open the housing and unplug the cable from the sensor PCB.The refrigerant leak sensor PCB is then replaced, and the cable is reused. The same steps can be followed in reverse to reassemble the indoor unit after service is completed.



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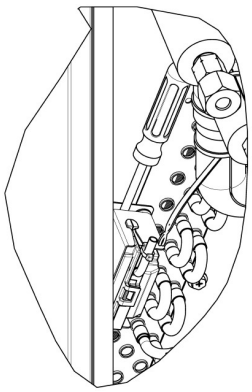
VERTICAL INSTALLATION ONLY DETAILS

TIP

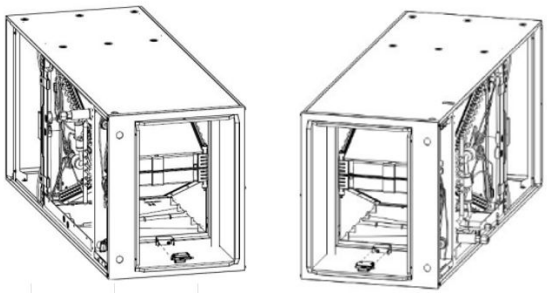
- If there is difficulty removing the refrigerant leak sensor / housing assembly from the vertical flow bracket, insert a screwdriver between the sensor housing assembly and the bracket as shown in the detailed area above.
- Gently apply pressure against the back of the sensor housing assembly to release it from the bracket.
- Once it has released, remove the bracket by hand.



DETAIL ↑

HORIZONTAL INSTALLATION ONLY DETAILS

Step. 6 Reaching through the front of the cabinet locate the refrigerant leak sensor attached to the bracket on the lower cabinet shelf as shown. Separate the sensor housing from the side flow sensor bracket. Once the refrigerant leak sensor housing assembly is removed from the bracket, open the housing and unplug the cable from the sensor PCB. The refrigerant leak sensor PCB is then replaced, and the cable is reused. The same steps can be followed in reverse to reassemble the indoor unit



15. Appendix A: Quick reference worksheet (minimum room area requirement)

IMPORTANT

This quick reference worksheet must be used in conjunction with Installation manual instructions regarding minimum room area calculation. All safety precautions and instructions must be followed as stated in the Installation manual.

1. What is the factory refrigerant pre-charge of the outdoor unit (ODU)?

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TIP

The factory refrigerant pre-charge of the ODU can be found on it's nameplate.

- **Factory pre-charge = _____lb or kg** (circle one)

2. Will there be an additional refrigerant line set beyond the limit of the factory refrigerant pre-charge?
   - **Additional charge = _____lb or kg** (circle one)
3. Take the values from **Step. 1** and **Step. 2**and use the following equation to find the Total planned system charge.
   - **Total planned system charge (m_c) = Factory (Step. 1) + Additional (Step. 2) = _____lb or kg** (circle one)
4. Is the installation space a conditioned space as defined in the installation manual? **YES** or **NO** (circle one)
   - If **Yes** – **Use Case D**. This is the easiest and least restrictive case.
   - Then, **Skip to step 6**. In this case only: **$TA_{min} = A_{min}$**
   - If **No** – Continue to the next step.
5. What is the planned installation height of the indoor unit (IDU), measure from floor to lowest downward facing surface of the IDU?
   - **Installation height (h_0) = _____ ft or m** (circle one)

h_0 - (ft, in.)	h_0 - (m)	Use Case:	Mark correct Case with an 'X'
Lower than 3 ft. 3 3/8 in.	Lower than 1 m	C	
3 ft. 3 3/8 in. to 7 ft 2 5/8 in.	1 m to 2.2 m	B	
Higher than 7ft. 2 5/8 in.	Higher than 2.2 m	A	

6. Use the **Minimum area requirement table,** on the following pages, to determine the correct values for A_{min} and TA_{min}.
   a. In the left most column, find the correct or nearest value for m_c (calculated Step. 2), mark this row with an *.
   b. In the top row, find the column that describes the correct Case (chosen in Step. 4) and the ODU installed, mark this column with an *.
   c. Find the intersection of the marked row and column. Circle the correct values for A_{min} and TA_{min}.
   d. Write the required minimum room area below:
      - Minimum room area for installation room
        A_{min} = _____ft^2 or m^2 (circle one)
      - Minimum conditioned space area
        TA_{min} = _____ft^2 or m^2 (circle one)
7. Now, find the total areas of each Zone (as defined in the installation manual) and add the room areas together to find the total **TA_{min}** for each zone.

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Zone 1		Zone 2		Zone 3		Zone 4	
Room	Area	Room	Area	Room	Area	Room	Area
Zone 1 TA_{min} total		**Zone 2 TA_{min} total**		**Zone 3 TA_{min} total**		**Zone 4 TA_{min} total**	

8. Answer questions **a. - d.** below to verify that room requirements are met.
   a. Does the combined area of each Zone meet or exceed $\mathbf{TA_{min}}$ as defined in Step. 6d?
      - **Yes** or **No** (circle one)
   b. Does the combined area of the installation room and adjacent connected rooms meet or exceed $\mathbf{A_{min}}$?
      - **Yes** or **No** (circle one)
   c. If **A and B** are **YES**, then proceed with installation.
   d. If **A and/or B** are **NO**, then additional area, ventilation, or installation height required.

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Table 23. Minimum room area requirement

Total planned system charge	Case A				Case B			
	Outdoor unit (ODU)				Outdoor unit (ODU)			
	SUZ/PUZ/MXZ-D		MXZ-SM		SUZ/PUZ/MXZ-D		MXZ-SM	
m_c kg (lbs)	Amin m2 [ft2]	TAmin m2 [ft2]	Amin m2 [ft2]	TAmin m2 [ft2]	Amin m2 [ft2]	TAmin m2 [ft2]	Amin m2 [ft2]	TAmin m2 [ft2]
0.9 [1.9]	2.8 [30.2]	9 [96.9]	x	x	6.1 [65.7]	9 [96.9]	x	x
1 [2.2]	3.1 [33.4]	9 [96.9]	x	x	6.8 [73.2]	9 [96.9]	x	x
1.5 [3.3]	4.7 [50.6]	9 [96.9]	x	x	10.2 [109.8]	9 [96.9]	x	x
2 [4.4]	6.2 [66.8]	9 [96.9]	x	x	13.6 [146.4]	9 [96.9]	x	x
2.5 [5.5]	7.7 [82.9]	9 [96.9]	x	x	16.9 [182]	9 [96.9]	x	x
3 [6.6]	9.3 [100.2]	9.3 [100.2]	x	x	20.3 [218.6]	9.3 [100.2]	x	x
3.5 [7.7]	10.8 [116.3]	10.8 [116.3]	x	x	23.7 [255.2]	10.8 [116.3]	x	x
4 [8.8]	12.3 [132.4]	12.3 [132.4]	4.2 [45.3]	9 [96.9]	27.1 [291.8]	12.3 [132.4]	9.2 [99.1]	9 [96.9]
4.5 [9.9]	13.9 [149.7]	13.9 [149.7]	4.5 [48.5]	9 [96.9]	30.5 [328.3]	13.9 [149.7]	9.9 [106.6]	9 [96.9]
5 [11]	15.4 [165.8]	15.4 [165.8]	4.9 [52.8]	9 [96.9]	33.8 [363.9]	15.4 [165.8]	10.6 [114.1]	9 [96.9]
5.5 [12.1]	16.9 [182]	16.9 [182]	5.2 [56]	9 [96.9]	37.2 [400.5]	16.9 [182]	11.3 [121.7]	9 [96.9]
6 [13.4]	18.5 [199.2]	18.5 [199.2]	5.5 [59.3]	9 [96.9]	40.6 [437.1]	18.5 [199.2]	12 [129.2]	9 [96.9]
6.5 [14.5]	20 [215.3]	20 [215.3]	5.8 [62.5]	9 [96.9]	44 [473.7]	20 [215.3]	12.7 [136.8]	9 [96.9]
7 [15.6]	21.5 [231.5]	21.5 [231.5]	6.1 [65.7]	9 [96.9]	47.3 [509.2]	21.5 [231.5]	13.4 [144.3]	9 [96.9]
7.5 [16.7]	23.1 [248.7]	23.1 [248.7]	6.4 [68.9]	9 [96.9]	50.7 [545.8]	23.1 [248.7]	14 [150.7]	9 [96.9]
8 [17.8]	24.6 [264.8]	24.6 [264.8]	6.7 [72.2]	9 [96.9]	54.1 [582.4]	24.6 [264.8]	14.7 [158.3]	9 [96.9]
8.5 [18.9]	26.2 [282.1]	26.2 [282.1]	7 [75.4]	9 [96.9]	57.5 [619]	26.2 [282.1]	15.4 [165.8]	9 [96.9]
9 [20]	27.7 [298.2]	27.7 [298.2]	7.3 [78.6]	9 [96.9]	60.9 [655.6]	27.7 [298.2]	16.1 [173.3]	9 [96.9]
9.5 [21.1]	29.2 [314.4]	29.2 [314.4]	7.7 [82.9]	9 [96.9]	64.2 [691.1]	29.2 [314.4]	16.8 [180.9]	9 [96.9]
10 [22.1]	30.8 [331.6]	30.8 [331.6]	8 [86.2]	9 [96.9]	67.6 [727.7]	30.8 [331.6]	17.5 [188.4]	9 [96.9]
10.5 [23.1]	32.3 [347.7]	32.3 [347.7]	8.3 [89.4]	9 [96.9]	71 [764.3]	32.3 [347.7]	18.2 [196]	9 [96.9]
11 [24.2]	33.8 [363.9]	33.8 [363.9]	8.6 [92.6]	9 [96.9]	74.4 [800.9]	33.8 [363.9]	18.8 [202.4]	9 [96.9]
11.5 [25.3]	35.4 [381.1]	35.4 [381.1]	8.9 [95.8]	9 [96.9]	77.8 [837.5]	35.4 [381.1]	19.5 [209.9]	9 [96.9]
12 [26.4]	36.9 [397.2]	36.9 [397.2]	9.2 [99.1]	9.2 [99.1]	81.1 [873]	36.9 [397.2]	20.2 [217.5]	9.2 [99.1]
12.5 [27.5]	38.4 [413.4]	38.4 [413.4]	9.5 [102.3]	9.5 [102.3]	84.5 [909.6]	38.4 [413.4]	20.9 [225]	9.5 [102.3]
13 [28.6]	40 [430.6]	40 [430.6]	9.8 [105.5]	9.8 [105.5]	87.9 [946.2]	40 [430.6]	21.6 [232.6]	9.8 [105.5]
13.5 [29.7]	41.5 [446.8]	41.5 [446.8]	10.1 [108.8]	10.1 [108.8]	91.3 [982.8]	41.5 [446.8]	22.3 [240.1]	10.1 [108.8]
14 [30.8]	43 [462.9]	43 [462.9]	10.5 [113.1]	10.5 [113.1]	94.6 [1018.3]	43 [462.9]	22.9 [246.5]	10.5 [113.1]
14.4 [31.7]	44.3 [476.9]	44.3 [476.9]	10.7 [115.2]	10.7 [115.2]	97.3 [1047.4]	44.3 [476.9]	23.5 [253]	10.7 [115.2]

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Total planned system charge	Case C				Case D			
	Outdoor unit (ODU)				Outdoor unit (ODU)			
m_c kg (lbs)	SUZ/PUZ/MXZ-D		MXZ-SM		SUZ/PUZ/MXZ-D		MXZ-SM	
	Amin m2 [ft2]	TAmin m2 [ft2]	Amin m2 [ft2]	TAmin m2 [ft2]	Amin m2 [ft2]	TAmin m2 [ft2]	Amin m2 [ft2]	TAmin m2 [ft2]
0.9 [1.9]	10.2 [109.8]	9 [96.9]	x	x	9 [96.9]	9 [96.9]	x	x
1 [2.2]	11.3 [121.7]	9 [96.9]	x	x	9 [96.9]	9 [96.9]	x	x
1.5 [3.3]	16.9 [182]	9 [96.9]	x	x	9 [96.9]	9 [96.9]	x	x
2 [4.4]	22.6 [243.3]	9 [96.9]	x	x	9 [96.9]	9 [96.9]	x	x
2.5 [5.5]	28.2 [303.6]	9 [96.9]	x	x	9 [96.9]	9 [96.9]	x	x
3 [6.6]	33.8 [363.9]	9.3 [100.2]	x	x	9.3 [100.2]	9.3 [100.2]	x	x
3.5 [7.7]	39.5 [425.2]	10.8 [116.3]	x	x	10.8 [116.3]	10.8 [116.3]	x	x
4 [8.8]	45.1 [485.5]	12.3 [132.4]	15.4 [165.8]	9 [96.9]	12.3 [132.4]	12.3 [132.4]	9 [96.9]	9 [96.9]
4.5 [9.9]	50.7 [545.8]	13.9 [149.7]	16.5 [177.7]	9 [96.9]	13.9 [149.7]	13.9 [149.7]	9 [96.9]	9 [96.9]
5 [11]	56.4 [607.1]	15.4 [165.8]	17.7 [190.6]	9 [96.9]	15.4 [165.8]	15.4 [165.8]	9 [96.9]	9 [96.9]
5.5 [12.1]	62 [667.4]	16.9 [182]	18.8 [202.4]	9 [96.9]	16.9 [182]	16.9 [182]	9 [96.9]	9 [96.9]
6 [13.4]	67.6 [727.7]	18.5 [199.2]	19.9 [214.3]	9 [96.9]	18.5 [199.2]	18.5 [199.2]	9 [96.9]	9 [96.9]
6.5 [14.5]	73.2 [788]	20 [215.3]	21.1 [227.2]	9 [96.9]	20 [215.3]	20 [215.3]	9 [96.9]	9 [96.9]
7 [15.6]	78.9 [849.3]	21.5 [231.5]	22.2 [239]	9 [96.9]	21.5 [231.5]	21.5 [231.5]	9 [96.9]	9 [96.9]
7.5 [16.7]	84.5 [909.6]	23.1 [248.7]	23.4 [251.9]	9 [96.9]	23.1 [248.7]	23.1 [248.7]	9 [96.9]	9 [96.9]
8 [17.8]	90.1 [969.9]	24.6 [264.8]	24.5 [263.8]	9 [96.9]	24.6 [264.8]	24.6 [264.8]	9 [96.9]	9 [96.9]
8.5 [18.9]	95.8 [1031.2]	26.2 [282.1]	25.7 [276.7]	9 [96.9]	26.2 [282.1]	26.2 [282.1]	9 [96.9]	9 [96.9]
9 [20]	101.4 [1091.5]	27.7 [298.2]	26.8 [288.5]	9 [96.9]	27.7 [298.2]	27.7 [298.2]	9 [96.9]	9 [96.9]
9.5 [21.1]	107 [1151.8]	29.2 [314.4]	27.9 [300.4]	9 [96.9]	29.2 [314.4]	29.2 [314.4]	9 [96.9]	9 [96.9]
10 [22.1]	112.7 [1213.1]	30.8 [331.6]	29.1 [313.3]	9 [96.9]	30.8 [331.6]	30.8 [331.6]	9 [96.9]	9 [96.9]
10.5 [23.1]	118.3 [1273.4]	32.3 [347.7]	30.2 [325.1]	9 [96.9]	32.3 [347.7]	32.3 [347.7]	9 [96.9]	9 [96.9]
11 [24.2]	123.9 [1333.7]	33.8 [363.9]	31.4 [338]	9 [96.9]	33.8 [363.9]	33.8 [363.9]	9 [96.9]	9 [96.9]
11.5 [25.3]	129.6 [1395.1]	35.4 [381.1]	32.5 [349.9]	9 [96.9]	35.4 [381.1]	35.4 [381.1]	9 [96.9]	9 [96.9]
12 [26.4]	135.2 [1455.3]	36.9 [397.2]	33.6 [361.7]	9.2 [99.1]	36.9 [397.2]	36.9 [397.2]	9.2 [99.1]	9.2 [99.1]
12.5 [27.5]	140.8 [1515.6]	38.4 [413.4]	34.8 [374.6]	9.5 [102.3]	38.4 [413.4]	38.4 [413.4]	9.5 [102.3]	9.5 [102.3]
13 [28.6]	146.4 [1575.9]	40 [430.6]	35.9 [386.5]	9.8 [105.5]	40 [430.6]	40 [430.6]	9.8 [105.5]	9.8 [105.5]
13.5 [29.7]	152.1 [1637.2]	41.5 [446.8]	37.1 [399.4]	10.1 [108.8]	41.5 [446.8]	41.5 [446.8]	10.1 [108.8]	10.1 [108.8]
14 [30.8]	157.7 [1697.5]	43 [462.9]	38.2 [411.2]	10.5 [113.1]	43 [462.9]	43 [462.9]	10.5 [113.1]	10.5 [113.1]
14.4 [31.7]	162.2 [1746]	44.3 [476.9]	39.1 [420.9]	10.7 [115.2]	44.3 [476.9]	44.3 [476.9]	10.7 [115.2]	10.7 [115.2]

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Table 24. *Mrel* for MXZ/PUMY Outdoor Units

System Charge (kg)	M_{rel} (kg)
7.1	2
7.4	2.1
7.9	2.2
8.4	2.3
8.9	2.4
9.4	2.5
9.9	2.6
10.4	2.7
10.9	2.8
11.4	2.9
11.9	3
12.4	3.1
12.9	3.2
13.4	3.3
13.9	3.4
14.4	3.5

IMPORTANT

For systems paired with **MXZ/PUMY outdoor units**, minimum room area calculations are based on **Mrel**, a smaller refrigerant amount that will not be recovered during leak mitigation.

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16. Appendix B - High altitude applications - capacity reduction factors

Capacity reduction

When air conditioners and heat pumps are installed in areas above sea level, operating capacity is reduced due to decreased air density. Because of this, equipment size may need to be increased to meet the load requirements. The following correction factors apply to M & P Series air conditioners and heat pumps for both heating and cooling operation. The indoor and outdoor units need to be sized based on the capacity reduction due to the increased air density.

Altitude ft (m)	Indoor unit correction factor	Outdoor unit correction factor
0	1.00	1.00
1,000 (305)	0.96	0.99
2,000 (610)	0.93	0.98
3,000 (914)	0.90	0.98
4,000 (1219)	0.86	0.97
5,000 (1524)	0.83	0.96
6,000 (1829)	0.80	0.95
7,000 (2134)	0.77	0.94
8,000 (2442)	0.74	0.94
9,000 (2743)	0.71	0.93
10,000 (3048)	0.69	0.92

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This product is designed and intended for use in the residential, commercial and light-industrial environment.

MITSUBISHI ELECTRIC US, INC.

:

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